CHEVRON REFINERY MODERNIZATION PROJECT

ENVIRONMENTAL IMPACT REPORT

CONSOLIDATED VERSION - VOLUME 1: DRAFT EIR
OCTOBER 2015

STATE CLEARINGHOUSE NO. 2011062042



LEAD AGENCY

CITY OF RICHMOND
450 CIVIC CENTER PLAZA
RICHMOND, CA 94804

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PLANNING AND BUILDING SERVICES DEPARTMENT
450 CIVIC CENTER PLAZA, RICHMOND, CA 94804 PHONE: (510) 620-6706 FAX: (510) 620-6858

CITY OF RICHMOND
NOTICE OF PUBLIC MEETINGS, 45-DAY NOTICE OF AVAILABILITY OF A REVISED DRAFT ENVIRONMENTAL IMPACT REPORT (EIR)

NOTICE IS HEREBY GIVEN that the City of Richmond has prepared a Revised Environmental Impact Report for the following described project in accordance with the California Environmental Quality Act (CEQA) of 1970, as amended, and the City of Richmond's Guidelines and Procedures for Implementation of CEQA.

Project Title: Chevron Refinery Modernization Project
Project Applicant: Chevron Products Company, a division of Chevron USA Inc.
Project Location: 841 Chevron Way, City of Richmond, County of Contra Costa
Assessor Parcel Nos.: 561-030-001; 561-030-002; 561-030-003; 561-030-005; 561-040-013; 561-040-014; 561-040-015; 561-040-016; 561-040-017; 561-080-001; 561-080-002; 561-080-003; 561-080-005; 561-080-006; 561-080-007; 561-090-003; 561-090-004; 561-100-003; 561-100-009; 561-100-010; 561-100-017; 561-110-020; 561-100-025; 561-100-037; 561-100-038; 561-100-042; 561-100-043; 561-100-044; 561-100-047; 561-100-048; 561-100-049; 561-110-022; 561-100-029; 561-110-034; 561-110-035; 561-110-036; 561-110-041; 561-110-044; 561-390-001; 561-390-003; 561-390-004; 561-390-016; 561-400-008; 561-410-002; 561-410-003;

Project Description: The Chevron Refinery Modernization Project (Modernization Project) would complete construction and begin operation of two of the Chevron Hydrogen and Energy Renewal Project major components: a replacement Hydrogen Plant, and a collection of new sulfur removal equipment improvements that remove naturally occurring sulfur contained in the feedstocks processed at the Facility. The Modernization Project also includes related infrastructure improvements to Facility piping, utility lines, and electrical systems. The Modernization Project includes several integral equipment components that would reduce air emissions from Facility operations (the Emission Reduction Project Components) and further Project Design Features proposed to avoid or minimize environmental impacts. The Project also includes a new Reliability Program, including new safety programs and several physical modifications including the replacement of 17 piping circuits in the Crude Unit. Reducing Project emissions would help meet Chevron's commitment of assuring that the Project would cause no net increase in emissions of criteria pollutants, greenhouse gases, and public health risks from air pollutants, when compared to the Facility emissions and operations that occurred during the baseline period of 2008 through 2010. Following issuance of all necessary approvals, Chevron proposes to complete Project construction within approximately 24 months.

Review and Comment Period: Comments on the Draft EIR, sent in writing, must be received by **5:00 p.m. on May 2, 2014**, at the following address:

Lina Velasco
City of Richmond Planning Division
450 Civic Center Plaza
P.O. Box 4046
Richmond, CA 94804

Study Session: A study session to introduce the Modernization Project and provide an overview of the Draft EIR will be held at the Planning Commission meeting held on **April 3, 2014 at 6:30 PM** or soon thereafter at the Richmond Council Chambers, 440 Civic Center Plaza, Richmond, CA 94804.

Public Hearing: A public hearing to receive comments on the Draft EIR will be held at the Planning Commission meeting held on **April 17, 2014 at 6:30 p.m.** or soon thereafter at the Richmond Council Chambers, 440 Civic Center Plaza, Richmond, CA, 94804.

Public Workshops: Workshops with technical experts will be held on **April 2, 2014 from 9:00 a.m. to 3:00 p.m.** and from **6:00 p.m**. **to 8:30 PM** at the Richmond Memorial Auditorium, 403 Civic Center Plaza, Richmond, CA, 94804.

Report Availability: A copy of the Draft EIR is available for review online at http://chevronmodernization.com/. Copies are also available for review at the following locations: **Richmond Public Libraries: Main Branch** 325

Civic Center Plaza, Richmond, CA 94804; **Bayview Branch Library**, 5100 Hartnett Ave., Richmond, CA, 94804; **West Side Branch**, 135 Washington Ave. Richmond, CA 94801; and City of Richmond, **Planning and Building Services Department**, City Hall, 450 Civic Center Plaza, Richmond, CA, 94804.

Start of Public Review: March 18, 2014 **End of Public Review**: May 2, 2014

PURPOSE OF THE CONSOLIDATED VERSION

This Consolidated Version of the Chevron Refinery Modernization Project EIR Environmental Impact Report (EIR) incorporates all the modifications to Draft EIR Volumes 1 and 2 that were identified in Volume 3, Final EIR, or in association with the City's certification of the EIR including, but not limited to, information added as part of the Staff Reports for the City Council's July 22 and 29, 2014 hearings where the EIR was reviewed and certified.

This Consolidated Version has been prepared to improve the ease of use by City of Richmond (City) staff when considering and administering implementation of the proposed Project.

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CHAPTER 1.
INTRODUCTION

1.1 PURPOSE OF THIS ENVIRONMENTAL IMPACT REPORT

This Environmental Impact Report (EIR) is an informational document intended to disclose to the public and decision-makers the potential environmental consequences of the proposed Chevron Refinery Modernization Project (Modernization Project or Project).[1] As described in further detail below, this EIR was prepared by the City of Richmond (City) in order to comply with the writ of mandamus (Writ) issued by the Contra Costa Superior Court on the 2008 Chevron Hydrogen and Energy Renewal Project EIR, Consolidated Volume (2008 EIR) prepared by the City for the previously proposed Chevron Hydrogen and Energy Renewal Project (2008 Project), and to analyze the potential environmental impacts that could result from the Modernization Project, a revised and down-sized form of the 2008 Project.

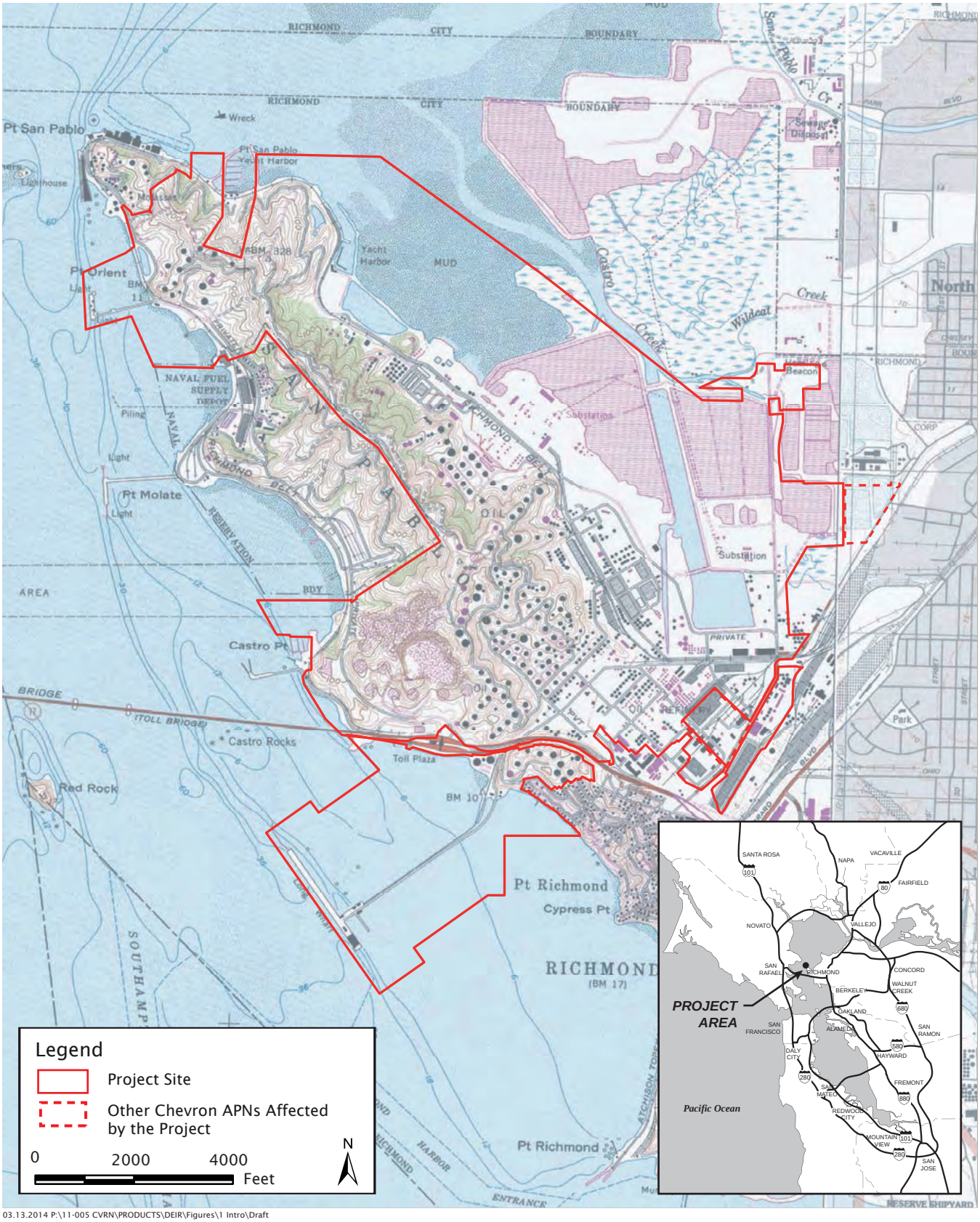
This EIR was prepared in compliance with the California Environmental Quality Act, California Public Resources Code Sections 21000-21178 (CEQA) and Title 14, Chapter 3, of the California Code of Regulations (CEQA Guidelines). Pursuant to CEQA, this EIR assesses the direct and indirect environmental impacts, as well as the cumulative environmental impacts, that could occur as a result of the construction and operation of the Modernization Project. The project description, summarized below and detailed in *Chapter 3, Project Description*, is based on Modernization Project information contained in Chevron's application and supplemental technical submittals to the City of Richmond.[2] The intent of this EIR is not to determine whether the Modernization Project should be approved, but to provide public disclosure and to aid the local planning and decision-making process.

1.2 PROJECT BACKGROUND

Chevron Products Company, a division of Chevron USA Inc. (Chevron), owns and operates the Chevron Richmond Refinery (Facility or Project Site), located along the western edge of the City of Richmond in Contra Costa County, California (see Figure 1-1). The Facility processes crude oil blends, externally sourced gas oils, and natural gas into a number of products, including motor gasoline, jet fuel,

[1] Previous notices referred to the Modernization Project as the "Revised Energy and Hydrogen Renewal Project" or "Revised Renewal Project" during the scoping period for this EIR.

[2] Chevron's application submittal and transmittals are available on the Project website for public review: http://chevronmodernization.com/.



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Source: USGS; ESA, 2008; Urban Planning Partners, 2014

Figure 1-1
Chevron Refinery Modernization Project EIR
Location of Modernization Project

diesel fuel, and lubricant base oils, as well as fuel oil, liquefied petroleum gas and sulfur. The Facility also produces steam and electricity primarily for its own use, and fuel gas and hydrogen solely for its own use. The Facility's operations include the import of crude oils and gas oils by ship (through the Richmond Long Wharf). The Facility exports products by pipeline, ship, rail, and truck.

In 2005, Chevron applied to the City of Richmond (City) for permits for the proposed 2008 Project. Major components associated with the 2008 Project included a new hydrogen plant to replace the existing hydrogen plant, improvements to refinery processing equipment related to sulfur treatment and removal that were referred to as "Hydrogen Purity Improvements," a catalytic reformer replacement, power plant replacement, and other new and replacement facilities (storage tanks and central maintenance building). In 2008, the City certified the 2008 EIR and approved design review and conditional use permits for the 2008 Project. Following certification of the 2008 EIR and receipt of City and other agency approvals, Chevron began construction of portions of the 2008 Project, including the new hydrogen plant and Hydrogen Purity Improvements.

In 2009, however, the Contra Costa Superior Court invalidated the 2008 EIR and City permits and issued an injunction halting further construction. At the time construction was halted, neither the new hydrogen plant nor the Hydrogen Purity Improvements were complete or operational.

In 2010, following an appeal, the California Court of Appeal affirmed in part and reversed in part the Superior Court decision (Appellate Court Decision) and concluded that: (1) the project description in the 2008 EIR was unclear and inconsistent as to whether or not the project would enable the Facility to process a heavier crude oil blend than it currently processes; (2) the 2008 EIR did not establish a baseline for purposes of determining whether there would be any increased impacts from any changes in the crude oil blend processed at the Facility; and (3) the 2008 EIR improperly deferred the formulation of greenhouse gas mitigation measures to a future, post-EIR process.[3] On March 14, 2011, the Contra Costa Superior Court issued the Writ ordering that the 2008 EIR and the permits be set aside on certain grounds.[4] In compliance with the Writ, the City vacated the 2008 Project permits.

In 2011, Chevron submitted a new application to the City for a revised project (Modernization Project or Project) that includes only two of the major components from the 2008 Project, the new hydrogen plant (now identified as the "Hydrogen Plant Replacement") and the Hydrogen Purity Improvements (now

[3] The Court of Appeal also concluded that the City properly treated the construction of a hydrogen pipeline as a separate project.

[4] The terms Appleate Court Decision and Writ are used interchangebly in this EIR.

identified as the "Sulfur Removal Improvements"). The Modernization Project does not include the other major components that were part of the 2008 Project.

Following receipt of this application, the City began preparation of this EIR in order to comply with the Writ and to analyze the potential environmental impacts that could result from the revised, down-sized Modernization Project.

1.3 PROJECT OVERVIEW

As described in detail in *Section 3.1.3* of *Chapter 3, Project Description*, the Modernization Project was designed to achieve three overarching goals:[5]

- Enhance the safety and reliability of the Facility through installation of newer, inherently safer systems and equipment consistent with the Richmond Industrial Safety Ordinance;
- Enhance the Facility's processing flexibility to continue to produce the full range of Facility products; and
- Achieve no net increase in criteria air pollutants, greenhouse gases, and public health risks from air pollution.

The Modernization Project would complete construction and begin operation of the Hydrogen Plant Replacement and the Sulfur Removal Improvements. The Project would also construct related infrastructure improvements to Facility piping, utility lines, and electrical and communications systems. In addition, the Modernization Project includes several equipment and design components that would reduce air emissions from Facility operations (collectively, the Emission Reduction Project Components), and equipment and design components that enhance the Facility's reliability. The Project also proposes various Facility Project Design Features to improve Facility safety and reliability and further reduce the Facility's post-Project air emissions. Project Design Features that avoid or reduce environmental impacts are required to be implemented as mitigation measures. The Emission Reduction Project Components and Project Design Features would help achieve Chevron's commitment of assuring that the Project would cause no net increase in emissions of criteria air pollutants, greenhouse gases, and public health risks from air pollutants, when compared to the Facility operations that occurred during the baseline period of 2008 through 2010. Following issuance of all necessary approvals, Chevron proposes to complete Project construction within 24 months.

[5] A discussion of how the Modernization Project fulfills these goals is provided *in Section 3.13, Modernization Project Goals.*

Chapter 3, Project Description, describes the Modernization Project in detail, including the Hydrogen Plant Replacement, Sulfur Removal Improvements, Emission Reduction Project Components, Project Design Features, and changes to the Facility's crude and gas oil blend processing capability that are reasonably foreseeable as a result of Project implementation.

1.4 USE OF THIS DOCUMENT BY AGENCIES

In accordance with CEQA, as amended, the City must consider the environmental implications of the Modernization Project before making any determination to grant or deny the requested Modernization Project approvals. The City will use this EIR when considering the Project application and subsequent building permits. A detailed discussion of required City permits and approvals is provided in *Section 3.5.1* of *Chapter 3, Project Description*.

This EIR will also be used by other state and local agencies with discretionary approval authority over aspects of the Modernization Project, including the Bay Area Air Quality Management District (BAAQMD), and potentially the San Francisco Regional Water Quality Control Board (RWQCB) and the California Department of Transportation (Caltrans). For example, the BAAQMD has permit authority over air emissions and emission reduction activities as described in detail in *Section 3.5.2* of *Chapter 3, Project Description*. Although none are expected, any changes in the Facility's National Pollutant Discharge Elimination System permit would require approval from the RWQCB.

1.5 OVERVIEW OF THE ENVIRONMENTAL REVIEW PROCESS

1.5.1 Lead Agency

In accordance with CEQA Guidelines Sections 15050 and 15367, the City has been designated the "Lead Agency," which is defined as the "public agency which has the principal responsibility for carrying out or disapproving a project." The Lead Agency is also responsible for determining the scope of the environmental analysis, preparing the EIR, and responding to comments received on the Draft EIR. Prior to making a decision whether to approve a project, the Lead Agency is required to certify that the EIR has been completed in compliance with CEQA, that the decision-making body reviewed and considered the information in the EIR, and that the EIR reflects the independent judgment of the Lead Agency.

1.5.2 Notice of Preparation and Scoping

On June 10, 2011, the City circulated a Notice of Preparation (NOP) to the public, local, state and federal agencies, and other known interested parties for a 30-day public and agency review period, in accordance with CEQA Guidelines Section 15802 (Appendix 1). The purpose of the NOP was to provide notification that an

EIR for the Modernization Project was being prepared, and to solicit public input on the scope and content of the document.

Pursuant to CEQA Guidelines Section 15082, the City held a scoping meeting for the EIR on June 22, 2011 at the City Council Chambers. Agencies and members of the public were invited to attend and provide input on the scope of the EIR. Comments from agencies and the public provided at the scoping meeting and in written comments submitted in response to the NOP are included within Appendix 1. Significant issues raised during the scoping process are summarized in *Section 1.6.1*.

The City held five educational sessions that were open to the public and can be viewed at http://chevronmodernization.com/meetings/.[6] The educational session topics included: Greenhouse Gas Emissions and Accounting 101, July 25, 2012; Health Risk Assessment for Airborne Emissions 101, August 22, 2012; How a Refinery Operates 101, September 29, 2012; CEQA 101 and New BAAQMD CEQA Guidelines, October 19, 2012; and Measuring Refinery Energy Efficiency, April 4, 2012.

1.5.3 Public Review of Draft EIR

A draft of this EIR (Draft EIR) will be distributed to federal, state, and local agencies and other interested parties for a 45-day review and comment period. The review and comment period begins following filing of a Notice of Availability with the Governor's Office of Planning and Research, State Clearinghouse. The duration of this review period is consistent with CEQA, and takes into account that: (1) the Modernization Project has fewer components than those already evaluated in the 2008 EIR; (2) with the exception of *Section 4.3, Air Quality, Section 4.8, Greenhouse Gases,* and *Section 4.13, Public Safety*, many of the conclusions in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures* of the EIR remain the same as presented in the 2008 EIR; and (3) there have been several informational workshops to help prepare the public for review of the Draft EIR.

Similar to the educational sessions that occurred during the scoping process, an enhanced public review process is also planned for this 45-day public comment period, including:

- A Planning Commission study session to present the Modernization Project and findings in the Draft EIR;

[6] Agendas and presentations of the educational sessions are also available online at: http://chevronmodernization.com/meetings/.

- Two interactive workshops will be held to walk interested parties through the findings in the Draft EIR; and
- A Planning Commission hearing to receive comments on the Draft EIR.

The dates and locations of these events will be announced in notices and posted on the Project website: http://chevronmodernization.com/.

The City will carefully consider and respond to timely comments on this EIR and will take those comments into consideration when making a decision about the Modernization Project. Comments may address any portion of the Draft EIR or the Modernization Project.

1.5.4 Final EIR and EIR Certification

Following the close of the public comment period, responses to comments and revisions to the Draft EIR will be completed for inclusion in the final EIR (Final EIR). Under CEQA, the Final EIR must be released 10 days prior to the Planning Commission's consideration of the EIR and pending project applications.

The Planning Commission's decision regarding the Modernization Project and associated EIR may be appealed to the City Council for final City action.

1.5.5 Mitigation Monitoring and Reporting Program

CEQA Section 21081.6 requires that a Lead Agency establish a program to report on and monitor measures adopted as part of the environmental review process to mitigate or avoid significant effects on the environment. *Chapter 9, Mitigation Monitoring and Reporting Program* of this EIR includes a template Mitigation Monitoring and Reporting Program (MMRP) that is designed to ensure that the mitigation measures identified in this EIR and adopted by the Lead Agency are fully implemented. The MMRP will describe the timing and frequency of mitigation implementation responsibilities and standards, and verification of compliance for the mitigation measures identified for the Modernization Project in the Final EIR.

1.6 SCOPE OF THE EIR

This EIR examined all potential adverse environmental impacts of the Modernization Project. All of the topics in the current CEQA checklist, CEQA Guidelines Appendix G, and other topics pertinent to the Modernization Project were studied: Aesthetics, Visual Quality, Light, and Glare; Agricultural Resources; Air Quality; Biological Resources; Cultural Resources; Energy; Geology, Soils, Seismicity, and Mineral Resources; Greenhouse Gases, Hydrology and Water Quality; Land Use, Plans, and Policies; Noise; Employment, Population, and

Housing; Public Safety; Public Services; Parks and Recreation; Transportation and Traffic; and Utilities and Service Systems.

1.6.1 Issues and Concerns Raised During Scoping

Listed below is a summary of concerns raised during the EIR scoping process.

1.6.1.1 Air Quality

Dr. Henry Clark, Director of West County Toxics Coalition, commented that the Project should reduce emissions below current levels; otherwise it would not meet requirements of environmental justice.

The BAAQMD provided eight comments regarding the air quality:

- Provide a discussion of the district's attainment status for all criteria pollutants and the implications for the region if these standards are not attained or maintained by statutory deadlines; a discussion of the health effects of air pollution, especially on sensitive receptors; and a discussion of greenhouse gas emissions and the potential impacts from climate change in the Bay Area.
- Provide a map that identifies the distance between the Project and all sensitive receptor locations, such as residences, schools, day cares, hospitals, and nursing care within 1,000 feet.
- Provide a detailed analysis of the Project's potential effects on local and regional air quality from construction and operations (including permitted and non-permitted stationary and area emissions, and mobile emissions). The cumulative impacts for the Project should also be evaluated.
- Estimate both the maximum emissions of volatile organic compounds, nitrogen oxides, greenhouse gases, and particulate matter.
- Estimate and evaluate the potential health risks from construction and operation activities to current and future sensitive populations within the Project site from toxic air contaminants.
- Include mitigation measures for any identified potentially significant air quality impacts.
- Consult with the BAAQMD's permit engineers to determine the appropriate baseline emissions for the Project air quality analysis.
- Include a list of all equipment that would be part of the Project.
- Toxic contaminants should not be increased or decreased disproportionately.

Linda Schneider, M.A. asked what specific steps Chevron will take to significantly move beyond current emission standards (more than 50%) and from gas and oil production to more green forms of production.

These topics are considered in *Section 4.3, Air Quality* in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*, of this EIR.

1.6.1.2 Biological Resources

The California Department of Fish and Wildlife (CDFW) provided the following comments and requests:

- A complete assessment (including but not limited to type, quantity, and locations) of the habitats, flora and fauna within and adjacent to the Project area, including endangered, threatened, and locally unique species and sensitive habitats, should be provided. The assessment should include the reasonably foreseeable direct and indirect changes (temporary and permanent) that may occur with implementation of the Project. Rare, threatened, and endangered species to be addressed should include all those which meet the CEQA definition set forth in CEQA Guidelines Section 15380.
- An analysis of changes in nitrogen deposition rates associated with new operational procedures at the Facility should be included.
- Any related nitrogen deposition impacts on special-status plants in the vicinity of the Project, such as increased competition from exotic plant species, should be discussed and addressed.
- A California Endangered Species Act (CESA) permit must be obtained if the Project has the potential to result in take of species of plants or animals listed under CESA, either during construction or over the life of the Project.
- The CEQA document must specify impacts, mitigation measures, and a mitigation monitoring and reporting program.
- For any activity that would divert or obstruct the natural flow, or change the bed, channel, or bank (which may include associated riparian resources) of a river or stream, or use material from a streambed, CDFW may require a Lake and Streambed Alteration Agreement.
- The CEQA document should fully identify the potential impacts to the stream or riparian resources and provide adequate avoidance, mitigation, monitoring, and reporting commitments for completion of the agreement.

These topics are considered in *Section 4.4, Biological Resources* in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*, of this EIR.

1.6.1.3 Cultural Resources

Caltrans commented that the document must include documentation of a current archaeological record search from the Northwest Information Center of the California Historical Resources Information System at Sonoma State University if construction activities are proposed within State right-of-way. Current record searches must be no more than 5 years old.

The Native American Heritage Commission provided the following recommendations in order to adequately assess and mitigate Project-related impacts to archeological resources:

- The appropriate regional archeological information center should be contacted for a record search.
- The Native American Heritage Commission should be contacted for a Sacred Lands File Check and a list of appropriate Native American contacts for consultation concerning the Project site and to assist in the mitigation measures.
- Lack of surface evidence of archeological resources does not preclude their subsurface existence.

These topics are considered in *Section 4.5, Cultural Resources* in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*, of this EIR.

1.6.1.4 Greenhouse Gases

Linda Schneider, M.A., asked how Chevron can participate in a community-wide, systematic change that is more beneficial to the overall environment and to the lives of individuals within the community and within Chevron's employ.

This topic is considered in *Section 4.8, Greenhouse Gases* in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*, of this EIR.

1.6.1.5 Hydrology and Water Quality

The Contra Costa Environmental Health Division (CCEHD) commented that a permit from the CCEHD is required for any well or soil boring prior to commencing drilling activities, including those associated with environmental investigation and cleanup, and geotechnical investigation. The CCEHD also commented that any abandoned wells (water, environmental, or geotechnical) and septic tanks must be destroyed under permit from the CCEHD. If the existence of such wells or septic tanks is known in advance or discovered during construction or other activities, these should be clearly marked, kept secure, and destroyed pursuant to CCEHD requirements.

These topics are considered in *Section 4.9, Hydrology and Water Quality* in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures,* of this EIR.

1.6.1.6 Land Use, Plans, and Policies

The San Francisco Bay Conservation and Development Commission commented that, although it appears the Project is located outside its "shoreline band" permitting jurisdiction, the Facility is located within a water-related industry priority use area as shown on Bay Plan Map 4. Under the Coastal Zone Management Act, in the event a federal permit or federal funding is needed for the Project, the commission has the authority to determine whether the activity is consistent with its law and policies. If there would be any such federal involvement with the Modernization Project, the Project proponent would need to contact Ms. Jaime Michaels of the commission's staff.

This topic is considered in *Section 4.10, Land Use, Plans, and Policies* in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*, of this EIR.

1.6.1.7 Employment, Population, and Housing

Tom Quinn (Senior Field Representative for the Carpenters Union), Latrice Maderas (Richmond BUILD Graduate), Paul Cohen (President of the Carpenters Union), and Rafael Madrigal (President of 23rd Street Merchant Association) expressed a desire for jobs.

These topics are considered in *Section 4.12, Employment, Population, and Housing* in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, of this EIR*.

1.6.1.8 Public Safety

Dr. Henry Clark, Director of West County Toxics Coalition, raised the following issues:

- Safety along the pipeline at the Facility and in Richmond: If there is a problem along the pipeline, how would it affect other parts of the Project or the Facility?

These topics are considered in *Section 4.13, Public Safety* in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*, of this EIR.

1.6.1.9 Transportation and Traffic

Caltrans commented that the City of Richmond, as the Lead Agency, is responsible for all Project mitigation, including any needed improvements to State highways. The Project's fair share contribution, financing, scheduling,

implementation responsibilities, and Lead Agency monitoring should be fully discussed for all proposed mitigation measures.

Caltrans also commented that, if it is determined that traffic restrictions and pedestrian/bicycle detours are needed, then a transportation management plan or construction traffic impact study may be required by the developer for approval by the Lead Agency and Caltrans prior to construction. Additionally, any Project work that requires movement of oversized or excessive load vehicles on State roadways, such as Interstate 580 (I-580), requires a transportation permit that is issued by Caltrans.

These topics are considered in *Section 4.16, Transportation and Traffic* in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*, of this EIR.

1.6.1.10 Utilities and Service Systems

The East Bay Municipal Utility District (EBMUD) commented that it determined that the Project does not require the preparation of a new Water Supply Assessment as the Project reduces the scope from the 2008 Project with the elimination of the co-generation facility and appears not to induce additional water demand from the original estimate. The reduction of water demand should be confirmed in the Draft EIR.

EBMUD also commented that it strongly urges Chevron to continue cooperating with EBMUD to develop the Richmond Advanced Recycled Expansion Water Project to offset the increased water usage anticipated by the Project and increase Chevron's use of recycled water at the Facility.

These topics are considered in *Section 4.17, Utilities and Service Systems* in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures,* of this EIR.

1.6.2 Issues and Concerns Raised in Writ

As described above, the Appellate Court Decision concluded that: (1) the project description in the 2008 EIR was unclear and inconsistent as to whether or not the project would enable the Facility to process a heavier crude oil than it currently processes; (2) the 2008 EIR did not establish a baseline for purposes of determining whether there would be any increased impacts from any changes in the crude oil processed at the Facility; and (3) the 2008 EIR improperly deferred the formulation of greenhouse gas mitigation measures to a future, post-EIR process.

As described in *Section 4.0.3, EIR Methodology Addressing Writ*, of *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures,* this EIR includes a comprehensive evaluation of the potential for, and environmental impacts

associated with, changing the type of crude oil blends and gas oils refined at the Facility. The EIR also has a revised project description, as well as comprehensive greenhouse gas mitigation measures.

1.6.3 Utilization

Because certain Facility impacts such as air emissions correlate to Facility utilization levels (i.e., higher utilization means greater throughput, and higher air emissions from "full" process units), this EIR evaluates Modernization Project impacts under two levels of Facility utilization:

- *93% Utilization Scenario.* First, this EIR analyzes post-Project Facility operations on the basis of a reasonably foreseeable utilization level that assumes the Crude Unit (through which all crude oil blends are processed) and the several "gateway" processing units that accept imported gas oils[7] would operate at an average annual rate of 93% of their maximum permitted capacity, under post-Project revised air permit limits. This 93% utilization level is the highest average annual utilization rate for refineries in the western United States, and it represents a material increase from the 88.6% utilization that occurred during the 2008 through 2010 baseline period and other recent years. Accordingly, the 93% Utilization Scenario represents a reasonably foreseeable post-Project utilization rate at the Facility.
- *100% Utilization Scenario.* Second, this EIR analyzes the post-Project Facility operations on the basis of full utilization scenario (100% Utilization Scenario), which assumes that the Crude Unit and the gateway gas oil processing units operate at all times up to their maximum permitted capacity following implementation of the Modernization Project.

For environmental impact topics that correlate to utilization rates, such as air quality, the EIR compares the environmental effects of the Project under the 93% and 100% Utilization Scenarios to baseline period emissions. *Section 4.0, Introduction to Chapter and Methodology*, *Appendix 4.3-URM*, and the impact assessment sections of this EIR provide further description of the baseline period utilization and the 93% and 100% Utilization Scenarios.

1.7 REPORT ORGANIZATION

This EIR contains the following chapters:

[7] These "gateway" gas oil processing units include the fluid catalytic cracker, the fluid catalytic cracker feed hydrotreater, the hydrotreater, and the two lube hydrocrackers, referred to as the heavy neutral hydrocracker and the light neutral hydrocracker.

- *Chapter 1, Introduction*. This chapter provides an introduction and overview of the EIR, describes the intended use of the EIR, and describes the review and certification process.
- *Chapter 2, Summary*. This chapter summarizes the elements of the Modernization Project and the environmental impacts that could result from implementation of the Project, and provides a table that lists impacts, describes proposed mitigation measures, and indicates the level of significance of impacts after mitigation.
- *Chapter 3, Project Description*. This chapter describes the location and nature of the various components that make up the Modernization Project analyzed in this EIR.
- *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*. This chapter describes the environmental setting, impacts, and mitigation measures. *Section 4.0* is an introduction, providing an overview of the scope of the analysis, the organization of the sections, the methods for determining which impacts are significant, and the applicability of mitigation measures. The chapter also explains how Chevron is meeting its voluntary project objective of assuring that the Modernization Project would result in no net increase in criteria air pollutants, greenhouse gases, and public health risks from air pollution, relative to the emissions that occurred during the 2008-2010 baseline period. Lastly, *Chapter 4* also describes the August 6, 2012 fire at the crude unit, which resulted in the temporary shutdown and repair of the crude unit, safety and reliability improvements made by Chevron following the fire, and the status of ongoing actions related to this incident.
- *Chapter 5, CEQA Statutory Sections*. This chapter provides discussions required by CEQA regarding impacts that would result from the Project, including a summary of significant adverse unavoidable impacts, growth-inducing impacts, and significant irreversible environmental changes. The Modernization Project, as mitigated, has no significant unavoidable impacts.
- *Chapter 6, Alternatives Analysis*. This chapter describes and compares alternatives to the Modernization Project and the associated environmental consequences of these alternatives.
- *Chapter 7, Report Preparation/Agencies and Organizations Contacted*. This chapter lists report preparers and agencies and organizations contacted for assistance in the preparation and review of the EIR.
- *Chapter 8, Glossary and Measurement Units*. This chapter provides a list of definitions for acronyms, technical words, and measurement units used in the EIR.

- *Chapter 9, Mitigation Monitoring and Reporting Program.* This chapter describes the Mitigation Monitoring and Reporting Program for mitigation measures identified in Chapter 4.

Additionally, at the top of the first page of each chapter and environmental topic subsection of *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures* a paragraph (formatted with *italic* type) that highlights how the chapter/section included in this EIR compares to the corresponding chapter/section included in the Chevron Hydrogen and Energy Renewal Project EIR Consolidated Volume (2008 EIR).

CHAPTER 2.
SUMMARY

2.1 INTRODUCTION

The City of Richmond (City), acting as Lead Agency, has revised this Environmental Impact Report (EIR) to comply with the writ of mandamus (Writ) issued by the Contra Costa Superior Court on the 2008 Chevron Hydrogen and Energy Renewal Project EIR, Consolidated Volume (2008 EIR) prepared by the City for the previously proposed Chevron Hydrogen and Energy Renewal Project (2008 Project), and to analyze the potential environmental impacts that could result from the currently proposed Chevron Refinery Modernization Project (Modernization Project or Project),[1] a revised and down-sized form of the 2008 Project. It is anticipated that this EIR will also be used by other state and local agencies with discretionary approval authority over aspects of the Modernization Project, including the Bay Area Air Quality Management District (BAAQMD), and potentially the San Francisco Regional Water Quality Control Board (RWQCB) and the California Department of Transportation (Caltrans). The intent of this EIR is not to determine whether the Modernization Project should be approved, but to provide public disclosure and to aid the local planning and decision-making process.

In compliance with the California Environmental Quality Act (CEQA), California Public Resources Code Sections 21000-21178 (CEQA) and Title 14, Chapter 3, of the California Code of Regulations (CEQA Guidelines), a draft of this EIR (Draft EIR) will be distributed to federal, state, and local agencies and other interested parties for a 45-day review and comment period. The review and comment period begins following filing of a Notice of Availability with the Governor's Office of Planning and Research, State Clearinghouse. Several educational sessions and a public hearing are planned during this 45-day public comment period to assist the public in their review of the Draft EIR. The dates and locations of these events will be announced in notices and posted on the Project website: http://chevronmodernization.com/.

The City will carefully consider and respond to timely comments on this EIR and will take those comments into consideration when making a decision about the Modernization Project. Following the close of the public comment period,

[1] Previous notices referred to the Modernization Project as the "Revised Energy and Hydrogen Renewal Project" or "Revised Renewal Project" during the scoping period for this EIR.

responses to comments and revisions to the Draft EIR will be completed for inclusion in the final EIR (Final EIR). Under CEQA, the Final EIR must be released 10 days prior to the Planning Commission's consideration of the EIR and pending project applications. The Planning Commission's decision regarding the Modernization Project and associated EIR may be appealed to the City Council for final City action.

The following is a summary of (1) the background and context of the EIR; (2) the objectives for the Modernization Project; (3) the project components and project design features of the Modernization Project; (4) the alternatives to the Project that are evaluated in this EIR and how their impacts compare to those of the Project; (5) potential areas of controversy determined during the scoping period; and (6) the environmental impacts, and associated mitigation measures, of the Modernization Project as developed during this analysis.

2.2 PROJECT BACKGROUND

Chevron Products Company, a division of Chevron USA Inc. (Chevron), owns and operates the Chevron Richmond Refinery (Facility or Project Site), located along the western edge of the City of Richmond in Contra Costa County, California.

In 2005, Chevron applied to the City for permits for the proposed 2008 Project at the Facility. In 2008, the City certified an Environmental Impact Report (2008 EIR) and approved design review and conditional use permits (Permits) for the 2008 Project. Following those approvals, Chevron began construction of certain portions of the 2008 Project. In 2009, however, the Contra Costa Superior Court invalidated the 2008 EIR and the Permits, and issued an injunction halting further construction. At the time construction was halted, none of the new equipment was complete or operational. Following an appeal, in 2010, the California Court of Appeal affirmed in part and reversed in part the Superior Court decision (Appellate Court Decision) and, on March 14, 2011, the Contra Costa Superior Court issued a writ of mandamus (Writ) ordering that the 2008 EIR and the Permits be set aside on certain grounds.[2] In compliance with the Writ, the City vacated the 2008 Project permits.

In 2011, the City Council of the City of Richmond adopted a resolution encouraging Chevron to resubmit its application. Later in 2011, Chevron submitted a new application to the City for the revised, down-sized Modernization Project, described below. Following receipt of this application, the

[2] The terms “Appellate Court Decision” and “writ” are used interchangeably in this EIR.

City began preparation of this EIR in order to comply with the Writ and to analyze the potential environmental impacts that could result from the Project.

2.3 OBJECTIVES OF THE MODERNIZATION PRO JECT

Chevron has identified the following objectives for the Modernization Project:

- Modernize, enhance equipment reliability, and enhance the integrity of the Facility by replacing older equipment with newer, cleaner, and inherently safer systems and equipment, consistent with the Richmond Industrial Safety Ordinance.
- Enhance the Facility's flexibility to process crude oil blends and externally sourced gas oils[3] containing higher levels of sulfur than those currently being processed, enabling Chevron to continue producing transportation fuels and lubricant base oils in compliance with low-sulfur State and federal standards.
- Replace the existing hydrogen production plant with a larger, more modern plant that is more energy-efficient, produces higher purity hydrogen, and has sufficient capacity to meet the Facility's hydrogen needs and for potential export.[4]
- Ensure that there is no net increase in emissions of greenhouse gases and criteria air pollutants compared to the baseline period, through a combination of: replacing some existing equipment with new Modernization Project components that are more energy-efficient and lower-emitting; installing emissions reduction Project Design Features in the Modernization Project; and implementing specific, feasible mitigation measures as described in this EIR.
- Ensure that there is no net increase in health risks associated with toxic air contaminants (TACs) from Facility operations as compared to the baseline period, using a combination of project components, Project Design Features,

[3] "Externally-sourced" gas oils are purchased for use as feedstock at the Facility, and are also called "imported" or "purchased" gas oils. The Facility crude unit also produces gas oils as an internal feedstock for further processing into end products. Section 3.3 provides a description of the Modernization Project's effect on the Facility's ability to process gas oil from both internal and external sources.

[4] Praxair Corporation, the owner and operator of the Hydrogen Plant Replacement, has separately sought authorization from the County and other jurisdictions to construct a hydrogen pipeline for export and sale of hydrogen not used by Chevron to third-party customers, including refineries and potentially other facilities in the East Bay. The Praxair export project was determined to be appropriately considered as a separate project in the Appellate Court Decision.

and mitigation measures, consistent with the methodology for assessing non-nominal risks established by the BAAQMD.[5]

- Maintain the Facility's current throughput processing capacity.

2.4 OVERVIEW OF MODERNIZATION PROJECT

Consistent with the project objectives described above, the Modernization Project was designed to achieve three overarching goals:[6]

- Enhance the safety and reliability of the Facility through installation of newer, inherently safer equipment and technologies;
- Enhance the Facility's processing flexibility to produce the full range of Facility products; and
- Achieve no net increase in criteria pollutants, greenhouse gases, and public health risks from air pollution.

The Modernization Project would complete construction and begin operation of two of the 2008 Project's major components, the Hydrogen Plant Replacement and a collection of new equipment improvements that remove naturally occurring sulfur contained in feedstocks processed at the Facility (collectively, the Sulfur Removal Improvements). The Project would also construct related infrastructure improvements to Facility piping, utility lines, and electrical systems. The Modernization Project includes several integral equipment components that would reduce air emissions from Facility operations (the Emission Reduction Project Components) and further Project Design Features proposed to avoid or minimize environmental impacts. The Project also proposed various Facility modifications that would improve Facility safety and reliability and, in combination with other emission reduction measures, would further reduce the Facility's post-Project air pollutant emissions. Reducing Project emissions would help meet Chevron's commitment of assuring that the Project would cause no net increase in emissions of criteria pollutants, greenhouse gases, and public health risks from air pollutants, when compared to the Facility emissions and operations that occurred during the Baseline period of 2008 through 2010.[7] Following issuance of all necessary approvals, Chevron proposes to complete Project construction within 24 months.

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[5] For a discussion of the Modernization Project's cumulative impacts related to health risks from toxic air emissions, see *Section 4.3, Air Quality*.

[6] A discussion of how the Modernization Project fulfills these goals is provided *in Section 3.13, Modernization Project Goals.*

[7] As described in detail in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, Section 4.3.4.1,* the City selected the years 2008-2010 as the baseline years

Because certain Facility impacts such as air emissions correlate to Facility utilization levels (i.e., higher utilization means greater throughput, and higher air emissions from "full" process units), this EIR evaluates Modernization Project impacts under two levels of Facility utilization:

- *93% Utilization Scenario.* First, this EIR analyzes post-Project Facility operations on the basis of a reasonably foreseeable utilization level the assumes that the Crude Unit (through which all crude oil blends are processed) and the several "gateway" processing units that accept imported gas oils[8] will operate at an average annual rate of 93% of their maximum permitted capacity, under post-Project revised air permit limits. This 93% Utilization Scenario is the highest average annual utilization rate for refineries in the Western United States from 1985 and it represents an increase from the 88.6% utilization that occurred during the 2008 through 2010 baseline period and other recent years. Accordingly, the 93% Utilization Scenario represents a reasonably foreseeable post-Project utilization rate at the Facility.
- *100% Utilization Scenario.* Second, this EIR analyzes the post-Project Facility operations on the basis of full utilization scenario (100% Utilization Scenario), which assumes that the Crude Unit and the gateway gas oil processing units operate at all times up to their maximum permitted capacity following implementation of the Modernization Project.

2.5 ALTERNATIVES TO THE PROJECT

The intent of the alternative discussion within this EIR is to meet CEQA requirements for describing a range of reasonable alternatives to the Project that would feasibly attain most of the project objectives and avoid or substantially lessen any of the Project's significant adverse impacts (CEQA Guidelines Section 15126.6). As described further below, *Chapter 6, Alternatives Analysis,* of this EIR provides an analysis of nine potentially feasible alternatives to the Modernization Project.

Chapter 6, Alternatives Analysis, evaluates six alternatives to the Modernization Project, in addition to the "no project" alternative required by CEQA. The alternatives analysis considers the impacts of each alternative with and without

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because they were the 3 years immediately preceding publication of the NOP for which complete operational and emissions data were available, and because 2008-2010, on average, generally represent typical refinery operations and emissions levels.

[8] These "gateway" processing units include the fluid catalytic cracker, the fluid catalytic cracker feed hydrotreater (FCC FHT), the hydrotreater, and the two lube hydrocrackers, referred to as the heavy neutral hydrocracker and the light neutral hydrocracker (HNC and LNC).

implementation of the Project's proposed Reliability Program described in *Section 4.14, Public* Safety. Likewise, the alternatives analysis considers the impacts of each alternative with and without implementation of the Project's "no net increase" commitment. Each alternative to the Modernization Project is summarized below.

2.5.1 "No Project" Alternative

Per CEQA Guideline Section 15126.6(e), this EIR is required to evaluate a "no project" alternative to the Modernization Project. The purpose of the "no project" alternative is to compare the impacts of the Modernization Project with the impacts likely to occur if the Project is not implemented.

Per the Facility's existing federal Clean Air Act Title V permit, the Facility is authorized to process up to 257,200 barrels per day (b/d) of crude oil. This permit limit would not be modified by the Modernization Project and the Project would maintain the Facility's current crude oil throughput capacity. *Chapter 6, Alternatives Analysis*, evaluates three variants of the required "no project" alternative, each of which assumes a different Facility utilization level in accordance with the Facility's existing Title V permit authorization, as follows:

- The "**No Project: 89% Utilization**" alternative analyzes Refinery Operations under no-Project future conditions (i.e., no changes to the Facility related to the Project occur) assuming 89% of the crude unit and gas oil gateway unit capacities are utilized on an annual average daily rate basis. This alternative represents a level of Refinery Operations that is consistent with those occurring during the 2008-2010 Baseline period and therefore most closely approximates future no-Project conditions;
- The "**No Project: 93% Utilization**" alternative analyzes Refinery Operations under no-Project future conditions (i.e., no changes to the Facility related to the Project occur) assuming 93% of the crude unit and gas oil gateway unit capacities are utilized on an annual average daily rate basis. This alternative represents a level of Refinery Operations that is authorized by the Facility's existing Title V permit, though the Facility rarely operates at this utilization level. Since, however, the Facility has occasionally operated at a 93% utilization rate during the Baseline period, and could theoretically do so again if the Project is not approved, this alternative is evaluated as a potential, though unlikely, "no project" scenario; and
- The "**No Project: 100% Utilization**" alternative analyzes Refinery Operations under no-Project future conditions (i.e., no changes to the Facility related to the Project occur) assuming 100% of the crude unit and gas oil gateway unit permitted capacities are utilized on an annual average daily rate basis.

Though it is unlikely that the Facility will operate at a 100% utilization given its existing crude oil and gas oil throughput limits, this operational level is authorized under the Facility's existing Title V permit. Accordingly, the No Project: 100% Utilization alternative is analyzed for purposes of comparing Project impacts against the Facility's legally permitted operational limits.

2.5.2 Reduced Sulfur Processing Alternative

As explained in *Chapter 6, Alternatives Analysis*, the Reduced Sulfur Processing Alternative assumes that the Modernization Project would be implemented as proposed, except that the sulfur recovery unit's sulfur removal capacity would only be increased to 750 long tons per day, whereas the Project proposes to increase such capacity to 900 long tons per day. Thus, under this alternative, Chevron would implement all of the Modernization Project's proposed Facility modifications, but the sulfur recovery unit's utilization rate would be limited to approximately 83.3% of the capacity proposed by the Modernization Project. Moreover, as with the Project, this alternative assumes that the Facility will be operated consistent with the 93% Utilization Scenario, processing the Project Crude Blend, with the Hydrogen Plant Replacement operating at 100% of capacity.

2.5.3 Hydrogen Cap Alternative

The Hydrogen Cap Alternative assumes that the Hydrogen Plant Replacement would be built but only permitted to produce 197 million metric square cubic feet per day (mmscfd) of hydrogen. This Hydrogen Cap Alternative further assumes that the Modernization Project would be implemented as proposed and that the Facility will be operated consistent with the 93% Utilization Scenario, processing the Project Crude Blend.

2.5.4 Renewable Energy Alternative

As explained in *Chapter 6, Alternatives Analysis*, the Renewable Energy Alternative assumes that the Modernization Project would be implemented as proposed, but it would also include construction of a 8 megawatt (MW) ground-mounted solar photovoltaic facility on approximately 40-acres of Chevron-owned property adjacent to the Project Site and generally encompassing an area commonly known as Landfill 15 (the 8-MW solar facility). The 8-MW solar facility would be comprised of approximately 31,200 photovoltaic solar panels, each

rated at 295 watts.[9] It is assumed that the energy produced by the 8-MW solar facility would be used at the Facility or put back into the electrical grid.

2.5.5 API Gravity 35.3 Cap Alternative

The API Gravity 35.3 Cap Alternative assumes that the Modernization Project would be implemented as proposed, except that the Facility would be required to limit its feedstock to crude and gas oils that do not exceed an API gravity of 35.3 degrees, a number that corresponds to the "Lightest Crude Blend" described in *Appendix 4.3-URM*. The alternative further assumes that the Facility will be operated consistent with the reasonably foreseeable 93% Utilization Scenario, and with the Hydrogen Plant Replacement operating at 100% of capacity. As explained in *Chapter 6, Alternatives Analysis*, this alternative would not achieve the Project's underlying fundamental purpose. Nevertheless, it is evaluated in Chapter 6 in response to prior expressions of public interest.

2.5.6 API Gravity 29.2 Cap Alternative

The API Gravity 29.2 Cap Alternative assumes that the Project would be implemented as proposed, except that the Facility would be required to limit its feedstock to crude and gas oils that do not exceed an API gravity of 29.2 degrees, a number that corresponds to the "Heaviest Crude Blend," described in *Appendix 4.3-URM*. The alternative further assumes that the Facility will be operated consistent with the reasonably foreseeable 93% Utilization Scenario, and with the Hydrogen Plant Replacement operating at 100% of capacity. As explained in *Chapter 6, Alternatives Analysis*, the API Gravity 29.2 Cap Alternative would not reduce any of the Project's environmental impacts and, in some cases, would increase them. However, this alternative describes Refinery Operations processing the heaviest crude blend the Facility can theoretically accommodate[10] and, therefore, it is evaluated for informational purposes in response to prior expressions of public interest.

2.5.7 Carbon Intensity Cap Alternative

The California Air Resources Board defines "carbon intensity" as the amount of "lifecycle" greenhouse gas emissions, per unit of energy of fuel delivered, expressed in grams of carbon dioxide equivalent per megajoule (gCO2e/Mj) (17 Cal. Code of Regs. Section 95481(a) (16)). In the context of hydrocarbon fuel

[9] The 8-WM solar facility is distinct from, but would be constructed adjacent to, the 2-MW solar facility included in the list of potential Community Greenhouse Gas Reduction Programs (CGRP) described in *Section 4.8, Greenhouse Gases*. If the 2-MW solar facility is implemented, it would be constructed in addition to the 8-MW solar facility assumed by this Renewable Energy Alternative.

[10] As explained in *Appendix 4.3-URM* .

production, carbon intensity is a metric that describes the total greenhouse gas emissions associated with the extraction, transportation, processing, distribution and ultimate consumption of a hydrocarbon fuel product.

The Carbon Intensity Cap Alternative assumes that the applicant would be required to limit Refinery Operations such that the Facility will not process feedstocks that exceed the "carbon intensity" of the feedstock processed during the 2008-2010 Baseline period. Accordingly, this alternative assumes that all of the Project's proposed Facility modifications will be implemented and that the Facility will be operated consistent with the 93% Utilization Scenario, with the Hydrogen Plant Replacement operating at 100% of capacity. Under this alternative, however, the Facility would be restricted to processing the so-called "Baseline Crude Blend," a crude blend that represents the average carbon intensity of the feedstock processed at the Facility during the 2008-2010 Baseline period.

As explained in *Chapter 6, Alternatives Analysis*, the Carbon Intensity Cap Alternative would not achieve the Project's underlying fundamental purpose. Nevertheless, this alternative is evaluated for informational purposes in response to prior expressions of public interest.

2.5.8 Reduced Sulfur Processing/No Increase in Refinery GHG Emissions Alternative

The Reduced Sulfur Processing/No Increase in Refinery GHG Emissions Alternative would limit sulfur removal to 750 long tons per day, which is 150 long tons higher than what is currently permitted, but only half of the 300 long tons capacity increase requested by Chevron and included in the Modernization Project. This alternative would also limit GHG emissions from Refinery operations (including Refinery-related transportation GHG emissions) to Baseline levels of 4,602,947 metric tons (MT) per year, and thus allow no physical increase in GHG emissions from the Refinery over Baseline.

2.5.9 Reduced Sulfur Processing/No Increase in Refinery GHG Emissions/No FCC FHT Expansion Alternative

The Reduced Sulfur Processing/No Increase in Refinery GHG Emissions/No FCC FHT Expansion Alternative includes all features in the Reduced Sulfur Processing/No Increase in Refinery GHG Emissions as well as elimination of the proposed Fluid Catalytic Cracker Feed Hydrotreater (FCC FHT) expansion. As explained in the Project Description (p. 3-25), the Modernization Project would increase the throughput capacity of the FCC FHT from 65,000 to 80,000 barrels per day, which would enable the Facility to import and process higher sulfur gas

oils in lieu of importing low sulfur gas oils that are fed directly to the Facility's FCC unit. Under this Alternative, this FCC FHT modification would not be completed.

2.5.10 Environmentally Superior Alternative

None of the alternatives described in *Chapter 6, Alternatives Analysis,* would implement the Project's commitment to no net increase of greenhouse gas emissions, CAP emissions, and health risks related to TAC emissions. As a result, all of the alternatives evaluated in Chapter 6 would result in overall greater emissions than the Modernization Project, with the exception of the Reduced Sulfur Processing/No Increase in Refinery GHG Emissions Alternative and the Reduced Sulfur Processing/No Increase in Refinery GHG Emissions/No FCC FHT Expansion Alternative. And of these two alternatives, the Reduced Sulfur/No Increase in Refinery GHG Emissions Alternative is the environmentally superior alternative because it would result in the lowest greenhouse gas, CAP and TAC emissions as compared to the Project. As noted discussed in *Chapter 6, Alternatives Analysis*, however, the EIR preparers have no information regarding the economic feasibility of these two alternatives for the applicant relative to the Project. Of the remaining alternatives, when compared to the Project, the Reduced Sulfur Processing alternative would have reduced transportation impacts and slightly reduced reliability and public safety impacts, as explained in *Chapter 6, Alternatives Analysis, Section 6.5.5.1*. Thus, of the remaining alternatives, if the Reduced Sulfur Processing alternative were approved, and if the not net increase (NNI) commitment were implemented, then the Reduced Sulfur Processing alternative would be environmentally superior to the Modernization Project.

2.6 POTENTIAL AREAS OF CONTROVERSY

The City of Richmond circulated a Notice of Preparation (NOP) for this EIR from June 10, 2011 through July 12, 2011. The City of Richmond also hosted a scoping meeting on June 22, 2011 to allow jurisdictional agencies and interested persons or groups to provide comments on the scope and content of the EIR.

Letters and verbal comments received on the NOP and at the scoping meeting raised a number of topics that the commenters wanted addressed in the EIR. These topics included public safety impacts, hazardous materials impacts, air emissions and related health impacts, greenhouse gas emissions, impacts on plants and wildlife, traffic and transportation impacts, impacts on archaeological resources, impacts on water supply, Bay shoreline land use impacts, and related permitting issues. In addition, some of the comments requested an open and transparent process, and some addressed the merits of the Modernization

Project itself and not the potential adverse environmental impacts that are the subject of this EIR.

Appendix 1 of this EIR contains the NOP and comment letters received, and a table that provides a summary of the comments received during the public scoping period.

2.7 SUMMARY OF IMPACTS AND MITIGATION MEASURES

The potential adverse impacts, as well as mitigation measures and improvement measures, relevant to the Modernization Project are presented in Table 2-1. The table has been organized to correspond with environmental topics discussed in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*. As summarized in Table 2-1, all potential impacts from the Modernization Project are, or can be mitigated to less-than-significant levels.

The table is arranged in four columns: (1) environmental impact; (2) mitigation and improvement measures; (3) level of significance of the impact before mitigation (when mitigation is necessary); and (4) level of significance of the impact after mitigation. Levels of significance are categorized as follows: LTS = Less than Significant; S = Significant; and SU = Significant and Unavoidable.

A number of improvement measures are also recommended in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*. Although not required by CEQA, the preparers of this EIR recommend, and Chevron has agreed to implement these improvement measures, which will further minimize already less-than-significant impacts. These measures are highlighted with *italics type* in Table 2-1.

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
4.1 Aesthetics, Visual Quality, Light, and Glare			
4.1-1: The Modernization Project would add new equipment and facilities in developed, industrial portions of the Project site. These new facilities, which would be visible from public view corridors, would slightly alter but would not significantly degrade the visual character of the setting. The new equipment would represent a relatively minor incremental visual change compared to the size and extent of existing Facility equipment.	**4.1-1:** None required.	LTS	LTS
4.1-2: Operations as a result of the Modernization Project would not be expected to increase the frequency and/or magnitude of flaring events at the Facility.	**4.1-2:** None required.	LTS	LTS
4.1-3: Operation of the Modernization Project could create water vapor plumes visible to surrounding residents and motorists. Steam would be generated as a part of the Modernization Project and used in the proposed process units. The formation of visible water vapor plumes from Facility process units is a function of varying local meteorological conditions, including air temperature, wind speed, and atmospheric humidity, as well as variation in the actual Facility process itself.	**4.1-3:** None required	LTS	LTS
4.1-4: The Modernization Project would introduce new lighting on the Project site. Additionally, existing lighting would be replaced with LED lighting. Nighttime construction, if undertaken, may also temporarily increase nighttime lighting on the Project site. These changes would not significantly alter existing light and glare conditions on the Project site.	**4.1-4:** None required	LTS	LTS
4.2 Agricultural Resources			
The Modernization Project would result in no significant adverse impacts to agriculture or forestry under the Appendix G CEQA thresholds for these resources.			

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
4.3 Air Quality			
4.3-1: Construction of the Modernization Project could result in potentially significant, localized construction dust-related air quality impacts.	**4.3-1:** All remaining construction activities for the Modernization Project shall comply with the following Bay Area Air Quality Management District (BAAQMD) construction mitigation measures: 1a: All exposed surfaces shall be watered at a frequency adequate to maintain minimum soil moisture of 12%. Moisture content can be verified by lab samples or moisture probe. 1b: All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 miles per hour. 1c: Wind breaks (e.g., trees, fences) shall be installed on the windward side(s) of actively disturbed areas of construction. Wind breaks should have at maximum 50% air porosity. 1d: Vegetative ground cover (e.g., fast-germinating native grass seed) shall be planted in disturbed areas as soon as possible and watered appropriately until vegetation is established. 1e: The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities on the same area at any one time shall be limited. Activities shall be phased to reduce the amount of disturbed surfaces at any one time. 1f: All trucks and equipment, including their tires, shall be washed off prior to leaving the site. 1g: Site accesses to a distance of 100 feet from the paved road shall be treated with a 6- to 12-inch compacted layer of wood chips, mulch, or gravel.	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	1h: Sandbags or other erosion control measures shall be installed to prevent silt runoff to public roadways from sites with a slope greater than 1%. 1i: All haul trucks transporting soil, sand, or other loose material off-site shall be covered. 1j: All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping shall be prohibited. 1k: All vehicle speeds on unpaved roads shall be limited to 15 miles per hour. 1l: All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used. 1m: Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure, Title 13, Section 2485 of California Code of Regulations). Clear signage shall be provided for construction workers at all access points. 1n: All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator. 1o: A publicly visible sign shall be posted providing the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The BAAQMD's phone number shall also be		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	visible to ensure compliance with applicable regulations.		
4.3-2: Future construction activities associated with the Modernization Project would generate short-term emissions of ozone precursors (i.e., oxides of nitrogen [NO_x] and reactive organic gases [ROGs]) that would exceed Bay Area Air Quality District (BAAQMD) significance thresholds.	**4.3-2a:** Chevron shall reduce construction-related NO_x emissions to less-than-significant levels by implementing one or more of the following feasible mitigation measures, all of which have been found to result in emissions reduction for construction projects: ▪ Using lower emitting construction equipment, increasing carpooling or otherwise reducing construction-worker automobile use in daily commutes, extending the duration of construction by 1 year by delaying the modifications required to increase the throughput capacity of the FCC FHT until after construction of the hydrogen plant and amine contactor, or reducing the hours of use of construction equipment; ▪ Reducing operations and/or emissions from portable generators at the Facility during the construction period, and thereby reducing NO_x emissions; ▪ Installing the low-NO_x burners included in the Modernization Project in the first 6 months of the construction period, thereby reducing net NO_x emissions from the Facility while construction of the Modernization Project continues; ▪ Retiring permanent NO_x emission reduction credits to offset this temporary NO_x construction increase, in an amount sufficient to offset construction period NO_x emissions; or ▪ Implementing a combination of two or more of the above measures, in an amount sufficient to offset	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	construction-period NO_x emissions to less-than-significant levels.		
	4.3-2b: Chevron shall reduce construction-related ROG emissions to less-than-significant levels by implementing one or more of the following feasible mitigation measures, all of which have been found to result in emissions reduction for construction projects: ▪ Installing the tank dome Project Design Feature, and installing one additional tank dome, in the first 6 months of Project construction, thereby reducing net ROG emissions from the Facility before completing construction of the hydrogen plant or sulfur removal components of the Modernization Project; ▪ Using lower emitting construction equipment, increasing carpooling or otherwise reducing construction-worker automobile use in daily commutes, extending the duration of construction by 1 year by delaying the modifications required to increase the throughput capacity of the FCC FHT until after construction of the hydrogen plant and amine contactor, or reducing the hours of use of construction equipment; ▪ Retiring permanent ROG emission reduction credits to offset this temporary ROG construction increase, in an amount sufficient to offset construction-period ROG emissions; or ▪ Implementing a combination of the above measures, in an amount sufficient to offset construction-period ROG emissions to less-than-significant levels.		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
4.3-3: Future construction activities associated with the Modernization Project would generate short-term emissions of particulate matter less than 10 microns (PM_{10}) and particulate matter less than 2.5 microns ($PM_{2.5}$) that could increase risks to public health.	***4.3-3:*** *The Modernization Project shall implement reasonable and prudent practices to reduce PM_{10} and $PM_{2.5}$ emissions from construction equipment to further reduce this less-than-significant impact. Such practices may include, but are not limited to, the following:* *3a: Idling time of diesel-powered construction equipment shall be minimized.* *3b: Off-road equipment (more than 50 horsepower) to be used in the construction project (i.e., owned, leased, and subcontractor vehicles) shall be newer, since newer equipment may achieve a Project-wide fleet-average 20% NO_x reduction, and 45% PM reduction compared to the most recent CARB fleet average. Acceptable options for reducing emissions include the use of late-model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available.* *3c: All construction equipment, diesel trucks, and generators shall be equipped with Best Available Control Technology for emission reductions of NO_x and PM.* *3d: Contractors should use equipment that meets CARB's most recent certification standard for off-road heavy duty diesel engines.*	LTS	LTS
4.3-4: Construction activities associated with the Modernization Project would result in toxic air contaminant (TAC) emissions that are below the level of significance.	**4.3-4:** None required.	LTS	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
4.3-5: Operation of the Modernization Project would result in increased emissions of criteria air pollutants (CAPs).	**4.3-5:** Chevron shall implement feasible mitigation measures to reduce CAP emissions below applicable BAAQMD significance thresholds and to ensure no net increase in Project CAP emissions over Baseline levels, as follows: 5a: NO_x Mitigation. Chevron shall implement the following measures in an amount sufficient to reduce NO_x emissions to below the BAAQMD NO_x significance threshold and to ensure no net increase in Project NO_x emissions above Baseline NO_x emission levels: (i) Chevron shall increase the average parcel size—the average ship cargo volume that is delivered or picked up from the Long Wharf—to reduce the number of ship calls, and thereby reduce NO_x emissions from shipping. (ii) Chevron shall fund and require installation of cleaner main and auxiliary engines on up to six tug boats serving the Long Wharf. Tugs are used to push barges, escort ships and barges, and assisting ships and barges into berths. Chevron shall fund the installation of new, cleaner Tier 4 main engines and Tier 3 auxiliary engines for the number of tugs required to remain below the BAAQMD NO_x significance threshold, and achieve the mandatory requirement that there be no net increase in Project NO_x emissions above Baseline NO_x emission levels. (iii) If, after implementing Mitigation Measures 4.3-5(a)(i) and 4.3-5(a)(ii), either Project NO_x emissions have not been reduced below the BAAQMD NO_x significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	reduction credits in quantities sufficient to fully offset Project NO_x emissions to Baseline levels on a net basis. (iv) If, after implementing Mitigation Measure 4.3-5(a)(iii), above, Project NO_x emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project NO_x emissions are reduced to Baseline levels on a net basis. 5b: PM_{10} Mitigation. Chevron shall implement the following feasible mitigation measures in an amount sufficient to reduce PM_{10} emissions to below the BAAQMD significance thresholds and to ensure no net increase in Project PM_{10} emissions above Baseline PM_{10} emission levels: (i) Chevron shall increase the size of the Fluid Catalytic Cracking Electrostatic Precipitator (ESP) by approximately 50% to eliminate an existing NH_3 injection process in the flue gas in the Fluid Catalytic Cracking unit. (ii) If, after implementing Mitigation Measure 4.3-5b(i), above, PM_{10} emissions have not been reduced below the BAAQMD significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission reduction credits in quantities sufficient to reduce Project PM_{10} emissions to Baseline levels on a net basis. Permanent retirement of emission reduction credits would ensure that these banked emissions cannot occur within Richmond or elsewhere. (iii) If, after implementing Mitigation Measure		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	4.3-5(b)(ii), above, Project PM_{10} emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project PM_{10} emissions are reduced to Baseline levels on a net basis. 5c: $PM_{2.5}$ Mitigation. Chevron shall reduce $PM_{2.5}$ emissions to below BAAQMD significance thresholds, and to emission levels that ensure no net increase in Project $PM_{2.5}$ emission above Baseline $PM_{2.5}$ emissions, by implementing Mitigation Measure 4.3-5b (PM_{10}), which would also reduce $PM_{2.5}$ emissions. Additionally, Chevron shall complete a validation study quantifying the relative amount of $PM_{2.5}$ reductions achieved by Mitigation Measure 4.3-5b, for review and approval by BAAQMD and the City, to ensure that adequate quantities of $PM_{2.5}$ reductions are achieved as required by this Mitigation Measure 4.3-5c. Finally, Chevron shall implement Mitigation Measure 4.3-6, to reduce health risks from all TACs, including but not limited to $PM_{2.5}$, below the BAAQMD significance thresholds for cancer, and chronic or acute non-cancer risks, and as necessary to ensure no net increase in health risks from all TACs. 5d: SO_x Mitigation. Chevron shall implement the following feasible mitigation measures in an amount sufficient to reduce SO_x emissions to below the BAAQMD significance threshold and to ensure no net increase in Project SO_x emissions above Baseline SO_x emissions: (i) Chevron shall increase the use of SO_x-reducing catalyst in the Fluid Catalytic Cracking unit that has been demonstrated to substantially reduce SO_x		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	emissions in refinery flue gases. (ii) If, after implementing Mitigation Measure 4.3-5d(i), above, SO_x emissions have not been reduced below the BAAQMD significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission reduction credits in quantities sufficient to reduce Project SO_x emissions to Baseline levels on a net basis. (iii) If, after implementing Mitigation Measure 4.3-5(d)(ii), above, Project SO_x emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project SO_x emissions are reduced to Baseline levels on a net basis. 5e: CO Mitigation. Chevron shall implement the following feasible mitigation measures to ensure no net increase in Project CO emissions above Baseline CO emission levels: (i) Chevron shall reduce CO emissions to achieve the mandatory requirement that there be no net increase in Project CO emissions above Baseline CO emissions by retiring BAAQMD-verified emission reduction credits in quantities sufficient to reduce Project CO emissions to Baseline levels on a net basis. Permanent retirement of emission reduction credits would ensure that these banked emissions cannot occur within Richmond or elsewhere. (ii) If, after implementing Mitigation Measure 4.3-5(e)(ii), above, Project CO emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project CO		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	emissions are reduced to Baseline levels on a net basis. 5f: ROG Mitigation. Chevron shall complete the following feasible mitigation measures to reduce ROG emissions to below the BAAQMD significance thresholds and to ensure no net increase in Project ROG emissions above Baseline ROG emissions: (i) Prior to the commencement of Project operations, Chevron shall install a tank dome on Tank 3225; (ii) Within 3 years following the commencement of Project operations, Chevron shall install tank domes on Tanks 3189 and 3202; (iii) Following the third anniversary of the commencement of Project operations, Chevron shall install domes on one or more of the following tanks to reduce VOC emissions as necessary to reduce ROG emissions below the BAAQMD significance threshold, and to ensure no net increase in Project ROG emissions above Baseline ROG emissions: Tanks 1491, 3213, 3134, 1688, 1514, , 3133, 3071, 992, 3197, 1687, 990, 991, 3073, 1296, 3191, 1287, 3220, 3127, 1488, 1459, 3180, 3074, 3076, 3193, 3128, 3201, and 3075. If, following Project approval, Chevron identifies feasible ROG reduction measures other than tank domes that result in quantified emissions reductions as verified by BAAQMD, City shall consider implementation of such alternative reduction measures in lieu of, or in combination with, the reduction measures required by this Mitigation Measure 4.3-5f(iii), provided that such measures have completed all required CEQA review and permitting processes prior to implementation (it is noted,		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	however, that no such measures are currently identified, planned or approved for implementation.) (iv) If, after implementing Mitigation Measure 4.3-5f(i) through 4.3-5(iii), above, ROG emissions have not been reduced below the BAAQMD significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission reduction credits in quantities sufficient to reduce Project ROG emissions to Baseline levels on a net basis. (v) If, after implementing Mitigation Measure 4.3-5(f)(ii), above, Project ROG emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project ROG emissions are reduced to Baseline levels on a net basis. 5g: Supplemental Mitigation for all CAPs. In any year that Chevron exceeds Baseline emissions for any CAP, Chevron shall contribute funding for, and participate in, a Clean Air Improvement Fund, which funding shall be in addition to, and payment thereof shall in no way relieve Chevron or the Project of, the requirement that the Project achieve no net increase in CAP emissions, as follows: ▪ Funding shall be in an amount determined based on a benchmark price to be agreed to by the City, BAAQMD and Chevron, as thereafter annually adjusted by the Consumer Price Index value for the San Francisco Bay Area. ▪ Funding shall be paid annually within 60 days following approval by BAAQMD of the Emission Inventory for the prior calendar year.		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	▪ All payments into the Clean Air Improvement Fund shall be spent on emission reduction measures for criteria pollutant(s) that increased above Baseline in the following order: (1) reductions from Facility emissions, (2) reductions within the City, and (3) reductions from the North Richmond area closest to the Facility. ▪ Funding and implementation decisions shall be made in a public process by a stakeholder group consisting of representatives from the City, the community, and Chevron. ▪ A brief report shall be prepared for each major emission reduction measure implemented using such funds, and be made available to help inspire similar emission reduction opportunities. Mitigation Measure 4.3-5g would not create any exception to Chevron's obligation to fully comply with all mitigation measures included in this EIR, including but not limited to Mitigation Measure 4.3-6, which requires the Project to ensure no net increase of health risks over Baseline levels caused by all TAC emissions. 5h: Chevron shall secure a permit amendment from BAAQMD reducing the annual throughput limit of the Solvent Deasphalting unit to 50,000 barrels per day. This must be completed prior to commencing operation of the new hydrogen plant. 5i: Chevron shall secure a permit amendment from BAAQMD reducing the hydrogen production limit of each train of the new hydrogen plant from 140 mmscf/day to 122 mmscf/day. This must be		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	completed prior to commencing operation of the new hydrogen plant.		
4.3-6: Modernization Project operations would not result in increases in toxic air contaminant (TAC) emissions that would exceed Bay Area Air Quality Management District (BAAQMD) significance thresholds for cancer risk, chronic health hazard index (HI), and acute HI. However under the lightest crude blend hydrogen case, emissions from increased shipping would exceed the BAAQMD significance threshold for TACs.	**4.3-6:** Chevron shall implement the following measures: 6a1: Prior to operation of the Project, Chevron shall implement the following measures to reduce Diesel Particulate Matter (DPM), inclusive of $PM_{2.5}$, to reduce health risk from all Project TAC emissions to below BAAQMD significance criteria (for the 93% Project Shipping Scenario) and to ensure no net increase of health risks from Project TAC emissions over Baseline levels: (i) Chevron shall fund and require installation of cleaner main and auxiliary engines on one tug boat serving the Long Wharf as well as non-Chevron facilities. Tugs are used to push barges, escort ships and barges, and assisting ships and barges into berths. The Long Wharf is primarily served by six tugs. Under applicable CARB rules, four of these tugboats are required to be retrofitted with cleaner engines meeting designated Tier 2 emission standards, over a phase-in period ending as late as 2022. The remaining two tugboats are required to be retrofitted with cleaner engines meeting designated Tier 3 emission standards in 2017. Prior to operation of the Project, Chevron shall fund the installation of new, cleaner Tier 4 main engines and Tier 3 auxiliary engines for one of the six tugboats. (ii) Chevron shall fund and cause to have implemented the project design feature described in the EIR as the removal of three ocean-going vessels (called "SuezMax" because they can go through the	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	existing Suez canal, and have cargo capacity of between 120,000 to 200,000 tons) from West Coast service, and replacement of these vessels with two new Chevron SuezMax ships. The main ship engines of each replacement ship shall meet a Tier 3 standard instead of the required Tier 2 standard, and the auxiliary engines shall be upgraded with turbochargers that are cleaner than Tier 3 standards. 6a2: Prior to operating the Project in excess of 93% Project utilization, Chevron shall implement a combination of the following measures to reduce DPM, inclusive of $PM_{2.5}$, to reduce health risk from all Project TAC emissions to below the BAAQMD significance criteria and to ensure no net increase of health risks from Project TAC emissions over Baseline levels, with all emission reduction amounts from such measures requiring validation by the BAAQMD: (i) Chevron shall increase the average parcel size—the average ship cargo volume that is delivered or picked up from the Long Wharf—to reduce the number of ship calls, and thereby reduce DPM emissions from shipping. (ii) Chevron shall fund and require installation of cleaner main and auxiliary engines on up to five non-retrofitted tug boat serving the Long Wharf as well as non-Chevron facilities. The Long Wharf is primarily served by six tugs, one of which will have been retrofitted as described in Mitigation Measure 4.3-a1(i) prior to Project operation. Chevron shall fund the installation of new, cleaner Tier 4 main engines and Tier 3 auxiliary engines on the number of tugs required to reduce DPM, and achieve the No Net Increase Project Objective.		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	(iii) If, after implementing Mitigation Measures 4.3-6(a)(2)(i) and 4.3-6a(2)(ii), above, health risk from Project TAC emissions remains above Baseline levels on a net basis, as determined by the health risk assessment required by Mitigation Measure 4.3-6b, below, Chevron shall install electric shore power, and require one or more of the ships using the Long Wharf to use such shore power in lieu of continuing to burn diesel fuel while berthed. Before implementing this mitigation measure, Chevron shall apply to the City and other responsible agencies for necessary permits, and shall complete the environmental process required under CEQA. Implementation of this measure is not required to achieve the performance standard included in this Mitigation Measure 4.3-6. (iv) If, after implementing Mitigation Measures 4.3-6(a)(2)(i) though 4.3-6(a)(2)(iii), above, health risk from Project TAC emissions remains above Baseline levels on a net basis, as determined by the health risk assessment required by Mitigation Measure 4.3-6b, below, then Chevron shall curtail Facility operations as necessary to ensure that such health risk is reduced to Baseline levels on a net basis. 6b: Chevron shall fund and participate in a Clean Air Improvement Fund for any net increase in health risks from TACs not avoided or mitigated as required in this EIR. (i) In any year for which the BAAQMD-approved emissions inventory, combined with annual emission estimates from shipping, results in an increase over Baseline levels identified in Table 4.3-24 of the three		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	primary risk drivers (DPM, benzene, and naphthalene), even if such emissions are adequately mitigated as CAP emissions through implementation of Mitigation Measure 4.3-5 such that there is no net increase of such CAP emissions over Baseline levels, then Chevron shall, within 60 days, fund the cost of the City's preparation of a new health risk assessment to identify whether these TAC emissions resulted in an increase in risk over Baseline. (ii) If the new risk assessment required by Mitigation Measure 4.3-6(b)(i), above identifies an increase in risk over Baseline risks, then Chevron shall contribute an additional $100,000 in further funding for the Clean Air Improvement Fund identified in this Mitigation Measure 4.3-6b. 6c: Chevron shall monitor designated metals in Facility feedstock and refinery fuel gas (RFG) and report annually on the correlation, if any, between total annual designated metal emissions (as calculated from RFG samples) and average annual concentrations of such metals in feedstocks. The annual report shall address the following metals of concern: nickel, vanadium, selenium, cadmium, and mercury. Metals are TACs, and contribute to health risks, and any net increase in metal emissions would also trigger the mitigation measure compliance requirements in Mitigation Measures 4.3-6a and 4.3-6b, above. 6d: Chevron shall monitor average annual sulfur and nitrogen concentrations in Facility feedstocks, and nitrogen-related refinery fuel gas air emissions, and		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	report annually on the correlation, if any, between total annual nitrogen-related CAP and TAC emissions (as reported in the BAAQMD annual Emissions Inventory) and average annual concentrations of sulfur and nitrogen in feedstocks. Any such increase over Baseline would require compliance with mitigation measures specified above to ensure no net increase in CAPs or risks from TACs over Baseline levels.		
4.3-7: The Modernization Project would allow the Facility to process crude and gas oils containing higher concentrations of sulfur, which could result in increased emissions of sulfur-related compounds and TACs.	**4.3-7:** Chevron shall implement Mitigation Measures 4.3-6a through 4.3-6d.	S	LTS
4.3-8: The Modernization Project could result in increased odors from sulfur-related compounds.	**4.3-8:** Chevron shall implement the following measures: (a) Chevron shall report annually to the City in writing on the number of odor complaints confirmed by the BAAQMD, and shall specify in such report, where available, whether each complaint relates to hydrogen sulfide, NH_3, or an unspecified compound or source. (b) If, in any year following commencement of Project operations, there is an increase in odor complaints confirmed by the BAAQMD relative to the number of odor complaints that occurred during the Baseline period, and such increase is due to H_2S or NH_3 odors, Chevron shall prepare, and submit to the City and BAAQMD for approval, an Odor Management Plan. At minimum, the Odor Management Plan shall: ▪ Establish protocols for monitoring odors at or from the Facility on an ongoing basis; ▪ Provide for the establishment of a regular odor	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	patrol to monitor odors at or from the Facility and to investigate, and take corrective actions with respect to, odor complaints on an ongoing basis; ▪ Establish protocols for the prompt recordation and annual reporting to City of odor complaints confirmed by BAAQMD; ▪ Establish community outreach protocols describing procedures for informing the public about how and where to submit odor complaints; ▪ Describe measures to be implemented as necessary to reduce BAAQMD-confirmed odor complaints below the BAAQMD threshold of significance, which measures shall include, but not be limited to, the following odor mitigation strategies recommended for refineries in the BAAQMD CEQA Guidelines (collectively, the "Odor Reduction Measures"): (i) implementation of water injections into the hydrocracking process; (ii) installation of vapor recovery systems; (iii) injection of masking odorants into refinery process streams; (iv) installation of flare meters and controls; (v) implementation of wastewater circulation technology for aerated ponds; (vi) implementation of thermal oxidizers; (vii) implementation of carbon absorption mechanisms; (viii) implementation of biofiltration and/or bio-trickling filters. ▪ Establish protocols for (1) the annual review and reporting on the effectiveness of any Odor		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	Reduction Measures implemented pursuant to this Mitigation Measure 4.3-8 and (2) adaptively managing the implementation of Odor Reduction Measures as necessary to maintain complaints below the BAAQMD threshold of significance on an ongoing basis. (c) If, in any year following commencement of Project operations, there is an increase in odor complaints confirmed by the BAAQMD relative to the number of odor complaints that occurred during the Baseline period, and such increase is due to H_2S or NH_3 odors, Chevron shall implement the odor patrol provided for under the Odor Management Plan and cause it to immediately commence monitoring odors at or from Facility on an ongoing basis, to investigate any odor complaint, to ensure that appropriate action is taken to reduce odors from the affected source, and to document the implementation and effectiveness of the corrective action. (d) If odor complaints above Baseline levels persist for more than 2 consecutive years following commencement of Project operations, Chevron shall fund a qualified third-party engineering firm to assume responsibility for: ▪ Immediately investigating odor complaints confirmed by the BAAQMD in accordance with Odor Management Plan protocols; ▪ Implementing and adaptively managing, at Chevron's sole expense and in consultation with the City and the BAAQMD, one or more of the Odor Reduction Measures described in the approved Odor Management Plan, to reduce or maintain		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	BAAQMD-confirmed odor complaints below the BAAQMD threshold of significance; ▪ Monitoring and documenting the implementation and effectiveness of such Odor Reduction Measures and the adaptive management thereof in accordance with Odor Management Plan protocols; and ▪ Annually reporting in writing to the City and the BAAQMD on the implementation and effectiveness of such Odor Reduction Measures and the adaptive management thereof in accordance with Odor Management Plan protocols. (e) Chevron shall cause the Project to comply with the City's odor standards and with BAAQMD Regulation 7-303, which limits the concentration of NH_3 from stacks to 5,000 ppm. The Facility heaters shall comply with the BAAQMD Permit Condition 24136, Item #16 limit of 10 ppm NH_3 at 3% oxygen in the stack, which is less than 5,000 ppm. Chevron shall further cause the Replacement Hydrogen Plant to comply with BAAQMD Regulations 7-303 for NH_3 at the other sulfur recovery units. Chevron shall confirm concentration of NH_3 in the stacks of both source categories after construction.		
4.3-9: The Modernization Project would not conflict with or obstruct implementation of the 2010 Bay Area Clean Air Plan.	**4.3-9:** None required.	LTS	LTS
4.4 Biological Resources			
4.4-1: Construction of the Modernization Project would not significantly impact any candidate, sensitive or special-status plants but it could potentially impact	**4.4-1a:** To avoid construction-related direct impacts (nest removal) or indirect impacts (increased noise levels) on nesting birds (including California	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
special-status wildlife species.	Department of Fish and Wildlife (CDFW) Fully Protected Species and Species of Special Concern), one of the following measures shall be implemented: ▪ Conduct vegetation clearing and grubbing activities from September 1 through January 1, when birds (including raptors) are not likely to be nesting on the site; OR ▪ Conduct pre-construction surveys for nesting birds if construction is to take place during the nesting season (January 1 through August 31). A qualified wildlife biologist shall conduct a pre-construction nest survey no more than 5 days prior to initiation of construction activities (including vegetation clearing and grubbing) conducted within 300 feet of any vegetated area to provide confirmation of the presence or absence of active nests on or immediately adjacent to the storage tank dome Project Design Feature within the Tank Farm Area. If active nests are encountered, species-specific measures shall be prepared by a qualified biologist and implemented to prevent abandonment of the active nest. At a minimum, grading in the vicinity of the nest shall be deferred until the young birds have fledged. A minimum exclusion buffer of 50 feet (300 feet or more for raptors) shall be maintained during construction, depending on the species and location. The perimeter of the nest-setback zone shall be fenced or adequately demarcated with staked flagging at 20-foot intervals, and construction personnel and activities would be restricted in the area. A survey report by		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	a qualified biologist verifying that (1) no active nests are present, or (2) the young have fledged, shall be submitted to the City and CDFW prior to initiation of grading in the nest-setback zone. The qualified biologist shall serve as a construction monitor during those periods when construction activities occur near active nest areas to ensure that no inadvertent impacts to these nests occur. **4.4-1b:** One of the following mitigation measures shall be implemented to lessen potential impacts on potential roost habitat and bat species: ▪ Construction activities near bat roost habitat or removal of potential bat roost habitat shall commence between September and October in order to avoid both the bat maternity period and the bat hibernation period; OR ▪ If this is not feasible, pre-construction bat roost surveys shall be conducted prior to removal of potential roost habitat. Pre-construction surveys for potential bat roost habitat shall be performed in all trees and buildings subject to removal or demolition for evidence of bat use (guano accumulation, acoustic or visual detections). If evidence is found, then acoustic surveys shall be conducted to determine whether a site is occupied. A minimum of three acoustic surveys shall be conducted in areas containing evidence of bat use between April and November under appropriate conditions using an acoustic detector (WBWG, 2002). If necessary, and with approval from CDFW, exclusion of bats from occupied roosts shall be		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	performed in the fall prior to construction. A qualified wildlife biologist shall be present during exclusion. **4.4-1c:** One of the following mitigation measures shall be implemented to lessen potential impacts on potential winter roost habitat for Monarch butterfly: ▪ Conduct tree removal when Monarch butterflies are not present (typically between March 31 and August 31); OR ▪ If conducting tree removal between March 31 and August 31 is not feasible, pre-construction Monarch butterfly roost surveys shall be conducted by a City-approved biologist within 100 feet of the storage tank dome Project Design Feature prior to initiation of any tree removal activities. If any winter roosts are encountered during the survey, construction shall be postponed until the roosting activity has ended. A follow-up survey shall be conducted by an approved biologist prior to construction in order to verify that the roosts have been vacated.		
4.4-2: Construction of the Modernization Project would not have a significant adverse effect on any riparian habitat or other sensitive natural community.	**4.4-2:** None required.	LTS	LTS
4.4-3: Construction of the Modernization Project would not have a significant adverse effect on federally protected wetlands, San Francisco Bay, or San Pablo Bay.	**4.4-3:** None required.	LTS	LTS
4.4-4: Construction of the Modernization Project would not interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife	**4.4-4:** None required.	LTS	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
corridors, or impede the use of a native wildlife nursery site.			
4.4-5: Construction of the Modernization Project would not conflict with any local policies or ordinances protecting biological resources.	**4.4-5:** None required.	LTS	LTS
4.5 Cultural Resources			
4.5-1: Although there are no known unique archaeological resources on the Project site, there is a remote potential that remaining Modernization Project subsurface excavation activities may result in the discovery of, and potential impacts to, a previously unknown archaeological resource.	**4.5-1:** In the event that any prehistoric or historic subsurface cultural resources, such as structural features or unusual amounts of bone or shell, artifacts, human remains, architectural remains (such as bricks or other foundation elements), or historic archaeological artifacts (such as antique glass bottles, ceramics, horseshoes, etc.), are discovered during ground-disturbing activities, all work within 50 feet of the resources shall be halted and Chevron and/or the lead agency shall consult with a qualified archaeologist to assess the significance of the find per CEQA Guidelines Section 15064.5. If any find is determined to be significant, representatives of Chevron and/or the lead agency and the qualified archaeologist shall meet to determine the appropriate avoidance measures or other appropriate mitigation, with the ultimate determination to be made by the lead agency. All significant cultural materials recovered shall be, as necessary and at the discretion of the consulting archaeologist, subject to scientific analysis, professional museum curation, and documented according to current professional standards. As part of the Mitigation Monitoring and Reporting Program for the EIR, Chevron shall have environmental monitors on-site during Modernization	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	Project actions that involve ground-disturbing construction. The construction workers shall be trained by the monitors on environmental sensitivity and the identification of prehistoric or historic subsurface cultural resources. In considering any suggested mitigation proposed by the consulting archaeologist to mitigate impacts to historical resources or unique archaeological resources, the lead agency shall determine whether avoidance is necessary and feasible in light of factors such as the nature of the find, Project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) shall be instituted. Work may proceed on other parts of the Project site while mitigation for historical resources or unique archaeological resources is carried out.		
4.5-2: Although there are no known unique paleontological or geologic features in the Project site, there is a remote potential that remaining Modernization Project subsurface excavation activities may result in the discovery of, and potential impacts to, a previously-unknown paleontological resource.	**4.5-2:** In the event of unanticipated paleontological discoveries, such as large deposits of fossil remains, Chevron shall notify a qualified paleontologist who shall document the discovery as needed, evaluate the potential resource, and assess the significance of the find under the criteria set forth in CEQA Guidelines Section 15064.5. In the event of an unanticipated discovery of a brea, true, and/or trace fossil during construction, excavations within 50 feet of the find shall be temporarily halted or diverted until the discovery is examined by a qualified paleontologist per Society of Vertebrate Paleontology standards (SVP, 1995). The paleontologist shall notify the appropriate agencies to determine procedures that would be followed before construction is allowed to resume at the location of the find. If the lead agency determines that avoidance is not feasible, the	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	paleontologist shall prepare an excavation plan for mitigating the impact of the Modernization Project on the qualities that make the resource important, and such plan shall be implemented. The plan shall be submitted to the lead agency for review and approval. As part of the Mitigation Monitoring and Reporting Program for the EIR, Chevron shall have environmental monitors on-site during Modernization Project actions that involve ground-disturbing construction. The construction workers shall be trained by the monitors on environmental sensitivity and the identification of prehistoric or historic subsurface cultural resources.		
4.5-3: There is a remote potential that remaining Modernization Project subsurface excavation activities may result in the discovery of, and potential impacts to, previously-unknown human remains.	**4.5-3:** In the event that human skeletal remains are uncovered during construction activities for the Modernization Project, Chevron shall immediately halt work, contact the Contra Costa County Coroner to evaluate the remains, and follow the procedures and protocols pursuant to Section 15064.5 (e)(1) of the CEQA Guidelines. If the County coroner determines that the remains are Native American, Chevron shall contact the NAHC, in accordance with Health and Safety Code Section 7050.5, subdivision (c), and Public Resources Code 5097.98 (as amended by Assembly Bill 2641). Per Public Resources Code 5097.98, the landowner shall ensure that the immediate vicinity, according to generally accepted cultural or archaeological standards or practices, where the Native American human remains are located is not damaged or disturbed by further development activity until the landowner has discussed and conferred, as prescribed in this section (Public Resources Code 5097.98), with the most likely	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	descendants regarding their recommendations, if applicable, taking into account the possibility of multiple human remains.		
4.6 Energy			
4.6-1: Construction of the Modernization Project would use non-renewable energy resources, primarily in the form of fuels for vehicles and equipment, and would use electrical energy from renewable and non-renewable sources for tools and lighting. The energy required is readily available, and the increased demand would not result in a substantial use of regional energy sources, nor would it require new energy infrastructure to be constructed.	**4.6-1:** None required.	LTS	LTS
4.6 2: Operation of the Modernization Project and its components would increase long-term consumption of natural gas and increase production of electricity and hydrogen at the Facility. The increased consumption would not result in substantial use of regional energy resources, and neither the increased consumption nor the increased production would require construction of facilities not already included in the Modernization Project.	**4.6-2:** None required.	LTS	LTS
4.6-3: Operation of the Modernization Project and its components would increase long-term generation and consumption of electrical energy at the Facility. The increased consumption would not result in substantial use of regional energy resources, and neither the increased consumption nor the increased generation would require construction of facilities not already included in the Modernization Project.	**4.6-3:** None required.	LTS	LTS
4.6-4: Operation of the Modernization Project would require additional energy for transportation of	**4.6-4:** None required.	LTS	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
employees, as well as raw materials and product (crude oil, additives, refined products, and byproducts). The change in energy use for transportation and production of product would be insubstantial compared to existing Facility consumption.			
4.6-5: Operation of the Modernization Project would result in increased overall energy efficiency.	**4.6-5:** None required.	LTS	LTS
4.7 Geology, Soils, Seismicity, and Mineral Resources			
4.7-1: In the event of a major earthquake in the region, seismic ground shaking could potentially injure persons at the Project site due to structural damage of Facility structures. Ground shaking could potentially expose persons and property to seismic-related hazards, including localized liquefaction and seismically induced settlement.	**4.7-1:** None required.	LTS	LTS
4.7-2: Proposed construction could experience damage from expansive soils and natural and/or differential settlement or be located on geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.	**4.7-2:** None required.	LTS	LTS
4.8 Greenhouse Gases			
4.8-1: Construction of the Project could result in emissions of greenhouse gas emissions exceeding 10,000 metric tons carbon dioxide equivalent (MT CO_2e) per year. However, best management practices and mitigation measures would be incorporated as applicable to reduce greenhouse gas emissions during construction to less than 10,000 MT CO_2e per year.	**4.8-1:** Consistent with air quality mitigation measures for construction activities, Chevron would be required to implement the following mitigation measures to reduce its Project construction emissions. Implementation of the mitigation measures would result in further reductions in greenhouse gas emissions.	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	1a: All vehicle speeds on unpaved roads shall be limited to 15 miles per hour (mph). 1b: Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California Airborne Toxic Control Measure (Title 13 of California Code of Regulations [CCR], Section 2485). Clear signage shall be provided for construction workers at all access points. 1c: All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator. 1d: The idling time of diesel-powered construction equipment shall be limited to 2 minutes. 1e: The Project shall develop a plan demonstrating that the off-road equipment (more than 50 horse-power) to be used in construction (i.e., owned, leased, and subcontractor vehicles) would achieve a Project-wide fleet-average 20% nitrogen oxide reduction and 45% particulate matter reduction compared to the most recent CARB fleet average. Acceptable options for reducing emissions include the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available. (Several of these measures would also reduce greenhouse gas emissions.) 1f: All contractors shall be required to use equipment that meets CARB's most recent certification standard for off-road heavy duty diesel engines.		

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	1g: Reuse and recycle construction and demolition waste (including, but not limited to, soil, vegetation, concrete, lumber, metal, and cardboard). 1h: Enforce and follow limits on idling time for commercial vehicles, including delivery and construction vehicles. 1i: Using alternative fueled (e.g., biodiesel, electric) construction vehicles/equipment on at least 15% of the fleet. 1j: Using local building materials of at least 10%. 1k: Recycling or reusing at least 50% of construction waste or demolition materials. 1l: For each year of Project construction, Chevron shall hire, at commercially reasonable rates and at Chevron's expense, a qualified third-party entity reasonably acceptable to the City to quantify and verify in writing whether the reductions achieved from the above described construction greenhouse gas mitigation measures for that year of Project construction adequately mitigated this potentially significant impact, which report shall be subject to City's reasonable approval. For any year of construction for which construction-related diesel emissions are not reduced to or below the 10,000-MT CO_2e per year significance threshold, Chevron shall implement one or more of the following measures in an amount sufficient to reduce construction period greenhouse gas emissions to less than significant levels: (i) Reduce diesel emissions from other equipment at the Facility, such as a diesel-powered generator, in an		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	amount equal to the construction-related greenhouse gas emissions in excess of 10,000 MT CO_2e per year for any calendar year of Project construction, which reduced emission level Chevron shall maintain for the following 2 years. (ii) Permanently retire, or retrofit from diesel to electric power, one or more Facility sources that emit more than 300 MT CO_2e per year.		
4.8-2: Operation of the Project would result in aggregate greenhouse gas emissions exceeding the BAAQMD CEQA significance threshold of 10,000 MT CO_2e per year, and would exceed Baseline. This impact would be reduced to a less-than-significant level under CEQA, and achieve the Project objective of NNI in greenhouse gases, after mitigation (including mitigation requiring implementation of Project Design Features).	As explained in the Draft EIR, Page 4.8-53, in the event the City selects the 2MW-solar project contemplated by the EIR as a potential Community Greenhouse Gas Reduction Program (CGRP) and such solar project is funded all or in part with funds required by Mitigation Measure 2.8-2e below, then, City shall ensure implementation of CGRP Solar Mitigation Measure Haz-1, Haz-2, Bio-1 and Bio-2 described in Section 4.8 of the EIR as follows: CGRP Solar Project Mitigation Measure Haz-1: Prior to commencing construction of the solar project, Chevron shall submit for City and RWQCB review the design of the facility, and sufficient information about construction and operational parameters as are determined by the City and/or RWQCB to be needed to assure that the solar project would not reduce the effectiveness of the remediation measures implemented in the solar site area. CGRP Solar Project Mitigation Measure Haz-2: Prior to commencing construction of the solar project, Chevron shall update the Facility emergency response and evacuation plans to account for the presence of the solar site on the Facility, and to assure that the modified emergency response and evacuation plans	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	remain effective given the presence of the solar project. CGRP Solar Project Mitigation Measure Bio-1: Standard construction BMPs and specific Project Design Features shall be implemented to treat and minimize discharge of soil and pollutants into the marsh and other off-site vegetated areas during construction and operation of the proposed project. Standard construction BMPs shall be implemented according to a Stormwater Pollution Prevention Plan required under the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit). Catch basin inlet protection and installation of straw wattles (fiber rolls) shall be used throughout the Project site during construction. Additional construction BMPs required by the Regional Water Quality Control Board and San Francisco Bay Conservation and Development Commission shall also be implemented. Potential impacts on the coastal brackish marsh during construction activities shall also be avoided by placement of exclusion fencing 5-10 feet from the perimeter of the coastal brackish marsh boundary or on the edge of the temporary disturbance area when this distance is greater. The Facility shall provide environmental awareness training for all construction personnel, bright-colored fencing and signage shall identify and restrict construction within environmentally sensitive areas, and a construction monitor/environmental inspector shall confirm the fence integrity on a daily basis to protect the area from accidental equipment damage.		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	Fence repair and/or reinforcements shall be completed immediately. CGRP Solar Project Mitigation Measure Bio-2: Although Herman's Slough contains marginally suitable habitat for mammal species, there is small potential that one could migrate onto the solar facility site from nearby degraded marsh habitat. To avoid inadvertent construction impacts on salt marsh harvest mouse, Suisun ornate shrew, saltmarsh wandering shrew, and San Pablo vole, a qualified biological monitor shall be present during initial clearing and grubbing activities prior to installation of solar panel arrays in the vicinity of Herman's Slough. The monitor shall pre-survey disturbance areas to confirm the absence of special-status small mammals. Contractor education shall include a section specific to species identification and protection measures. The entire project construction area abutting coasts brackish marsh habitats shall be surrounded by exclusion fencing. Fencing installed around the project disturbance area during construc-tion shall be adequate to exclude these species. A maximum speed limit of 25 mph shall be observed by construction and maintenance vehicles. The Facility shall provide environmental awareness training for all construction personnel, bright-colored fencing and signage shall identify and restrict construction within environmentally sensitive areas, and a construction monitor/environmental inspector shall confirm the fence integrity on a daily basis to protect the area from accidental equipment damage. Fence repair and/or reinforcements shall be completed immediately.		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	4.8-2: Chevron shall implement all greenhouse gas Project Design Features described above, including those measures described in subsections 2a through 2f below. If implementation of subsections 2a through 2f, below, does not reduce Facility greenhouse gas emissions to Baseline levels on an annual net basis, then Chevron shall implement subsection 2g, below. If implementation of subsections 2a through 2g, below, does not reduce Facility greenhouse gas emissions to Baseline levels on an annual net basis, then Chevron shall implement subsection 2h, below: 2a: Implement water conservation measures during Modernization Project construction; 2b: Install LED Lighting at the Facility during Modernization Project construction; 2c: Implement fluid catalytic cracker cooling water tower motor upgrades during Modernization Project construction; 2d: Participate, for Chevron Commercial Facilities (and industrial accounts, if practicable), in the Marin Clean Energy Program prior to commencement of construction; 2e: Provide $30M over ten years in funding for implementation of the Community Greenhouse Gas Reduction Measures, which measures shall be selected by the City through a public process with input from stakeholders from the City, North Richmond, and Chevron, as described above; 2f: Acquire and timely surrender to CARB Cap and Trade Emission Allowances in quantities sufficient to		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	reduce Facility greenhouse gas emissions to or below Baseline levels on a net basis (rounded up to the nearest metric ton), after taking into account reductions achieved by Mitigation Measures 2a-2e above; 2g: Acquire greenhouse gas reduction credits through the California Air Pollution Control Officers Association (CAPCOA) GHG Rx credit exchange, or through a similar exchange certified by the BAAQMD or CARB, in quantities sufficient to reduce Facility greenhouse gas emissions to or below Baseline levels on a net basis (rounded up to the nearest metric ton), after taking into account reductions achieved by Mitigation Measures 2a-2e above, and after taking into account net reductions achieved by Mitigation Measure 2f above; 2h: Curtail facility operations such that Facility greenhouse gas emissions are reduced to or below Baseline levels on a net basis (rounded up to the nearest metric ton), after taking into account reductions achieved by Mitigation Measures 2a-2e above, and after taking into account net reductions achieved by Mitigation Measures 2f-2g above. **4.8-2B:** *Clean Air Improvement Fund.* Chevron shall fund and participate in a Clean Air Improvement Fund for any Facility greenhouse gas emissions over Baseline. • Funding shall be in an amount equivalent to the difference between Project and Baseline greenhouse gas emissions (in MT CO2e) multiplied by the settlement price of greenhouse gas emission allowances determined at the 1st quarter 2014		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	California Air Resources Board (CARB) auction, annually adjusted by the Consumer Price Index value for the San Francisco Bay Area. The difference between Project and Baseline greenhouse gas emissions shall be determined in accordance with the procedures for determining the Remaining Offset described above in *Section 4.8.4.1.2.3.3.2.* • Funding shall be paid annually and in accordance with the procedures described above in *Section 4.8.4.1.2.3.3.2*. • Funding shall be spent on greenhouse gas emission reduction measures in the following priority order: (1) reductions from Facility emissions; (2) reductions within the City; and (3) reductions from the North Richmond area closest to the Facility. • Funding and implementation decisions shall be made by the City, as part of a public process, with input from stakeholders including representatives from the City, North Richmond, and Chevron. • A brief report shall be prepared for each major emission reduction measure implemented using such funds, and be made available to help inspire other emission reduction opportunities.		
4.8-3: Greenhouse gas emissions associated with the Project would not conflict with greenhouse gas reduction plans and policies. This impact would be less than significant and no mitigation is necessary.	**4.8-3:** None required.	LTS	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
4.9 Hydrology and Water Quality			
4.9-1: The Modernization Project has potential to affect the quality and/or quantity of water entering the Facility's wastewater treatment plant, which could in turn affect the quality of receiving waters (the San Pablo and San Francisco Bay).	**4.9-1a:** Chevron shall prepare and submit a SWPPP to the RWQCB that includes best management practices to treat stormwater runoff during the construction period (and achieve water quality objectives) at least 10 days prior to commencement of construction activities. The BMPs included in the SWPPP shall be implemented during construction. **4.9-1b:** Chevron shall implement two Project Design Features (Stripped Sour Water Reuse/Distillation and Reforming Area and Stripped Sour Water Reuse in South Isomax Area) to offset average annual process wastewater flows under the 93% Utilization Scenario. **4.9-1c:** If the Modernization Project increases wastewater generation above the 93% Utilization Scenario, any increases in wastewater generation shall be offset by implementation of additional water reuse projects, which may include (1) reuse of stripped sour water from 8 and 18 plants to supply wash water for the FCC FHT and hydrocracker located in the North Isomax area; and (2) reuse stripped sour water from 8 and 18 plants to supply wash water for lube crackers in the Richmond lube oil plant area. Additional or alternative stripped sour water reuse measures could also be implemented to assure no net increase in wastewater generation with City approval.	S	LTS
4.9-2: The Modernization Project could disturb, expose, or otherwise alter the present state of the existing soil contamination, leading to significant adverse changes in wastewater effluent quality.	**4.9-2:** Any stockpiles of soils containing contaminants generated under the Modernization Project shall be covered with plastic sheeting to ensure that sediments and pollutants are not entrained in runoff or infiltrated into the subsurface during rainfall	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	events. Reuse or disposal of contaminated soils shall be completed in accordance with applicable laws and regulations. If the soil is a hazardous waste, it shall be disposed of off-site at a licensed facility within 90 days of generation.		
4.9-3: The Modernization Project would not substantially deplete groundwater supplies or interfere with groundwater recharge.	**4.9-3:** None required.	LTS	LTS
4.9-4: The Modernization Project would not substantially alter the existing drainage pattern of the site, including through alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in substantial erosion, siltation or flooding on- or off-site.	**4.9-4:** None required.	LTS	LTS
4.9-5: The Modernization Project would not create or contribute to runoff water that would exceed the capacity of existing or planned stormwater drainage systems.	**4.9-5:** None required.	LTS	LTS
4.9-6: The Modernization Project could place structures within the 100-year flood hazard area that would impede or redirect flood flows.	**4.9-6:** None required.	LTS	LTS
4.9-7: The Modernization Project would place structures in areas subject to storm-related flooding. The Modernization Project also includes ongoing use of Facility equipment in areas subject to coastal flooding, including tsunami wave run-up and sea level rise. A tsunami in San Francisco Bay is a low probability event, and Chevron has an emergency response plan in place for addressing a tsunami event, and therefore near-term impacts related to a tsunami are less than significant. However, future flood risks will likely increase with predicted sea level rise, exacerbating coastal flooding problems.	**4.9-7:** Within 5 years, Chevron shall retain qualified professionals to develop a Facility flood contingency plan that addresses all types of coastal flooding (i.e., storm-related flooding, extreme high tides, and tsunamis) and how these coastal flooding hazards will increase over time due to sea level rise. The contingency plan shall be submitted to the City of Richmond for review and approval.	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
4.9-8: The Modernization Project would include increased shipping activities related to transportation of crude and gas oils. An increase in shipping activity could incrementally increase potential impacts related to accidental spills and routine discharges from vessels and potentially affect water quality in the Bay. These potential impacts were already addressed in the Chevron Long Wharf EIR.	**4.9-8:** None required.	LTS	LTS
4.10 Land Use, Plans, and Policies			
4.10-1: The Modernization Project would be constructed within the existing Facility boundaries and would not divide an established community.	**4.10-1:** None required.	LTS	LTS
4.10-2: The Modernization Project would not conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental impact and result in a physical change in the environment.	**4.10-2:** None required.	LTS	LTS
4.11 Noise			
4.11-1: Daytime construction activities associated with the Modernization Project would be required to comply with City of Richmond noise limits applied to activities longer than 15 days, and are unlikely to generate noise levels substantially above existing ambient levels in the Project vicinity. Therefore, daytime construction activities would result in less-than-significant noise impacts, even during the most intense construction period. Additionally, if weekend or nighttime construction were to occur, construction noise could	**4.11-1a:** If nighttime construction is required, no pile driving shall be allowed and the types and intensity of any construction activities shall be limited to ensure noise generation does not exceed the City's nighttime noise limit of 50 dBA or cause an increase greater than 5 dBA.	S	LTS
	4.11-1b: If nighttime construction is required and the City of Richmond or the construction compliance and complaint manager receive verified complaints due to noise from the use of backup alarms, Chevron shall		

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
exceed City of Richmond noise limits and/or substantially exceed ambient noise levels during the quietest nighttime hours.	implement feasible measures to reduce this noise at the Facility boundary. Measures may include the use of alarms with ambient sensing/broadband technology instead of the traditional fixed level/ narrowband alarms or the use of administrative controls such as using a spotter or flagger and prohibiting all foot traffic in the work area.		
4.11-2: Increased vehicle traffic to and from the Facility during the construction period would increase ambient noise levels at receptors along the travel route. However, the change in roadside noise level due to Modernization Project construction-related traffic would not be perceptible over existing conditions.	**4.11-2:** None required.	LTS	LTS
4.11-3: Operational noise from the equipment to be installed as part of the Modernization Project, and from additional transportation associated with Refinery Operations after installation of the Project, could produce noise at nearby sensitive noise receivers. However, any increase in noise levels compared to existing ambient levels would be at less-than-significant levels.	**4.11-3:** None required.	LTS	LTS
4.12 Employment, Population, and Housing			
4.12-1: The Modernization Project could result in direct population growth within the City of Richmond.	**4.12-1:** None required.	LTS	LTS
4.13 Public Safety			
4.13-1: There will be no new significant hazard risks from the transportation of hazardous materials and hazardous waste during Modernization Project construction.	**4.13-3:** None required.	LTS	LTS
4.13-2: The use of hazardous materials during the construction phase of the Modernization Project would	**4.13-2a:** Store hazardous materials for Modernization Project construction activities only in the construction	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
result in a potentially significant adverse impact requiring mitigation. However, with mitigation requiring construction materials storage only in authorized locations and implementing training and safety requirements for construction workers, the use of these hazardous materials would have a less-than-significant impact after mitigation.	staging locations identified in Figure 3-1 (*Chapter 3, Project Description*) unless an alternate location within a previously developed portion of the Facility is approved as part of the building permit approval process. **4.13-2b:** Implement worker training and safety requirements for construction workers, including emergency response and hot work and contractor refinery instructions as more fully described in *Section 4.13.2.3* and *Appendix 4.13-DET*, and report training and implementation of safety requirements monthly to the City during construction and demolition activities. Communicate location and scope of Modernization Project-related construction activities weekly to City and Facility management to avoid any conflicts between construction and refining activities. The required implementation will include the new Leak Response Protocol developed since August 2012 (Chevron, 2012a).		
4.13-3: The management and disposal of hazardous wastes, and demolition and construction wastes, generated during Modernization Project construction could result in a potentially significant adverse impact requiring mitigation.	**4.13-3a:** Demolition and other construction wastes, and hazardous wastes, must be stored only in Facility locations approved by the City. **4.13-3b:** Hazardous wastes must be transported off-site to an authorized disposal, treatment, or recycling facility by a transportation company with appropriate federal and state transporter licenses within 90 days after the wastes are generated. **4.13-3c:** Non-hazardous demolition and construction waste must be transported off-site to an authorized disposal, recycling, or reuse facility by a transportation company with required transporter licenses within 180 days after the wastes are generated.	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
4.13-4: Additional quantities of hazardous materials would be used and hazardous wastes generated, during the operation of the Modernization Project relative to the Baseline; however, no new types of hazardous materials would be introduced and no new types of hazardous wastes would be generated. With mitigation, the additional quantities of hazardous materials being managed and hazardous waste generated during Modernization Project operations would have a less-than-significant impact.	**4.13-4a:** Chevron will implement its Modernization Project Reliability Program (*Appendix 4.13-PROG*) including updating the detailed PHAs prepared for the 2008 Project for all new and modified Modernization Project components, which shall include ISSAs, damage mechanism reviews, and evaluation of the consequences thereof resulting from the Project, and LOPA, as part of these PHAs, prior to recommence-ment of construction of the Modernization Project, and again post-construction but before startup of Project operations for any changes that arise during construction that may affect the earlier PHAs, ISSAs, and LOPAs. Chevron will notify CCHS and the City of the availability of these PHAs, and make these PHAs available for review by CCHS and the City**.** The PHAs (initial and updates/revalidations), ISSAs, damage mechanisms reviews, and LOPAs shall be consistent with (proposed) amendments to the RISO. Chevron shall conduct the LOPAs and submit written LOPA reports, prepared in accordance with industry best practices (such as those issued by the Center for Chemical Process Safety) to CCHS and the City for review prior to construction (and post-construction, for those LOPAs warranting changes based on changes that arise during construction). CCHS will work with the City in implementing these and other Public Safety mitigation measures. **4.13-4b:** Chevron will submit to CCHS a revised RMP and Safety Plan for the modified and new equipment at the Facility, and shall cause a revised RMP and Safety Plan to be submitted by the operator of the new hydrogen plant, in accordance with the requirements established in the applicable regulations. The revised	S	LTS

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	RMPs and Safety Plans shall be submitted by the earlier of: 1) prior to operations; and 2) timing requirements under applicable regulations. The revised RMPs and Safety Plans shall reflect integration of ISSA, including consideration of damage mechanisms and evaluation of the consequences thereof resulting from the changes, as well as the LOPAs, conducted as a part of PHAs (initial and PHA updates/revalidations), consistent with (proposed) amendments to the RISO. The RMPs must include all required components, including but not limited to a revised "off-site consequence" analysis of worst case and alternate scenarios (EPA, 2009), a revised accident prevention and training program, pre-startup safety reviews and prescribe training and safety requirements for contractors conducting hot work and other designated types of activities. The RMPs must cover accident risks that have been identified in the Project-related PHAs, including inherently safer systems analyses conducted as a part of Project-related PHAs and management of change procedures. Chevron will report to the City acceptance of these plans by the CCHS prior to start-up of Modernization Project operations. **4.13-4c:** Chevron will submit an amended hazardous materials business plan to CCHSHMP via the California Environmental Reporting System (CERS) consistent with the timing requirements of the applicable regulations. Chevron shall cause to be submitted by the operator of the hydrogen plant an amended hazardous materials business plan to CCHSHMP. The amendments will reflect the modified and new equipment at the Facility, including the hydrogen plant. Chevron will provide		

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	written confirmation to the City of CCHSHMP's acceptance of the amended plans. **4.13-4d:** Chevron will revise the Facility's SPCC Plans and Facility ERPs consistent with the timing requirements of the applicable regulations, and shall cause the SPCC and ERPs for the hydrogen plant to be updated as well. Plan revisions must address the modified and new equipment at the Facility including the hydrogen plant. Chevron shall make the plans available for review upon request by CCHSHMP and EPA. **4.13-4e:** For the additional catalyst identified in Table 4.13-4 (at hydrogen plant and FCC FHT), Chevron will either send spent catalyst for metal reclamation or dispose of the spent catalyst that cannot be reclaimed to a secure and licensed facility. Chevron will maintain records on the amount of catalyst sent for reclamation and for disposal and report to the City annually on these amounts. **4.13-4f:** Chevron shall ensure, through its contractual arrangements with Praxair, that Praxair will comply with all mitigation measures in this EIR as they pertain to the new hydrogen plant, and shall require Praxair to cooperate with Chevron as needed to ensure the mitigation measures with regard to the hydrogen plant are effectively implemented. Prior to construction of the new hydrogen plant, Chevron shall provide to the City and County documentation reflecting that these requirements are included in contractual agreements between Chevron and Praxair.		

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4.13-5: Additional quantities of hazardous materials and wastes would be transported during the operation of the Modernization Project relative to the Baseline; however, no new types of hazardous materials or wastes would be transported, nor is the acceptance of crude oil by rail being authorized as part of the Modernization Project.	**4.13-5a:** Chevron is required to continue to implement the following mitigations from the Long Wharf EIR (Chambers Group, Inc., 2006, 2007): OS-3b, OS-3c; OS-4; OS-6b; and OS-7a,b. **4.13-5b:** Implement Mitigation Measure 4.13-4d. **4.13-5c:** All spills and releases of hazardous materials or hazardous waste to the environment, including those from the transportation of these materials, must be reported within 48 hours to the City, and to the other appropriate regulatory agencies in accordance with the timing and other notification and reporting requirements prescribed by the applicable laws and regulations. Prompt cleanup of all such spills is also required.	S	LTS
4.13-6: The Modernization Project's physical changes could increase the risks of accidental releases of acutely hazardous substances.	**4.13-6:** Prior to commencing construction, Chevron shall: 6a: For all Modernization Project new and modified equipment, including but not limited to the hydrogen plant, Chevron shall obtain new or amended building permits from the City's Building Department pursuant to City Building Code and CBC requirements in effect at the time the permits are issued. 6b: For all Modernization Project new and modified equipment, including but not limited to the hydrogen plant, that are subject to City of Richmond Fire Department permit requirements, Chevron shall obtain new or amended fire permits from the City of Richmond Fire Department pursuant to City Fire Code and the CFC requirements in effect at the time the permits are issued.	S	LTS

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
4.13-7: The Modernization Project has the potential to increase the risk of accidental releases of acutely hazardous materials due to Modernization Project-related operational changes resulting in increases in sulfur content of feedstocks, increased hydrogen purity produced by the new hydrogen plant, and increased H_2S partial pressures in hydroprocessing plant's recycle stream.	**4.13-7a:** Chevron shall implement the Modernization Project Reliability Program for all units and processes affected by the Modernization Project, including written reports specified in the Modernization Project Reliability Program. An initial Reliability Program report shall be submitted to the City and County prior to Project construction. Annual reports shall be submitted thereafter, including a report prior to commencement of Project operations. For the PHAs (initial and revalidations) specified in the Modernization Project Reliability Program, Chevron would complete the PHAs prior to commencement of Project construction, and again after construction but before startup of Project operations for any changes that may have arisen during construction that could affect the earlier PHAs. Chevron will thereafter update and revalidate PHAs in accordance with the RISO but not less than once every 5 years. As indicated in Mitigation Measure 4.13-4a, the PHAs shall include LOPAs, and written LOPA reports must be submitted to the County prior to construction for review, and Chevron shall submit a copy to the City simultaneously. To the extent that any post-construction PHA revalidations are warranted, Chevron shall submit LOPA reports for the post-construction PHA revalidations to the County for review prior to the startup of Project operations, and Chevron shall submit a copy to the City simultaneously. **4.13-7b:** Chevron shall complete an ISSA (as defined in the RISO), including review damage mechanisms and evaluation of their consequences, and LOPAs with written LOPA reports submitted by Chevron to the		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	County for review, for new and modified Modernization Project components as part of the PHA revalidation process specified in the Modernization Project Reliability Program and Mitigation Measure 4.13-9a. Chevron will make the ISSA and PHAs available for review by the CCHS and the City, and will submit the LOPA reports to the County prior to construction for review. **4.13-7c:** Chevron will continue to review its procedures and programs for evaluating the hazards of planned changes at the Facility, and update them to incorporate damage mechanism review, including the identification of applicable damage mechanisms as well as the evaluation of the potential impacts of the damage mechanisms in light of the proposed changes, and layers of protection analysis consistent with the Reliability Program. Chevron's review and update of programs and procedures shall include, at a minimum, the Facility's management of change program/procedure and its PHA program/procedure. Chevron shall include, in its annual Modernization Project Reliability Program reports to the City, a description of the status of this documentation review and update process, as well as how the changes to these programs/procedures are being implemented at the Facility. **4.13-7d:** Chevron will fund the costs of qualified third-party experts to assist CCHS and the City in the review of PHAs, ISSAs, and LOPAs completed for the Modernization Project pre- and post-construction, and will cooperate in providing access to Chevron documentation and facilities, as needed, for the third-		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	party expert, CCHS, and the City to complete these reviews. At such time as the RISO is amended, and to the extent this amendment requires Chevron to fund a new, full-time chemical process safety inspector to do inspections at the Facility, Chevron shall provide to CCHS and/or the City the level of funding required to hire a new, full-time chemical process safety inspector for the Facility, and thereafter shall no longer be required to fund a separate third-party expert for post-construction reviews of PHAs, ISSAs, and LOPAs or other inspections. **4.13-7e:** Chevron shall provide funding in a reasonable amount sufficient for the City to complete an air deposition background study of air quality at up to 20 locations in Richmond. The study may be done in conjunction with local high school science departments or otherwise, and may include quarterly sampling, using surface sampling collection pads, and certified laboratory analysis of such pads at locations to be determined. Study results shall be compiled annually, and made publicly available. Chevron will fund this program for a 5-year period following commencement of Modernization Project operations. In the event of a future accidental fire or other significant accidental release of air pollutants from the Facility, Chevron shall reimburse the City for the cost of engaging a qualified consultant to perform additional air deposition sampling and analysis to evaluate the magnitude and significance of the release. The results of the post-accident deposition sampling will be publicly available.		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	4.13-7f: Given the Modernization Project would include new equipment and operational practices at the Facility, Chevron will provide further training for and coordinate with the Richmond Fire Department prior to Modernization Project operations. Training would continue annually during Project operations. **4.13-7g:** Chevron shall work with the Contra Costa Sheriff's Department, the City, and other interested stakeholders, prior to the commencement of Project operations, to evaluate the existing CWS and to determine whether additional services would be beneficial, including but not limited to mechanisms for the provision of emergency messages and communications, translated into multiple different languages (considering possible integration with existing cell phone registration, email, and social media notification databases and systems), and the provision of emergency notifications to locations in the community where large numbers of people may congregate at any given time (such as shopping centers, transit centers such as Bay Area Regional Transit stations, Amtrak stations, and bus stations). Chevron shall contribute toward, and help identify additional funding for, such additional services. **4.13-7h:** Chevron will fund the costs of a third-party expert to assist the County and the City with the review of the Reliability Program reports and other submittals required by the Reliability Program and related mitigation measures, as needed. The third-party expert will be selected and retained by the County or the City within the County's or City's discretion. This funding obligation survives any		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	amendment of the RISO that may require funding of an inspector for the Facility. **4.13-7i:** Chevron shall adhere to the total acid number (TAN) limits of 0.3 mg milligrams potassium hydroxide per gram (KOH/g) for crude, 1.5 mg KOH/g for sidecuts produced from the crude unit, and 1.0 for gas oils and blends processed through the fluid catalytic cracker, fluid catalytic cracker feed hydrotreater, hydrocracker, heavy neutral hydrocracker, and light neutral hydrocracker. If Chevron intends to process a feedstock for a short-term basis (i.e., up to 6 months) that exceeds these TAN limits, it must complete its Management of Change (MOC) process, which shall include a corrosion review, for the proposed deviation, and shall take into account any existing damage mechanism reviews as specified in Mitigation Measure 4.13-7c that have been prepared for the identified units and piping circuits. If Chevron intends to process a feedstock for a longer-term basis (i.e., more than 6 months) that exceeds these TAN limits, it must complete its MOC process for the proposed deviation, and the MOC shall include a reliability analysis to evaluate, among other things, existing process conditions, monitoring and inspection data, expected corrosion rates, metallurgy, existing damage mechanism reviews, and monitoring and inspection frequency. The MOC evaluation, for short or longer duration TAN deviations, shall include an evaluation of the potential hazards that could result from the TAN deviation in all affected units and piping circuits, including naphthenic acid corrosion impacts. Chevron shall designate a Facility Area		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	Business Unit Manager with final decision-making authority to approve any TAN deviation from the TAN limits. Chevron shall provide the results of any TAN deviation MOC evaluation to the City and County before processing the feedstock that deviates from the established TAN limits. Chevron shall include in its annual Reliability Program reports: (a) details regarding the results of its MOC for any TAN deviations; (b) average annual TAN for crudes and gas oils/blends processed at the Facility for each calendar year starting with 2008; and (c) for any feedstock runs with TAN levels higher than established TAN limits, include the actual TAN levels of the deviating feeds and the duration of the deviating feedstock runs. **4.13-7j:** Chevron shall include in its annual Reliability Program reports the annual average sulfur content of feedstocks, including separate annual averages for crude oils/blends and gas oils/blends, processed at the Facility for each year since and including 2008.		
4.13-8: The hazard risks of accidental releases of acutely hazardous substances from Modernization Project-related storage quantities were evaluated and none were found to cause an increased risk beyond the existing potential Facility impacts from currently stored acutely hazardous substances, but H_2S and anhydrous NH_3 were found to have a potential for off-site impacts in non-residential areas.	**4.13-8:** Implement Mitigation Measures 4.13-4a, b, c, d, f; 4.13-5a, b, c; 4.13-6a, b; 4.13-7a, b, c, d, e, f, g, h, I, j; 4.13-11a, b, c.	S	LTS
4.13-9: The Modernization Project facilities would lie entirely within the existing Facility and would not be within 0.25 mile of an existing or proposed school. However, past incidents resulting in releases of	**4.13-9a:** Chevron will coordinate with the Contra Costa County Sheriff's Department, as owner and operator of the CWS, and other stakeholders, to work with local area schools (Washington Elementary	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
hazardous substances triggering shelter-in-place alerts have occurred when schools were in session.	School, Lincoln Elementary School, Peres Elementary School, Verde Elementary School) to ensure that their emergency response procedures and plans are adequate to minimize the risk to students in the event of a refinery incident. This shall include, as necessary, updating plans and procedures, providing emergency response equipment, and providing training to school staff. Chevron will coordinate with the Sheriff's Department and local area schools to ensure that the schools have operational National Oceanic and Atmospheric Administration weather radios and receive training on how to use them. Coordination will be completed prior to start of Modernization Project operations. **4.13-9b:** Implement Mitigation Measures 4.13-4a, b, c, d; 4.13-6a, b; 4.13-7a, b, c, d, e, f, g; 4.13-11a, b, c.		
4.13-10: The Modernization Project would be located within the Facility, which is listed on the EnviroStor list of hazardous waste and substance sites compiled pursuant to Government Code Section 65962.5. With mitigation, the known hazardous materials releases on the site (all of which have been the subject of remediation activities under the oversight of the RWQCB), will not cause any impact warranting further mitigation.	**4.13-10a:** If contamination is discovered during Modernization Project construction, the Facility will report the discovery to the City, the RWQCB, and any agency required to receive such notice under applicable law, and shall promptly manage, contain, treat, transport, and/or arrange for off-site disposal of such contaminated material as required by applicable law and existing RWQCB Order. Chevron shall also train construction workers to recognize contamination, and shall use authorized remediation contactors with trained workers to characterize and manage any contaminated media discovered during Modernization Project construction. **4.13-10b:** If Modernization Project construction occurs in areas subject to RWQCB Order R2-2011-	S	LTS

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	0036, Chevron will first receive approval of the construction activities from the RWQCB, as required under the order, and report the approval conditions to the City. Chevron will comply with applicable regulatory requirements and RWQCB approval conditions in managing the Modernization Project construction activities.		
4.13-11: The Modernization Project is located within the existing Facility and is not introducing any hazardous materials not currently used at the Facility (as discussed in *Section 4.13.4.1*), so would not interfere with existing emergency plans for areas located outside of the Facility. The Modernization Project would be integrated into the Facility's emergency plan, described in *Section 4.13.2*, above.	**4.13-11a:** Update the Facility's emergency plan to assure that the Modernization Project would not impair implementation of the plan, and to assure that the plan is effective. Develop Emergency Operating Procedures for new and modified Modernization Project equipment. Revisions to the plan and procedures would include clear instructions to ensure all non-essential personnel stay outside of hazardous areas during an emergency. Incorporate revisions into a revised Safety Plan submitted to CCHS for approval and acceptance prior to commencement of Modernization Project operation, and report submission date and CCHS approval to the City. **4.13-11b:** Ensure Facility personnel and contractors are trained on the revised emergency procedures, including to ensure all non-essential personnel stay outside of hazardous areas during an emergency. Maintain records on initial training and annual refreshers that can be provided to the City or County upon request. **4.13-11c:** Chevron shall coordinate with the City, County, and other local and regional agencies, including BAAQMD and fire departments in neighboring communities, to plan and conduct periodic emergency response drills, to establish joint	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	operations centers and joint information centers, and to establish communications networks and protocols for emergency response communications extending to these neighboring communities and agencies to further develop the infrastructure and readiness for mutual aid as between these various agencies and fire departments, in the event of emergency response incidents.		
4.13-12: The Modernization Project is located in close proximity to areas of urbanized, non-native vegetated open space areas that are susceptible to fires. Potential accidents associated with the Modernization Project could cause a fire or explosion that can result in ignition of vegetation in these areas. Smoke generated from fires in these vegetated areas could also result in health impacts to people. Fires in the vegetated open space areas can be mitigated through the development and implementation of a fire protection plan for vegetated areas within the Facility that would include fuel management measures, construction and maintenance of fire breaks, and coordination of emergency response efforts.	**4.13-12:** Chevron will update its fire protection plan to address vegetated open space areas adjacent to process areas, and to assure that Chevron Fire Department personnel are trained and equipped to serve as first responders to a fire in these vegetated areas. The plan will be provided to and accepted by the Richmond Fire Department prior to start of Modernization Project operations. The plan must include: 12a: Fuel management, including seasonal mowing, removal of brush, trimming of trees, or other measures to reduce fuel loads during the dry season (i.e., from April 1 through November 30, unless extended by the Richmond Fire Department) in areas within 100 feet of process areas. 12b: Construction and seasonal maintenance of appropriate fire breaks (e.g., maintenance of unvegetated areas) to minimize size of fire in vegetated open space areas, provided no new vegetative clearing shall be completed until surveys have been completed for protected plants and animals, and the absence of such resources has been confirmed.	S	LTS

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	12c: Maintenance of fire roads in vegetated open space areas to provide immediate access to emergency responders, including removal of potential obstacles and brush and leveling of dirt roads on steep hillsides following the end of each rainy season (approximately April or May). 12d: Emergency response coordination, including enhanced mutual aid, protocols to assure adequate firefighter responses to vegetated open space area fires as well as Facility area.		
4.13-13: The Modernization Project, in conjunction with existing and reasonably foreseeable future activities within the Facility, and nearby industrial and transportation facilities, could lead to a cumulative increase in the risks of accidental release of acutely hazardous substances. This risk could be potentially significant within the Facility, but is unlikely to extend to any off-site industrial or transportation operations and is thus not cumulatively considerable with respect to such off-site uses.	**4.13-13a:** Prior to restarting construction of the Modernization Project, and again prior to commencement of Project operations, Chevron shall submit to the City a report describing the status of its compliance with all corrective action measures (including, but not limited to, compliance with probationary terms) imposed or agreed to as a result of the agency proceedings relating to the August 6, 2012 fire. As part of this report, Chevron shall describe its ongoing consultations with the agencies that investigated the August 6, 2012 fire, including Cal/OSHA, the CSB, and Contra Costa County, including any feedback or direction that has been provided by those agencies concerning implementation of the corrective action and agency recommendations and Chevron's response thereto. **4.13-13b:** Chevron will fund the costs of a qualified expert in refinery safety, to be selected and retained by the County and/or the City within the County's and/or City's discretion, to review the ISSAs, PHAs, LOPAs, and other safety documentation associated with events triggering such ISSAs, PHAs, or LOPAs.	S	LTS

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	Chevron will also cooperate in providing access to Chevron documentation and facilities, as needed, for the expert, the County, and the City review. At such time as the RISO is amended, and to the extent this amendment requires Chevron to fund a new, full-time chemical process safety inspector to do inspections at the Facility, Chevron shall provide to CCHS and the City the level of funding required to hire a new, full-time chemical process safety inspector for the Facility, and thereafter shall no longer be required to fund a separate third-party expert for reviews of PHAs, ISSAs, LOPAs, or other inspections. **4.13-13c:** Chevron will complete the tri-annual safety audits required by RISO. In addition, upon request by the County and/or City, Chevron shall fund the costs of a qualified third-party expert in refinery safety to perform a safety or compliance audit that would be provided to the County and/or City for review. **4.13-13d:** Chevron will report to the City quarterly, and shall provide a copy of this report to the County, after Project approval on the status of the corrective actions taken to implement agency recommendations to Chevron resulting from the August 6, 2012 fire, as well as any corrective actions taken by Chevron as a result of its own investigation. To the extent that Chevron elects not to implement a recommendation made by an agency, Chevron shall include in these quarterly reports a detailed explanation of its rationale for doing so. **4.13-13e:** Chevron shall fund the City's coordination with the CSB, Cal/OSHA, the BAAQMD, and the EPA on their investigations regarding the Facility to the		

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	extent these agencies request City involvement or consultation. **4.13-13f:** Chevron shall designate a Facility Area Business Unit Manager as the management level position bearing responsibility for any and all decisions to not implement a recommendation made during an inspection or turnaround. Chevron shall also designate a Facility Area Business Unit Manager as the management level position bearing responsibility for the establishment of the parameters in the Integrity Operating Window program, as well as for any decisions to override, bypass, or otherwise disregard an alert or flag that arises through the Integrity Operating Window program. The annual Reliability Program reports shall include clear identification of the individuals acting as Area Business Unit Managers to whom these accountabilities have been assigned. If the management position bearing any of these responsibilities changes within Chevron from the Area Business Unit Manager to another management-level job title, Chevron shall notify the City and include an update to this effect in its Reliability Program annual report. **4.13-13g:** Prior to the issuance of building and fire permits for the Project, Chevron shall provide to the City documentation demonstrating that it has completed implementation of (to Cal/OSHA's satisfaction) or otherwise discharged (through administrative appeal) all corrective or abatement actions resulting from Cal/OSHAs investigation following the August 2012 fire, and from Cal/OSHAs temporary leak seal investigation.		

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	4 .13-13h: Chevron shall establish Integrity Operating Windows (IOWs) to monitor process temperatures for purposes of identifying process temperature increases above the baseline period (2008-2010) for any individual circuit affected by the Modernization Project (as indicated in the Reliability Analysis Appendix 4.13-REL). The IOW shall establish temperature "flags" for each temperature monitoring location based on industry-standard damage curves. Prior to implementation of the IOW temperature flags, Chevron shall provide information to the City and County regarding the flag trigger temperature levels and the basis for them, and provide the City and County an opportunity to review and comment on them before they are implemented. The IOW-2 temperature flag shall be triggered if the process temperature exceeds the established temperature for a cumulative 365 days, and shall require Chevron to perform a reliability analysis to evaluate, among other things, existing process conditions, flag dates for wall thickness, monitoring and inspection data, expected corrosion rates, metallurgy, existing damage mechanism reviews, and monitoring and inspection frequency. Chevron shall report the results of these reliability analyses in its annual Reliability Program report, and shall make process temperature data for all temperature monitoring locations within each process unit and circuit included in the Reliability Analysis (Appendix 4.13-REL) available for review by the City or County at the refinery. Chevron also shall include in its annual Reliability Program reports a listing of all events relating to process temperatures reaching levels that triggered a IOW-		

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	level 2 (defined by Chevron as a "slower acting event that requires technical evaluation and recommendations within one week") alert during the calendar year that is the subject of the annual report, as well as a description of the resolution of each such event. Chevron shall report to the City and County within one week of any IOW-level 1 (defined by Chevron as a "fast acting event that requires operator action within a shift or two") alert event relating to IOW process temperature parameters for circuits affected by the Modernization Project (as indicated by the Reliability Analysis Appendix 4.13-REL).		
4.14 Public Services			
4.14-1: During the construction phase, the Modernization Project could result in an increase in the number of incidents necessitating calls to the Richmond Police Department and an increased need for the Richmond Police Department to deploy traffic control personnel. Increased employees during operation of the Modernization Project could result in the need for increased Richmond Police Department patrols. However, these increases would not trigger the need for new, altered, or expanded police service facilities or equipment.	***4.14-1:*** *1a: During the construction phase, Chevron shall hire additional security services as necessary to compensate for the increase in personnel on-site.* *1b: Mitigation Measures 4.16-1 through 4.16-5 and Improvement Measure 4.16-1 through 9 (see Section 4.16, Transportation and Traffic) shall be implemented to reduce the demand for help from the Richmond Police Department for traffic-related issues.*	LTS	LTS
4.14-2: Operation of the Modernization Project would contribute to the ongoing need for the Richmond Fire Department to provide mutual aid to the Facility. To effectively provide mutual aid, the Richmond Fire Department needs heavy rescue training and heavy rescue equipment to respond to fires and their associated environmental impacts, including emissions of air pollutants and hazardous materials releases.	***4.14-2:*** *Chevron and the Richmond Fire Department shall establish an agreement that ensures training on new equipment and the acquisition of any necessary heavy equipment (e.g., large diameter hoses, large scale pumping equipment).*	LTS	LTS

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
However, the ongoing need for mutual aid would not trigger the need for new, altered, or expanded fire service facilities or equipment.			
4.14-3: The Modernization Project could result in an increase in the number of calls to the Richmond Fire Department during the construction phase of the Project, and possibly more assistance calls for medical emergencies. However, these potential increases would not result in the need for new, altered, or expanded fire service facilities. The need for expanded Richmond Fire Department training and equipment is addressed further in *Section 4.13, Public Safety*.	**4.14-3:** None required.	LTS	LTS
4.14-4: The Modernization Project would not result in an increase in need for new, altered, or expanded public service facilities such as schools, libraries, or hospitals.	**4.14-4:** None required.	LTS	LTS
4.15 Parks and Recreation			
4.15-1: The temporary increase in construction labor force during construction of the Modernization Project could increase the use of nearby neighborhood parks and increase demand for use of the proposed segments of the Bay Trail along Western Drive.	**4.15-1:** None required.	LTS	LTS
4.16 Transportation and Traffic			
4.16-1: Modernization Project construction-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Castro Street/I-580 Westbound Ramps.	**4.16-1:** Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) and Caltrans to provide modified traffic control implemented at the intersection of Castro Street/I-580 Westbound Ramps during peak arrival and departure times in the PM peak hour. The modified traffic control shall be accomplished by one or more of the following methods: (1) posting a technician at the intersection	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs of Richmond police officers or other law enforcement personnel to provide the traffic control under above-cited methods (1) or (3).		
4.16-2: Modernization Project construction-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Richmond Parkway/ Gertrude Avenue.	**4.16-2:** The following measures shall be implemented at the intersection of Richmond Parkway/Gertrude Avenue: 2a: Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) to provide modified traffic control during peak arrival and departure times in the PM peak hour. The modified traffic control shall be accomplished by one or more of the following methods: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs for sheriff's deputies or other law enforcement personnel to provide the traffic control under above-cited methods (1) or (3). 2b: During the peak congestion periods, through the use of traffic cones (and flaggers as needed), Chevron shall reconfigure the southbound (Richmond Parkway)	S	LTS

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	approach to the intersection to provide one shared left-through lane, one through lane, and one shared right-through lane.		
4.16-3: Modernization Project Construction Plus Other Projects conditions-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Castro Street/I-580 Westbound Ramps.	**4.16-3:** Mitigation Measure 4.16 1 shall be implemented.	S	LTS
4.16-4: Modernization Project Construction Plus Other Projects conditions-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Castro Street/Hensley Street. This impact would be reduced to a less-than-significant level after mitigation.	**4.16-4:** The following measure shall be implemented at the intersection of Castro Street/Hensley Street: Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) to provide modified traffic control during peak arrival and departure times in the PM peak hour. The modified traffic control shall be accomplished by one or more of the following methods: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs of law enforcement personnel to provide the traffic control under above-cited methods (1) or (3).	S	LTS
4.16-5: Modernization Project Construction Plus Other Project conditions-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Richmond Parkway/Gertrude Avenue.	**4.16-5:** Mitigation Measure 4.16-2 shall be implemented.	S	LTS

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Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
4.16-6: Modernization Project Plus Other Projects Plus Major Turnaround conditions-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Castro Street/I-580 Westbound Ramps.	**4.16-6:** Mitigation Measure 4.16-1 shall be implemented.	S	LTS
4.16-7: Modernization Project Plus Other Projects Plus Major Turnaround conditions-generated increases in traffic volumes would result in a significant adverse impact to AM and PM peak hour traffic operations at the signalized study intersection of Castro Street/General Chemical Access (Gate 91).	**4.16-7:** The following measures shall be implemented, in consultation with the Public Works Director or his designee, at the intersection of Castro Street/General Chemical Access: 7a: During the AM peak period, through the use of traffic cones (and flaggers as needed), Chevron shall reconfigure the northbound (Castro Street) approach to the intersection to provide two left-turn lanes and one shared right-through lane. The inbound approach on General Chemical Access shall also be reconfigured to provide two receiving lanes. 7b: During the PM peak period, through the use of traffic cones (and flaggers as needed), Chevron shall reconfigure the eastbound (General Chemical Access) approach to the intersection to provide two exclusive right-turn lanes and one exclusive left-turn lane. 7c: Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) to provide modified traffic control during peak arrival and departure times in the AM and PM peak hours. The modified traffic control shall be accomplished by one or more of the following methods: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs of law enforcement personnel to provide the traffic control under above-cited methods (1) or (3).		
4.16-8: Modernization Project Plus Other Projects Plus Major Turnaround conditions-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Castro Street/Hensley Street.	**4.16-8:** Mitigation Measure 4.16-4 shall be implemented.	S	LTS
4.16-9: Modernization Project Construction Plus Other Projects Plus Major Turnaround conditions-generated increases in traffic volumes would result in a significant adverse impact to AM and PM peak hour traffic operations at the signalized study intersection of Richmond Parkway/Gertrude Avenue.	**4.16-9:** Mitigation Measure 4.16-2 shall be implemented.	S	LTS
	4.16-1 through 9*: Chevron shall implement one or more of the following measures to further reduce Modernization Project construction impacts by reducing construction-related traffic trips during the AM and PM peak hours.*		
	1 through 9a: Chevron shall stagger the hours of operation of the craft labor so that the construction-related traffic would be distributed over the peak and non-peak hours of traffic operation.		
	1 through 9b: Chevron shall promote the use of car-sharing by the craft labor.		
	1 through 9c: Chevron shall coordinate the schedule among construction of the Modernization Project, construction of the other projects, and the major facility turnaround to minimize combined traffic generation on any single day.		

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
4.16-10: Modernization Project construction-generated increases in heavy truck traffic on area roadways could result in substantial damage or wear of public roadways.	**4.16-10:** Chevron shall repair any roads damaged as a result of Modernization Project construction activity to a structural condition equal to that which existed prior to construction activity. Prior to Project construction, City of Richmond Public Works Department or the Director's designated representative would document road conditions for all routes that would be used by Project construction-related vehicles. The City would also document road conditions after Project construction is completed. The pre- and post-construction conditions of the haul routes shall be reviewed, and Chevron or contractor(s), and staff of the Public Works Department, would enter into an agreement prior to construction that details the pre-construction conditions and the post-construction requirements of a rehabilitation program.	S	LTS
4.16-11: Modernization Project construction plus other projects plus major turnaround conditions generated increases in traffic volumes would add new trips to the intersections at Richmond Parkway and Pittsburg Avenue and Richmond Parkway and Parr Boulevard. These intersections currently operate at LOS A and C or better. While not expected, it is possible that the addition of new trips could result in a significant adverse impact to AM and PM peak hour traffic operations at these intersections.	**4.16-11:** These intersections are maintained by the County, and thus the City has no independent jurisdiction to enforce any requirement to mitigate impacts at these intersections. However the City and Chevron shall coordinate with the Contra Costa County Department of Public Works to implement the following mitigation measure at the intersections of Richmond Parkway and Pittsburg Avenue and Richmond Parkway and Parr Boulevard: 11a: Collect traffic data at the Richmond Parkway/Pittsburg Avenue and Richmond Parkway/Parr Boulevard intersections two weeks after start of construction during the AM and PM peak commute periods (6:00 to 9:00 a.m. and 4:00 to 6:00 p.m.). If traffic data indicate that either or both intersections operate below the established standard	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
	(i.e., LOS E or LOS F), Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) in coordination with the Contra Costa County Public Works Department to implement one or more of the of the following during the construction period: 1. Provide modified traffic control during the peak AM and/or PM peak commute periods. The modified traffic control shall be accomplished by one or more of the following methods: a. Posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers). b. Programming an alternate signal timing plan that would be in operation during the peak commute periods c. Posting traffic control officers to manually control traffic movements during peak commute periods 2. Using cones and/or flaggers, temporarily reconfigure the lane assignments at the intersection during peak AM and/or PM peak commute periods Chevron shall pay the full cost of this measure, including costs of law enforcement personnel to provide the traffic control under above-cited methods (1) or (2).		
4.16-12: The Modernization Project could increase the potential for traffic and emergency response hazard from non-compliant signage at the Richmond Lane	**4.16-12:** Chevron shall post the correct emergency information at the Richmond Lane rail spur crossing in accordance with GO 75-D and evidence of	S	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
railroad crossing.	compliance shall be provided to the City prior to issuance of any building or grading permits. All construction located near the rail track within the Project site shall comply with the Public Utilities Commission's General Orders (GO). Details on the Commission's General Orders are located here: http://www.cpuc.ca.gov/crossings. These General Orders consist of: ▪ GO 26-D: Clearances on railroads and street railroads as to side and overhead structures, parallel tracks and crossings ▪ GO 72-B: Construction and Maintenance – Standard types of pavement construction at railroad grade crossings ▪ GO 75-D: Warning Devices for at-grade railroad crossings ▪ GO 88-B: Alterations of railroad crossings ▪ GO 118: Construction, reconstruction and maintenance of walkways and control, of vegetation adjacent to railroad tracks.		
4.17 Utilities and Services			
4.17-1: Solid waste generated from Modernization Project construction and operation would not adversely affect landfill capacity. The Project would not affect the Facility's ability to continue to comply with federal, State, and local statutes and regulations related to solid waste.	***4.17-1:*** *Prior to issuance of a demolition, grading, or building permit, Chevron shall submit a Debris Recovery Plan and Debris Recovery Report demonstrating that at least 50% of the construction and demolition debris generated on the jobsite is reused, recycled, or otherwise diverted. The Debris Recovery Plan shall be submitted to the City for review and approval.*	LTS	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE CHEVRON REFINERY MODERNIZATION PROJECT

Environmental Impact	Mitigation and Improvement Measures (Note. Improvement Measures are in *italic type*)	Impact Significance before Mitigation	Impact Significance after Mitigation
4.17-2: Implementation of the Modernization Project would result in an increase in water use. However, under the 93% Utilization Scenario, there would be sufficient water supplies available to serve the Modernization Project from existing entitlements and resources.	**4.17-2:** None required.	LTS	LTS
4.17-3: Implementation of the Modernization Project under the 100% Utilization Scenario would result in an increase in water use. However, under the 100% Utilization Scenario, there would be sufficient water supplies available to serve the Modernization Project from existing entitlements and resources.	**4.17-3:** None required.	LTS	LTS

CHAPTER 3.
PROJECT DESCRIPTION

This chapter provides a discussion of the location and nature of the various Project components and Project Design Features that make up the Chevron Refinery Modernization Project (Modernization Project or Project) analyzed within this EIR. To assist the reader in understanding the context of the Modernization Project, a non-project specific description of the refining process as it generally occurs at the Chevron Richmond Refinery (Facility or Project site) is provided in *Appendix 3, Overview of Oil Refining Process*; and additional discussion regarding the relationship of the Modernization Project to the production capacity and utilization of the Facility is provided in *Section 4.0.3 of Section 4.0, Introduction to Chapter and Methodology.* Additionally, a glossary is provided in *Chapter 8, Glossary,* for reference.

3.1 PROJECT OVERVIEW AND LOCATION

3.1.1 Procedural Background

Chevron Products Company, a division of Chevron U.S.A. Inc. (Chevron), owns and operates the Facility, located along the western edge of the City of Richmond (City), in Contra Costa County (County), California. The Facility processes crude oil blends, externally sourced (purchased) gas oils, and natural gas (each, a so-called feedstock[1]) into a number of products, including motor gasoline, jet fuel, diesel fuel, and lubricant base oils, as well as fuel oil, liquefied petroleum gas, and sulfur. The Facility also produces steam and electricity, primarily for its own use,[2] as well as fuel gas and hydrogen solely for its own use. Facility operations include the import of crude oil and gas oils by ship (through the Richmond Long Wharf).

In 2005, Chevron applied to the City for permits for the proposed Chevron Hydrogen and Energy Renewal Project (2008 Project) at the Facility. In 2008, the City certified the Chevron Hydrogen and Energy Renewal Project EIR Consolidated Volume (2008 EIR) and approved design review and conditional use permits (Permits) for the 2008 Project. Following those approvals, Chevron began construction of certain portions of the 2008 Project, including a Hydrogen Plant Replacement to replace the existing plant and certain improvements referred to in the 2008 EIR as the "Hydrogen Purity Improvements." In 2009, the Contra

[1] Feedstock is the raw material used to make refined petroleum products.

[2] This includes power used by the Chevron Energy Technology Company and all other Chevron companies located on or adjacent to the Facility property.

Costa Superior Court invalidated the 2008 EIR and associated Permits, and issued an injunction halting further construction. At the time construction was halted, none of the new equipment was complete or operational. Following an appeal, in 2010, the California Court of Appeal affirmed in part and reversed in part the Superior Court decision (Appellate Court Decision) and, on March 14, 2011, the Contra Costa Superior Court issued a writ of mandamus (Writ) ordering that the 2008 EIR and Permits be set aside on certain grounds, as described in *Chapter 1, Introduction.*[3]

In 2011, the Richmond City Council adopted a resolution encouraging Chevron to resubmit its application.[4] Later in 2011, Chevron submitted a new application to the City for a revised project (Modernization Project or Project) that includes only two of the 2008 Project's major components, the Hydrogen Plant Replacement (Hydrogen Plant Replacement, as further described in *Section 3.3.1,* below), and a collection of new equipment improvements that remove naturally occurring sulfur contained in feedstocks processed at the Facility (collectively, the Sulfur Removal Improvements, as further described in *Section 3.3.2,* below), Emission Reduction Project Components that are integral to the Hydrogen Plant Replacement and Sulfur Removal Improvements, and several features designed to avoid or reduce environmental impacts (Project Design Features).[5] Following this application, the City began preparation of this EIR in order to comply with the California Court of Appeal decision and related Trial Court writ (Appellate Court Decision or Writ), and to analyze the potential environmental impacts that could result from the Modernization Project.

3.1.2 Modernization Project Overview

The Modernization Project would complete construction and begin operation of the Hydrogen Plant Replacement and the Sulfur Removal Improvements. The Project would also construct related infrastructure improvements to Facility piping, utility lines, and electrical systems. The Modernization Project includes several integral equipment components that would reduce air emissions from Facility operations (the Emission Reduction Project Components) and Project Design Features proposed to avoid or minimize environmental impacts. The

[3] The Appellate Court Decision and Writ are used interchangeably in this EIR.

[4] See additional discussion of the City's Resolution in *Section 4.0.3 of Section 4.0, Introduction to Chapter and Methodology.*

[5] In the 2008 EIR, the Sulfur Removal Improvements were referred to as the "Hydrogen Purity Improvements." The 2008 Project's proposed catalytic reformer replacement, power plant replacement, and various other Facility improvements have been eliminated from the proposed Modernization Project. Also, a storage tank replacement project that was originally part of the 2008 Project, which involved the replacement of five organic liquid storage tanks and construction of one new firewater storage tank at the Facility, has been separately permitted and is currently in construction.

Project also proposed various Facility modifications that would improve Facility safety and reliability and, in combination with other emission reduction measures, would further reduce the Facility's post-Project toxic air contaminant (TAC) emissions. Reducing Project emissions would help meet Chevron's commitment of assuring that the Project would cause "no net increase" in emissions of criteria air pollutants (CAPs), greenhouse gases, and public health risks in residential areas from TACs, when compared to the Facility emissions and operations that occurred during the baseline period of 2008 through 2010.[6] A detailed description of the major Modernization Project components—including the Hydrogen Plant Replacement, Sulfur Removal Improvements, Emission Reduction Project Components, Reliability Project Components, and the Project Design Features—is set forth in *Section 3.3, Modernization Project Components,* below. Each Project component is listed in Table 3-1, appearing in *Section 3.3*.

Because Facility impacts such as air emissions correlate to Facility utilization levels (i.e., higher utilization means greater throughput, and higher air emissions from "full" process units), this EIR evaluates Modernization Project impacts under two Facility utilization scenarios:

- First, this EIR analyzes post-Project Facility operations on the basis of a reasonably foreseeable highest utilization scenario (93% Utilization Scenario) that assumes that certain primary process units would operate at an average annual rate of 93% of their maximum permitted capacity, under the post-Project revised Title V permit limits.[7] This 93% Utilization Scenario is the highest average annual utilization rate for refineries in the Western United States from 1985, and it represents an increase from the 88.6% utilization of the Facility's crude unit that occurred during the 2008 through 2010 baseline period and other recent years. Accordingly, the 93% Utilization Scenario represents a reasonably foreseeable post-Project utilization rate at the Facility. The 93% Utilization Scenario includes 100% utilization of the hydrogen plant.
- Second, this EIR analyzes the post-Project Facility operations on the basis of full utilization, or a 100% Utilization Scenario. This scenario assumes Facility units that process crude oil blends and externally sourced gas oil would

[6] As described in detail in *Section 4.3.4.1 of Section 4.3, Air Quality,* the City selected the years 2008-2010 as the baseline years because they were the three years immediately preceding publication of the NOP for which complete operational and emissions data were available, and because 2008-2010, on average, generally represent typical Facility operations and emissions levels.

[7] These units are the crude unit, the fluid catalytic cracker, the fluid catalytic cracker feed hydrotreater (FCC FHT), the hydrotreater, and the two lube hydrocrackers, referred to as the heavy neutral hydrocracker and the light neutral hydrocracker.

operate at all times up to their maximum permitted capacity following implementation of the Modernization Project. The 100% Utilization Scenario also includes 100% utilization of the hydrogen plant.

For environmental impact topics that correlate to utilization rates, such as air quality, the EIR compares the environmental effects of the Project from the 93% and 100% Utilization Scenarios to the 2008-2010 baseline period emissions. *Section 4.0, Introduction to Chapter and Methodology* and *Appendix 4.3-URM, Unit Rate Model* provide further description of the baseline period utilization and the 93% and 100% Utilization Scenarios.

A detailed description of the crude oil blends and gas oils processed at the Facility during the baseline period, and a discussion of methodology used for analyzing the potential environmental effects of processing post-Project crude oil blends and gas oils, are provided in *Section 4.3*, *Air Quality,* and *Appendix 4.3-URM, Unit Rate Model*.

3.1.3 Modernization Project Goals

As described in *Chapter 1, Introduction, Section 1.3*, consistent with the objectives of the Project described in *Section 3.2, Objectives of Modernization Project,* below, the Modernization Project was designed to achieve three overarching goals. The following discussion summarizes how the Modernization Project fulfills these goals.

3.1.3.1 Enhance the Facility's Safety and Reliability through Installation of Newer, Inherently Safer Equipment and Technologies.

Certain proposed Modernization Project components have been designed to incorporate inherently safer designs and provide increased reliability of equipment. For example, the Hydrogen Plant Replacement would replace one of the Facility's oldest process units with a more modern plant, which would, in turn, improve overall Facility reliability and enhance Facility maintenance efforts. The Hydrogen Plant Replacement would also eliminate the use of monoethanolamine (MEA) and arsenic in the plant's hydrogen production process, thus eliminating a hazardous waste source from Refinery Operations. In addition, as explained in *Appendix 3, Overview of Oil Refining Process*, the Hydrogen Plant Replacement would use pressure swing adsorption technology to purify the manufactured hydrogen stream, improving overall Facility reliability and efficiency. The Hydrogen Plant Replacement is also designed to safely use ammonia produced during the Facility's refining process as a feedstock; it is anticipated that this design would improve Facility safety by decreasing the amount of ammonia stored at, or transported out of, the Facility.

The Sulfur Removal Improvements would also enhance Facility reliability and safety in the following ways:

- Installing a new hydrogen sulfide (H_2S) absorber that removes H_2S from a process gas stream, thereby reducing a potential source of corrosion in the system;
- Constructing a new amine regenerator near the Facility's sulfur recovery units, thus limiting the length of the piping circuit that contains H_2S gas that is subject to corrosion risks from H_2S gas; and
- Installing a new H_2S scrubber to absorb and process H_2S gas not otherwise recovered by the Facility's sulfur recovery units, thus providing additional time for the Facility to shut or slow down process units or divert H_2S gas flows.

These and other Modernization Project reliability components are further described in *Section 3.3, Modernization Project Components*, below, and their effects on public safety are analyzed in *Section 4.13, Public Safety*.[8]

3.1.3.2 Enhance the Facility's Processing Flexibility to Produce the Full Range of Facility Products

The Modernization Project is also designed to increase the Facility's flexibility to process crude oil blends and gas oil feedstocks with higher sulfur contents while continuing to manufacture the full range of Facility products (i.e., gasoline, jet fuel, diesel fuel, and lubricant base oils). It would do this primarily by: (1) increasing the physical capacity or mechanical capacity of certain Facility components; and (2) increasing certain regulatory permit limits that currently restrict the production capacity of various Facility components, as further explained below. It is important to note, however, that the Facility's crude unit (the process unit into which unprocessed crude oil blends are first pumped at the start of the refining process) has a permit capacity limit of 257,200 barrels per day and the Modernization Project would not increase this throughput

[8] This EIR also considers the hydrocarbon leak and subsequent fire that occurred on August 6, 2012 in the Facility's crude unit, which is the unit through which crude oil blends are first processed for refining into end products. The repairs in the crude unit complex following the fire were completed in April 2013, and the crude unit recommenced operations in April 2013. The crude unit repairs were separately permitted by the City and are not part of this EIR, and the Modernization Project proposes no changes to the crude unit. However, *Section 4.13, Public Safety*, describes the scope of the crude unit repairs and the ongoing engineering and administrative controls being implemented by the Facility to prevent a recurrence of the fire or other accidental release, as potentially related to public health and safety considerations in the operation of the Facility following implementation of the Modernization Project.

limitation. Thus, if the Modernization Project is approved, the maximum daily amount of crude oil processed at the Facility would not be increased.

As noted below, the Modernization Project would enhance the Facility's flexibility to process higher sulfur feedstocks by increasing the physical (mechanical) capacity of certain Facility components, including the following:

- The Facility's hydrogen production capacity would increase from 181.1 million standard cubic feet per day (scfd) to 244 million scfd after replacing the existing hydrogen plant.
- The physical capacity of the Facility's FCC FHT would be increased from 65,000 to 80,000 barrels per day of gas oil.

Oxygen enrichment facilities would be added to the Facility's sulfur recovery units to increase their physical capacity from 600 long tons per day[9] to 900 long tons per day. While these physical improvements would not change the Facility's crude oil throughput capacity, they would enable the Facility to process crude oil blends and gas oils with higher sulfur contents on a sustained basis,[10] thus providing greater flexibility to process crude and gas oils from the wider global market while continuing to manufacture the full range of Facility products (i.e., gasoline, jet fuel, diesel fuel, and lubricant base oils).

In addition to physical capacity improvements, the Modernization Project would also enhance the Facility's ability to process higher sulfur feedstocks by increasing regulatory permit limitations applicable to some Facility components. Title V of the Federal Clean Air Act requires local and state air quality agencies to issue comprehensive operating permits to facilities that emit prescribed amounts of CAPs and TACs. The Facility currently operates pursuant to a Title V permit issued and administered by the Bay Area Air Quality Management District (BAAQMD). The Modernization Project proposes to increase the Facility's Title V permit limits, as follows:

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[9] One long ton (the standard unit for measuring sulfur exports) equals 2,240 pounds or 1.12 standard tons.

[10] While the Modernization Project would not result in any increase in crude oil throughput capacity, it would result in a small increase in the Facility's capacity for processing gas oils. This small increase in gas oil capacity (<1%) is a result of a throughput increase at the Facility's FCC FHT, and is the only modification included in the Modernization Project affecting the physical throughput capacity of the Facility. This total refining capacity is an approximation only, as there is no single permitted limit for the quantity of gas oil that can be processed at the Facility. Therefore, to provide context for the amount of increase that 1,200 barrels represents compared to the Facility's total capacity, a conservative assumption was made that the Facility can process a maximum of approximately 80,000 barrels per day of gas oil, assuming a reasonable crude oil blend. See *Section 4.0.3.2* for further discussion.

- The permit limit applicable to the Hydrogen Plant Replacement would increase from 181.1 million scfd to 330 million scfd, which is a lower permitted limit than was approved as part of the 2008 Project, however, the City will require Chevron to accept a new, lower permit limit of 294 million scfd as a condition of commencing operation of the hydrogen plant.
- The permit limit for the Facility's sulfur recovery units would increase from 600 to 900 long tons per day.
- The permit limit for the Facility's FCC FHT would increase from 65,000 barrels per day to 80,000 barrels per day of gas oil.

Additionally, Chevron is seeking a separate permit from the BAAQMD to replace the Facility's liquid sulfur truck loading rack and related equipment. As part of the Modernization Project, Chevron is seeking to amend its permit to allow for truck loading of the additional elemental sulfur related to the increased capacity of the sulfur recovery units, as described further in *Section 3.3.2.4*.

The Modernization Project would, however, reduce the Title V annual permit limit applicable to the Facility's solvent de-asphalting unit (SDA unit) from 56,000 barrels per day to 50,000 barrels per day. Together, the Project's proposed permit modifications would authorize the Facility to operate in a manner that will accommodate higher sulfur feedstocks.

Although the Modernization Project proposes to increase the Facility's physical and legal capacity to remove and recover sulfur, thereby enabling the Facility to process higher sulfur feedstocks, the Facility's basic design and configuration, which the Project would not fundamentally alter, constrains the range of feedstocks that can be processed. During the 2008 to 2010 baseline period, the Facility processed crude oil blends at the light end of the intermediate American Petroleum Institute (API) gravity range (i.e., crude oil blends in the low-to-mid 30s).[11] As explained in *Appendix 4.3-URM, Unit Rate Model*, the Facility's ability to process crude oil that is much heavier or lighter than the crude oil blend used during the baseline period is subject to two existing constraints: (1) the physical and permitted throughput limit of the Facility's SDA unit for heavier crudes;[12] and (2) the physical and permitted throughput limit of the Facility's naphtha hydrotreater for lighter crudes. Neither throughput limit would be increased by the Modernization Project. Therefore, the Project would not enable a significant change in the API gravity of the crude oil processed at the Facility. Indeed, any

[11] Intermediate crude is defined as crude with API gravity of 18-36. See *Section 4.0.3* for additional discussion.

[12] Heavy crude is defined as crude with API gravity below 18. See *Section 4.0.3* for additional discussion.

such significant change would adversely affect the Facility's ability to effectively manufacture its full range of products, including lubricant base oil, required to satisfy customer demand.[13]

Nevertheless, it is reasonably foreseeable that some post-Project crude oil blends processed at the Facility may be somewhat heavier than those processed by the Facility during the baseline period. The Modernization Project would provide the Facility flexibility to process higher sulfur crude blends, and depending on the source of the crude, increases in sulfur concentrations can have a correlation to increases in API gravity. It is anticipated that post-Project crude oil blends being processed at the Facility would still have API gravity in the low 30s (intermediate-light range) in order to maintain higher overall Facility utilization levels and throughputs. *Section 4.3, Air Quality*, and *Appendix 4.3-URM, Unit Rate Model* evaluate a broad range of potential crude oil blends to demonstrate the effect of the crude blends on operating conditions, and estimates the post-Project emissions from these cases. This includes crude oil blends at both the higher and lower ends within the intermediate-light range, and also outside of (above or below) that intermediate-light range.

3.1.3.3 Achieve No Net Increase in Criteria Air Pollutants, Greenhouse Gases, and Public Health Risks from Toxic Air Contaminants

While the Modernization Project would result in increased capacity to produce hydrogen, remove sulfur, and process gas oil, it would do so with no net increase above baseline period emission levels of CAPs, greenhouse gases, and public health risks in residential areas from TACs. This would be achieved through implementation of the Emission Reduction Project Components, Project Design Features, and mitigation measures identified in this EIR.

The Modernization Project would reduce emissions of nitrogen oxide (NO_x) by installing low-NO_x burners in the sulfur recovery units, the furnaces in the Hydrogen Plant Replacement, and in the five existing furnaces not otherwise affected by the Modernization Project. The Hydrogen Plant Replacement would also reduce fuel usage per hydrogen product, and the modifications to the FCC FHT would create energy efficiencies that allow for additional throughput without requiring additional heat input. Chevron has also committed, as a voluntary Project Design Feature, to upgrade two ships in its Pacific fleet that frequently call on the Facility, by installing Tier 3 certified onboard engines, resulting in additional NO_x reductions.

[13] The Chevron Richmond Facility is the only manufacturer of lubricant base oils on the West Coast.

Other Project-related improvements result in no net increase of sulfur dioxide (SO_2), fine and respirable particulate matter (PM_{10} and $PM_{2.5}$), volatile organic compounds (VOCs), and carbon dioxide (CO_2), as further explained in *Section 4.3, Air Quality*.

As part of the Modernization Project, Chevron is also proposing to invest in other types of Facility improvements and to provide funding to support community emission reduction programs, in order to reduce and help achieve no net increase of greenhouse gases. These improvements and investments include:

- The Hydrogen Plant Replacement would include a new steam turbine generator that has the potential to offset the plant's entire electricity demand or even provide additional electricity for use in other parts of the Facility. The production of steam by the Hydrogen Plant Replacement can also be used by other parts of the Facility, reducing the amount of energy needed to create the steam needed for other Facility utility operations.
- Other Modernization Project components (i.e., a new power recovery turbine in the FCC FHT, an upgrade of existing hydrogen compressors) would also result in energy efficiencies and corresponding greenhouse gas reductions.
- The Modernization Project also includes Facility modifications to reduce greenhouse gas emissions that are not directly related to the Hydrogen Plant Replacement and Sulfur Removal Improvements equipment. For example, the Project includes upgrading approximately 6,000 lighting fixtures in the Refinery Process Area with LED lighting, thereby reducing energy consumption and the associated greenhouse gas emissions by approximately 1,000 metric tons per year.
- The Facility is also committing to participate in Marin Clean Energy for Chevron's commercial accounts at Richmond facilities and potentially its industrial accounts to the extent Marin Clean Energy can reasonably accommodate the variations in the Facility's energy consumption/generation operating scenarios.

Finally, as part of the Modernization Project, Chevron would fund local community greenhouse gas reduction programs such as the City of Richmond's R3: Richmond Recovery Rebates, a residential energy rebate program implemented by the City of Richmond Environmental Initiatives. Community-based greenhouse gas reduction measures are discussed further in *Section 4.8, Greenhouse Gases*.

3.1.4 Location of Modernization Project

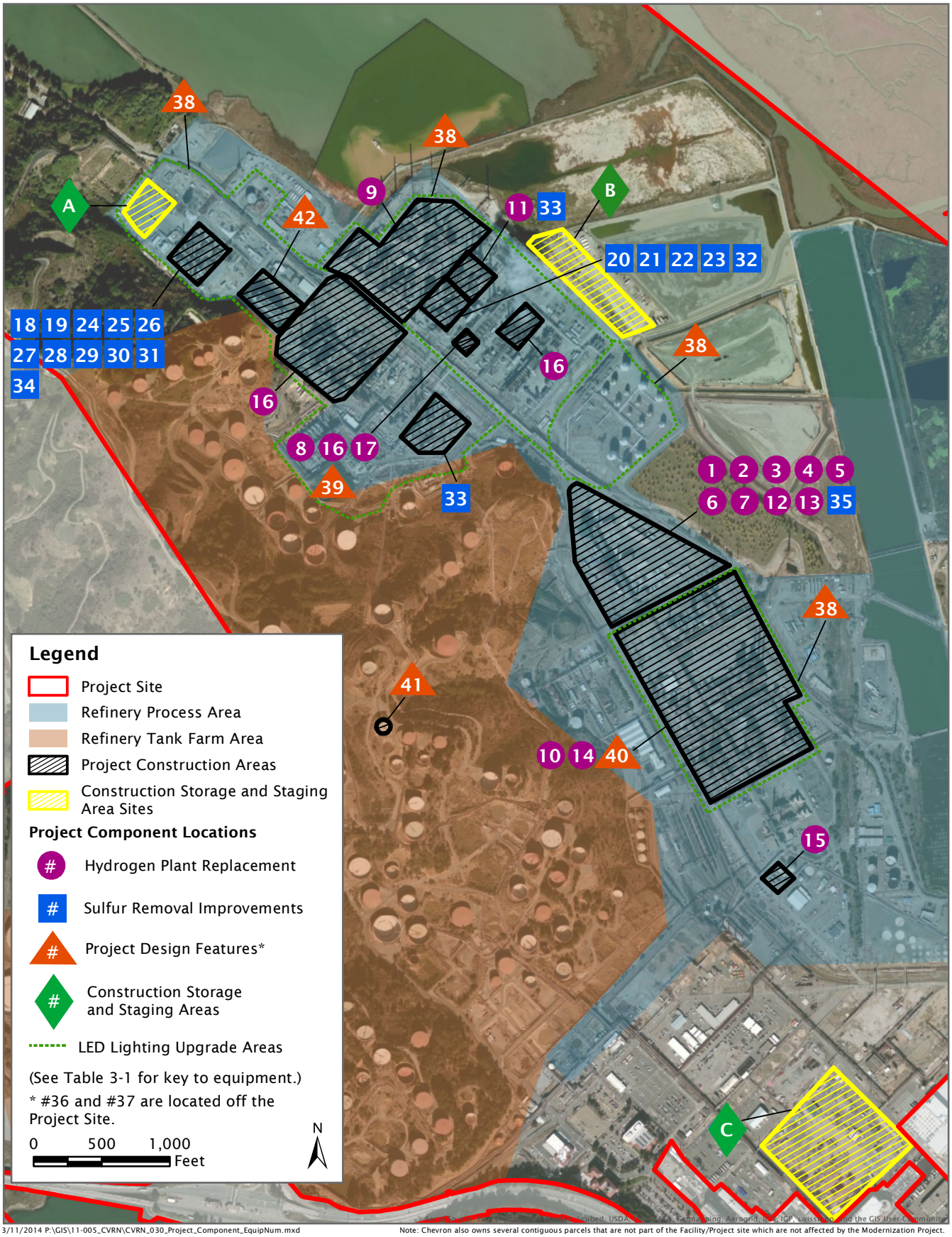
The Facility (Project site) occupies approximately 2,153 acres[14] along the western boundary of the City, as depicted in Figure 1-1. The main portion of the Project site is bounded by the Chevron Richmond Marketing Fuels Terminal to the southeast and Chevron Energy Technology Company to the south. The primary areas of the Project site affected by the Modernization Project are the Refinery Process Area, the Tank Farm Area, and three construction equipment storage and staging areas (two of which are located outside of the Refinery Process and Tank Farm areas).

The marine terminal and wharf (Long Wharf) are located on the southern boundary of the Project site on San Francisco Bay. The Long Wharf is over 1 mile long and receives and unloads crude oil and other raw materials shipped from worldwide locations, including Alaska and the Middle East. The Long Wharf also serves for loading of refined products produced at the Facility for shipment elsewhere.

As shown in Figure 3-1, the majority of the Modernization Project components are located within either the Facility's Refinery Process or Tank Farm areas. The Sulfur Removal Improvements would be constructed within the FCC FHT or adjacent to the sulfur recovery units. Associated “tie-in” piping and other components would be constructed in existing Facility process units. As further described in *Section 3.3, Modernization Project Components*, below, certain mitigation measures and project features designed to reduce project impacts are located outside the Refinery Process and Tank Farm areas, including the proposed ship/vessel upgrades and some greenhouse gas reduction measures, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron’s participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 3.3.3.4*.

The residential communities of Atchison Village, Santa Fe, and Iron Triangle are located southeast of the Facility, across Castro Street and Garrard Boulevard; Shields-Reid community and Parchester Village are located northeast of the Project site; and Point Richmond is located to the southwest. Point San Pablo Yacht Harbor, where some residents may reside in house boats, is located north of the Project site. Point San Pablo Peninsula and San Francisco Bay form the

[14] The Facility includes the following assessor parcels: 561-100-043; 561-030-005; 561-030-003; 561-030-002; 561-030-001; 561-040-017; 561-040-013; 561-040-015; 561-040-014; 561-040-016; 561-400-008; 561-100-003; 561-410-003; 561-410-002; 561-100-025; 561-100-042; 561-100-009; 561-080-006; 561-080-001; 561-080-007; 561-080-002; 561-080-003; 561-080-005; 561-090-004; 561-090-003; 561-100-010; 561-100-049; 561-100-044; 561-100-048; 561-100-047; 561-100-017; 561-110-020; 561-110-044; 561-110-022; 561-110-041; 561-110-034; 561-110-035; 561-110-036; 561-100-029; 561-100-037; 561-100-038; 561-390-001; 561-390-003; 561-390-004; 561-390-016.



3/11/2014 P:\GIS\11-005_CVRN\CVRN_030_Project_Component_EquipNum.mxd

Note: Chevron also owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T22r2, T36Cr3, T38r1, and T54)

Figure 3-1
Chevron Refinery Modernization Project EIR
Project Component Locations

western border of the Project site and San Pablo Bay forms the northern boundary of the Project site.

There are three construction staging areas for the Modernization Project located within the Project site; the staging areas are identified as A, B, and C on Figure 3-1. Staging Area A is located in the northwest portion of the Refinery Process Area. Staging Area B is adjacent to the northeast portion of the Refinery Process Area. Staging Area C is located in the southern area of the Project site, west of Castro Street. There are several residences within a mile of Staging Area C. Point San Pablo Yacht Harbor is approximately 0.9 mile north of the Staging Area A, while Point Richmond residences are approximately 0.2 mile south from Staging Area C. Residences in Atchison Village are approximately 0.5 mile east of Staging Area C, while residences in the Iron Triangle and Santa Fe are located approximately 0.75 mile and 1 mile, respectively, from Staging Area C.

3.2 OBJECTIVES OF MODERNIZATION PROJECT

Chevron has identified the following objectives for the Modernization Project:

- Modernize, enhance equipment reliability, and enhance the integrity of the Facility by replacing older equipment with newer, cleaner, and inherently safer systems and equipment that is consistent with the Richmond Industrial Safety Ordinance.
- Enhance the Facility's flexibility to process crude oil blends and externally sourced gas oils[15] containing higher levels of sulfur than those currently being processed, enabling Chevron to continue producing transportation fuels and lubricant base oils in compliance with low-sulfur State and federal standards.
- Replace the existing hydrogen production plant with a larger, more modern plant that is more energy-efficient, produces higher purity hydrogen, and has sufficient capacity to meet the Facility's hydrogen needs and for potential export.[16]

[15] "Externally sourced" gas oils are purchased for use as feedstock at the Facility, and are also called "imported" or "purchased" gas oils. The Facility crude unit also produces gas oils as an internal feedstock for further processing into end products. *Section 3.3* provides a description of the Modernization Project's effect on the Facility's ability to process gas oil from both internal and external sources.

[16] Praxair Corporation, the owner and operator of the Hydrogen Plant Replacement, has separately sought authorization from the County and other jurisdictions to construct a hydrogen pipeline for export and sale of hydrogen not used by Chevron to third-party customers, including refineries and potentially other facilities in the East Bay. The Praxair export project was determined to be appropriately considered as a separate project in the Appellate Court Decision.

- Ensure that there is no net increase in emissions of greenhouse gases and CAPs compared to the baseline period, through a combination of: replacing some existing equipment with new Modernization Project components that are more energy-efficient and lower-emitting; installing emissions reduction Project Design Features in the Modernization Project; and implementing specific, feasible mitigation measures as described in this EIR.
- Ensure that there is no net increase in health risks in residential areas associated with TACs from Facility operations as compared to the baseline period, using a combination of project components, Project Design Features, and mitigation measures, consistent with the methodology for assessing non-nominal risks established by the BAAQMD.[17]
- Maintain the Facility's current throughput processing capacity.

3.3 MODERNIZATION PROJECT COMPONENTS

The Facility is a complex industrial facility that processes crude oil blends and gas oils into transportation fuels and lubricant base oils, which are mixed with small amounts of imported, partially refined cutter and blendstock to produce finished products, such as gasoline, diesel fuel, and lubricant base oils that leave the Facility. As described above, the Modernization Project would enhance the Facility's operational flexibility by enabling it to process crude oil blends and gas oils with higher sulfur levels. This section describes the Hydrogen Plant Replacement and the Sulfur Removal Improvements. These improvements would enable the Facility to process higher sulfur crude and gas oils, as well as other attendant benefits.

Table 3-1 provides a detailed description of each Modernization Project component and sub-component. Figure 3-2 provides a visual representation of the major Project components.

This section also describes the Emission Reduction Project Components and the Project Design Features included in the Modernization Project to meet the Project objective of no net increase over the baseline period for CAPs, greenhouse gas emissions, and public health risks from TACs. Finally, this section describes Project components and Project Design Features designed to improve Facility reliability and safety. Project Design Features proposed to mitigate project impacts are also separately required to be implemented as mitigation measures.

[17] For a discussion of the Modernization Project's cumulative impacts related to health risks from toxic air emissions, see *Section 4.3, Air Quality*.

TABLE 3-1 MODERNIZATION PROJECT COMPONENTS

	Project Component	Construction Complete	Construction Remaining	Equipment Dimensions	Emission Reduction?	Improve Safety and Reliability?
Hydrogen Plant Replacement						
Replace existing hydrogen plant with a more efficient hydrogen plant that produces more and higher quality ("more pure") hydrogen.	1. Hydrogen recovery vessels	Vessels are set in place. Piping, instrumentation, and electrical wiring have been procured and are on-site.	Above grade ancillary piping, instrumentation, electrical wiring.	60 feet high	X	X
	2. Train 1 steam reformer furnace	Furnace is set in place. Piping, instrumentation, and electrical wiring have been procured and are on-site.	Above grade ancillary piping, instrumentation, electrical wiring.	162 feet high	X	X
	3. Train 2 steam reformer furnace	Furnace is set in place. Piping, instrumentation, and electrical wiring have been procured and are on-site.	Above grade ancillary piping, instrumentation, electrical wiring.	162 feet high	X	X
	4. Pressure swing adsorption recovery unit	Unit is set in place. Piping, instrumentation, and electrical wiring have been procured and are on-site.	Above grade ancillary piping, instrumentation, electrical wiring.	60 feet high	X	X
	5. Flare	Foundation has been installed. The flare, piping, instrumentation, and electrical wiring have been procured and are on-site.	Set flare in place, install ancillary piping, instrumentation, and electrical wiring (all above grade).	195 feet high		X
	6. Cooling water tower	Foundation has been installed. The cooling water tower, piping, instrumentation, and electrical wiring have been procured and are on-site.	Set cooling water tower in place, install ancillary piping, instrumentation, and electrical wiring (all above grade).	43 feet high		X
	7. Steam turbine generator (provides electric power to the hydrogen plant)	None. The generator, piping, instrumentation, and electrical wiring have been procured and are on-site.	Foundation completion. Set equipment in place. Above grade piping, instrumentation, and electrical wiring.	17-megawatt net output	X	

TABLE 3-1 MODERNIZATION PROJECT COMPONENTS

Project Component	Construction Complete	Construction Remaining	Equipment Dimensions	Emission Reduction?	Improve Safety and Reliability?
8. Upgrade H2 booster compressors	None. Equipment to upgrade the compressors has been procured and is on-site.	Above grade modifications to compressors to process higher pressures from new H2 plant.	No change in dimensions. Thicker wall to handle higher H2 Pressure.	X	X
9. Upgrade Richmond lube oil plant area compressors	None. Equipment to upgrade the compressors has been procured and is on-site.	Above grade modifications to compressors to process higher purity, lower density hydrogen than present.	No change in dimensions. Thicker wall to handle higher H2 pressure.		
10. Upgrade distillation and reforming area compressors	None. Equipment to upgrade the compressors has been procured and is on-site.	Above grade modifications to compressors to process higher purity, lower density hydrogen than present.	Internal changes only. No change in dimensions.		
11. Upgrade Isomax area compressors	35% Complete (FCC FHT).	Complete turbine and compressor upgrades in remainder of facility. Above and below grade modifications to process higher purity, lower density hydrogen than present.	No change in dimensions rotat-ing equipment. New 40-foot-tall structure for lubrication of machinery.		
12. Process piping and fittings	Small portion of process piping and fittings. Piping and fittings have been procured and are on-site.	Majority of process piping and fittings.	Various lengths and diameters		
13. New control room	Control room building has been constructed.	Interior walls, utility connections, electrical wiring, finish work (walls, floors, décor).	9,450 square feet		

TABLE 3-1 MODERNIZATION PROJECT COMPONENTS

	Project Component	Construction Complete	Construction Remaining	Equipment Dimensions	Emission Reduction?	Improve Safety and Reliability?
	14. Modify and upgrade electrical and communications infrastructure.	None. Transmitters have been procured and are on-site.	Smart transmitters for process monitoring.	N/A		
Reverse osmosis plant expansion	15. Two reverse osmosis trains, (1) pump, (1) water storage tank, piping	None	All	Reverse osmosis trains: 500 gpm each Tank: 20,000 BBL Piping: 1,000 feet		
Boiler feed water optimization and condensate recovery	16. Piping, (2) pumps	25%	75% – piping installation	Pumps:500 gpm Piping: 2,500 feet		
Decommission existing hydrogen plant	17. Dismantle existing hydrogen plant	None	All	N/A		
Sulfur Removal Improvements						
Modify and install equipment to remove and recover additional quantities of sulfur from the sour gas system.	18. Upgrades to sulfur recovery units	All equipment has been procured and is on-site. Minor process piping and oxygen skid are installed.	Two heat exchanger modifications per unit. Additional piping upgrades and furnace modifications for oxygen injection per unit. Installation of new emissions control and containment equipment (e.g., wet electrostatic precipitator).	475 x 150 feet (existing—no change proposed)	X	
	19. Upgrades to sour water concentrator	100%	None	400 gpm		

TABLE 3-1 MODERNIZATION PROJECT COMPONENTS

	Project Component	Construction Complete	Construction Remaining	Equipment Dimensions	Emission Reduction?	Improve Safety and Reliability?
FCC FHT – modifications	20. Add, modify, or replace 4 sumps, 2 vessels, 2 heat exchangers, and process piping to improve FCC FHT reliability	100%	None	No change in dimensions		X
FCC FHT – Feed rate increase	21. Add, replace, or modify 7 heat exchangers, modify or replace 9 pumps, and modify 1 distillation column internal components.	None. Heat exchangers and pumps are still in the design phase and have not been procured.	Complete design and procurement of new, replacement, and modified equipment. Install new heat exchangers and modify existing heat exchangers. Install new pumps, and modify existing pumps. Make modifications to distillation column internal components (trays).	N/A; design incomplete	X	
	22. Process piping and fittings.	None. Piping and fittings have not been procured.	Install process piping and fittings.	N/A; design incomplete		
Sulfur Removal – amine contactor and regenerator	23. Recycle hydrogen amine contactor (also referred as amine absorber and H_2S absorber)	None. Piping and instrumentation has been procured and are on-site.	Set contactor in place, connect ancillary piping, instrumentation, and electrical wiring.	100 feet high 0.3 MM SCFH		X
	24. Amine regenerator	None. Piping and instrumentation has been procured and are on-site.	Set regenerator in place, connect ancillary piping, instrumentation, and electrical wiring.	120 feet high		X

TABLE 3-1 MODERNIZATION PROJECT COMPONENTS

Project Component	Construction Complete	Construction Remaining	Equipment Dimensions	Emission Reduction?	Improve Safety and Reliability?
25. Lean amine storage tank	None. Piping, instrumentation and wiring has been procured and is on-site.	Set tank in place, connect ancillary piping, instrumentation, and electrical wiring (all above grade).	35 feet in diameter x 24 feet high		
26. Fresh amine storage tank	None. Piping and instrumentation has been procured and is on-site.	Refurbish and change service of caustic tank T-2400 to amine service, connect ancillary piping, instrumentation, and electrical wiring (all above grade).	25 feet in diameter x 20 feet high		
27. Fresh caustic storage tank	None. Piping and instrumentation has been procured and is on-site.	Set tank in place, connect ancillary piping, instrumentation, and electrical wiring (all above grade).	40 feet high		
28. Spent caustic storage tank	None. Piping and instrumentation has been procured and is on-site.	Set tank in place, connect ancillary piping, instrumentation, and electrical wiring (all above grade).	40 feet high		
29. Acid gas scrubber	None. Scrubber, piping and instrumentation have been procured and are on-site.	Set scrubber in place, connect ancillary piping, instrumentation, and electrical wiring (all above grade).	70 feet high	X	X
30. Liquid oxygen storage tank and vaporizer	Liquid oxygen tanks and vaporizer have been set in place. Piping and connections have been procured and are on-site.	Above-grade piping and connections.	50 feet high		

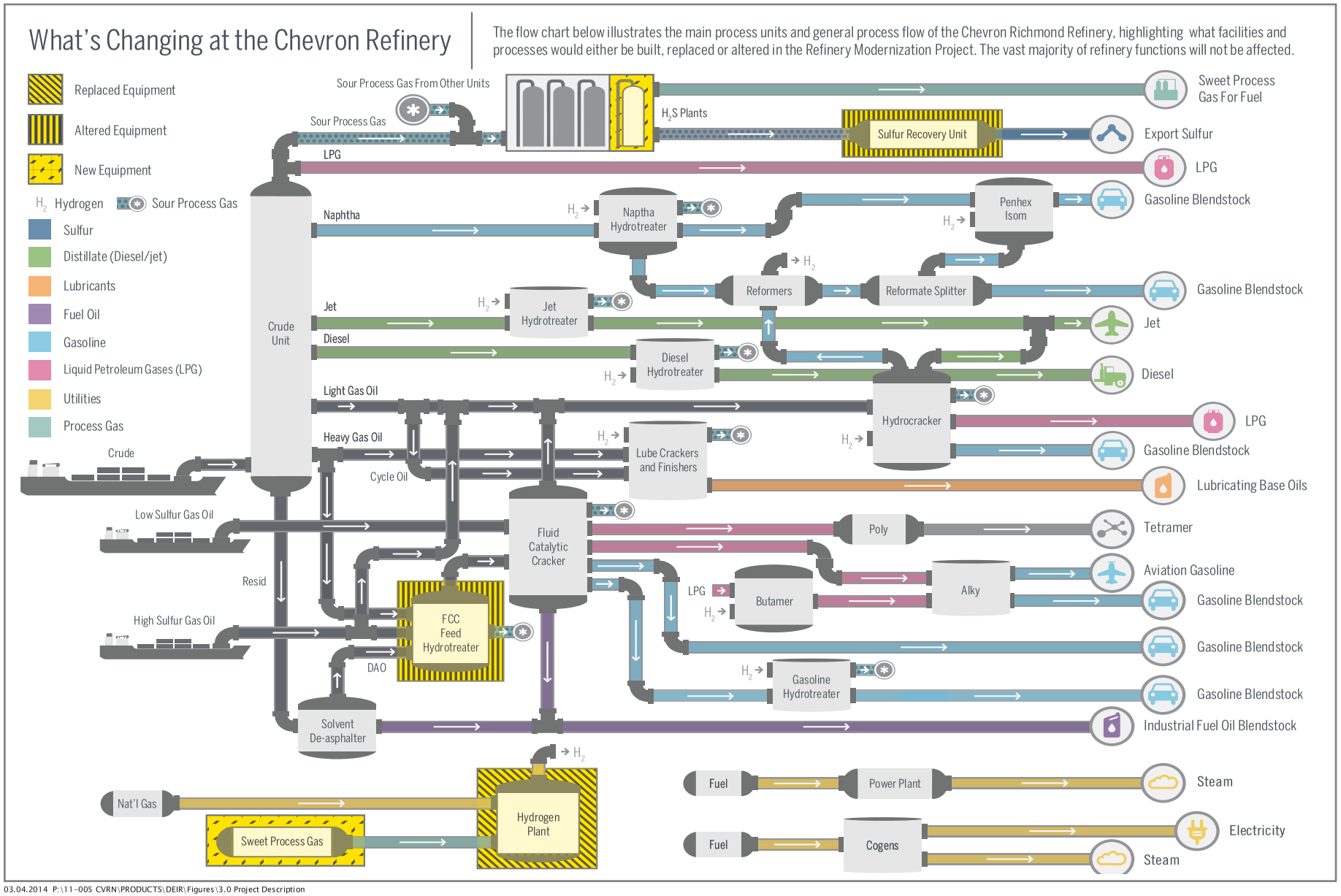
TABLE 3-1 MODERNIZATION PROJECT COMPONENTS

	Project Component	Construction Complete	Construction Remaining	Equipment Dimensions	Emission Reduction?	Improve Safety and Reliability?
	31. Process piping and fittings	A small portion (5%) of required piping and fittings has been installed. The remainder of piping and fittings has been procured and are on-site.	Install remainder of piping and fittings.	Diameter: 2-24 inches Length: 5,000 feet		
	32. New power recovery turbine	None on mechanical equipment. Foundations for new equipment complete. 10% complete overall.	Complete piping and install mechanical equipment and structural components.	920 Recovered Horsepower	X	
	33. Low NOx burners	None installed. Equipment procured only.	Modify furnaces in the Facility's Taylor Katalytic DeNitrification Isomax and Poly units to handle new burners. Install filters to and equipment.	Replacement of burners: 3 x 2 feet per burner	X	
	34. New truck loading/ unloading rack for bisulfite, caustic and amine	None. Loading arms and ancillary piping have been procured and are on-site.	Complete foundations and install new loading arms and ancillary piping.	20-foot-high arm		
Related piping and other ancillary equipment	35. Off-plot Inter-connecting piping and pipe racks	P and U racks are 100% complete. W, Q, and V racks are 50% complete. Structural steel and piping has been procured and is on-site. Approximately 7,000 feet of piping for P, Q, U, V, and W racks installed.	Remainder of W, Q, and V racks (above ground with some minor soil excavation for steel support footings). Approximately 41,000 linear feet of piping for P, Q, U, V, and W racks (all above grade).	Diameter: 2-16 inches Length: (see columns to left)		

TABLE 3-1 MODERNIZATION PROJECT COMPONENTS

	Project Component	Construction Complete	Construction Remaining	Equipment Dimensions	Emission Reduction?	Improve Safety and Reliability?
Project Design Features						
	36. Marin Clean Energy participation	N/A	N/A	N/A	X	
	37. Marine engines upgrades	None	Upgrade main ship and auxiliary engines to IMO Tier 3 standards.	N/A	X	
	38. LED lighting	None	Replace existing lighting with LED lights.	N/A	X	
	39. Water reuse: South Isomax	None	Heat exchanger, process piping, and fittings.	N/A; design incomplete	X	
	40. Water reuse: distillation and reforming	None	Two electric pumps, process piping, and fittings.	N/A; design incomplete	X	
	41. Storage tank dome	None	Installation of spherical, geodesic tank dome on T-1491.	Diameter: 90 feet	X	
	42. Fluid catalytic cracker cooling water tower motor upgrade	None	Replace existing constant speed motors and gearbox drive system with adjustable speed direct drive motors and drive system.	N/A; design incomplete	X	
	43. Modernization Reliability Program	None	Replace 17 piping circuits and 4 piping components.			X

Note: FCC FHT = fluid catalytic cracker feed hydrotreater; gpm = gallons per minute; IMO = International Maritime Organization; LED = light-emitting diode
Source: Chevron Data Transmittal 36C (Rev #3), 2014.



Source: Chevron (T39r2)

Figure 3-2
Chevron Refinery Modernization Project EIR
Facility Process Diagram

3.3.1 Hydrogen Plant Replacement

Hydrogen plays a number of important roles in the refining process, as explained further in *Appendix 3, Overview of Oil Refining Process*. The Modernization Project would replace the existing hydrogen production plant with a larger, more energy-efficient hydrogen plant. Following the new plant's start-up, the existing hydrogen production plant would be shut down, decommissioned, and dismantled, as described further in *Section 3.4, Construction, Decommissioning, and Dismantling* below. This section provides a description of the Facility's existing hydrogen production capabilities and how they would change following implementation of the Modernization Project.

3.3.1.1 Existing Hydrogen Production Capability

Hydrogen gas is currently produced on-site in an existing hydrogen plant, as well as in two process units used during the reforming process—i.e., the catalytic reformers. The existing hydrogen production plant produces hydrogen from a process known as steam reforming. Steam reforming takes water (i.e., steam) combined with methane (CH_4, the primary component of natural gas), and, through a chemical reaction with heat, produces hydrogen and other impurities. The existing plant further processes these impurities through a "wet scrubber" process, using energy and chemicals, to convert them into and/or remove them from the hydrogen stream.

The steam reforming/wet scrubber design of the existing hydrogen production plant is a process that was in widespread use until the 1960s. This process results in hydrogen that is approximately 94% "pure," meaning approximately 94% of the hydrogen stream produced is actually hydrogen, and the remainder consists of impurities such as CO_2 and unconverted CH_4. The existing hydrogen plant has a Title V permit production limit of 181.1 million scfd. However, the existing hydrogen plant only produces 170 million scfd because the hydrogen is only 94% pure (181 x 0.94 = 170).

In addition to producing hydrogen, the Facility operates a hydrogen recovery unit that uses pressure swing adsorption technology (described in *Section 3.3.1.2, Hydrogen Plant Replacement*) to recover hydrogen from a small portion of the Facility's process unit off-gas. The existing hydrogen recovery unit is permitted to recover up to 50 million scfd of hydrogen gas. Based on the permitted limits, the Facility currently has a combined production and recovery capacity of 232.1 million scfd of hydrogen gas (181.1 + 50 = 232.1).

3.3.1.2 Hydrogen Plant Replacement

The Hydrogen Plant Replacement would be owned and operated by Praxair, which would supply hydrogen produced by the new plant to the Facility and

potentially to other customers.[18] The Hydrogen Plant Replacement is designed to meet the Modernization Project objectives of producing more hydrogen and higher-purity hydrogen in a more energy-efficient manner. Hydrogen produced from the steam reforming process would go through a pressure swing adsorption unit, consisting of a series of vessels which selectively adsorbs the hydrocarbons in the gas stream and allows the hydrogen to pass through. The vessel is periodically regenerated by removing the adsorbed impurities, like CO_2 and unconverted CH_4, by depressurizing and purging the vessel. Hydrogen produced from the steam reforming process (which today is about 94% pure) would go through a pressure swing adsorption unit, which consists of a series of vessels, instead of the conversion and removal steps in the current plant. The pressure swing adsorption vessels selectively adsorb the hydrogen in the gas stream at a high pressure, leaving behind impurities like CO_2 and unconverted CH_4. The adsorption mixture is then depressurized, leaving only higher-purity hydrogen (i.e., approximately 99% pure). The other light gases and some hydrogen left in the pressure swing adsorption units are used as fuel in the process unit's furnace to provide heat for the reforming reaction. Also, whereas the existing hydrogen plant uses MEA with arsenic injected as a corrosion inhibitor for the adsorption mixture, the Hydrogen Plant Replacement with pressure swing adsorption technology would not require the use of MEA or arsenic.[19]

The Hydrogen Plant Replacement would consist of a new hydrogen recovery unit and two identical production units, known as "trains." Each train generally consists of a steam CH_4 reformer to produce, and a pressure swing adsorption unit to purify, the hydrogen stream. After Chevron accepts a new, lower permit limit of 294 million scfd as a condition of commencing operation of the hydrogen plant, each hydrogen train would be permitted to produce 122 million scfd of hydrogen gas on an annual basis, and the new hydrogen recovery unit would be permitted to recover 50 million scfd of hydrogen. The Hydrogen Plant Replacement would thus be permitted to generate up to 294 million scfd of hydrogen gas, an increase in production and recovery capacity of 63 million scfd, when compared to the permitted capacity of the existing hydrogen plant. This increase in hydrogen gas is needed to provide the Facility with the flexibility to

[18] As was the case in the 2008 Project, Praxair has sought separately the permits necessary to construct a pipeline from the Facility to other refineries and manufacturing facilities in the East Bay, in order to supply hydrogen not purchased by Chevron to these other facilities. As part of the judicial review of the 2008 Project, the Court of Appeal affirmed that Praxair's proposed Contra Costa County pipeline and export activity is considered a separate project for CEQA purposes, and it is therefore considered in the cumulative impacts analysis in this EIR, as discussed in *Chapter 5, CEQA Statutory Sections*.

[19] For further discussion of the benefits of eliminating MEA and arsenic from the adsorption process, see *Section 4.13, Public Safety*.

remove larger quantities and higher concentrations of sulfur in feedstocks that may be refined following implementation of the Modernization Project. In some operational circumstances, the Facility itself may use all or most of the hydrogen production capacity of the Hydrogen Plant Replacement. However, there may be other instances in which excess hydrogen from the Hydrogen Plant Replacement is available for sale and export to third parties, such as other refineries.

The Hydrogen Plant Replacement's higher-purity stream would be more efficient in carrying out the chemical reactions central to the refining process and, compared to the existing hydrogen plant, the newer pressure swing adsorption technology would use about 20% less fuel to produce the same amount of hydrogen. Moreover, the Hydrogen Plant Replacement would capture more hydrogen to be reused in the refining process. In addition, the Hydrogen Plant Replacement reforming furnaces would be equipped with low-NO_x emitting burners. Low-NO_x emitting retrofits are among the components of the Modernization Project that would result in a net reduction in Facility-related emissions, and would be used to achieve the no net increase Project objective.

The Hydrogen Plant Replacement includes construction of a new dedicated emergency flare[20] to ensure there would be no impact on the Facility's existing relief system during hydrogen plant start-up, shutdown, emergencies, upsets, or breakdowns. The existing South Isomax flare, to which the existing hydrogen plant is connected, would remain, though its utilization would be reduced once the existing hydrogen plant is disconnected.

3.3.1.3 Construction

As described above, construction of the Hydrogen Plant Replacement commenced following approval of the 2008 Project and halted when the Contra Costa Superior Court issued an injunction in 2009. Consequently, the Hydrogen Plant Replacement is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place. Most of the required footings and foundations are also installed. The Hydrogen Plant Replacement flare and the majority of ancillary equipment (piping, instrumentation, motor controls, and electrical wiring) still need to be installed.

3.3.2 Sulfur Removal Improvements.

As explained in greater detail in *Section 4.0.3.1 of Section 4.0, Introduction to Chapter and Methodology*, sulfur is a naturally occurring constituent of crude

[20] Flares are used to combust gas in excess of what can be managed by the Facility's flare gas recovery compressors, treatment systems, and/or fuel gas system. *Section 4.0.3.3.3.3* provides a further description of the Facility's flaring system.

and gas oils that must be removed in order to produce certain end products. When removed from crude and gas oils and returned to its elemental form, sulfur can be sold for various agricultural and industrial uses. In addition to the existing Facility's limited availability of hydrogen for sulfur removal, explained above, the Facility's current ability to process sulfur contained in feedstocks is constrained in two primary ways. First, for gas oils, the current capacity of the FCC FHT limits the Facility's flexibility to process gas oil and gas oil blends with higher sulfur content. Second, the Facility's overall capacity to remove sulfur in feedstocks (both crude and gas oils) is constrained by the capacity of the sulfur recovery units. As described in this section, the Modernization Project would increase the permitted capacity of the FCC FHT from 65,000 to 80,000 barrels per day of gas oil, and the capacity of the sulfur recovery units from 600 to 900 long tons per day.

3.3.2.1 Fluid Catalytic Cracker Feed Hydrotreater

The FCC FHT is a key component in the refining "treatment" process, in which crude oils and gas oils are treated to remove non-hydrocarbons like sulfur, metals, and nitrogen, as described in more detail in *Section 4.0.3.3.1 of Section 4.0, Introduction to Chapter and Methodology* and *Appendix 3, Overview of Oil Refining Process*. The FCC FHT uses hydrogen to treat gas oil, and is labeled FCC FHT because the gas oil it treats is primarily fed into the next unit in the process, called the fluid catalytic cracker unit. The FCC FHT currently treats both gas oil from the Facility's crude unit (internally produced gas oil), and gas oil that is purchased from other refineries (externally sourced gas oil). Some gas oil processed at the Facility is already low-sulfur (sometimes called "sweet" as explained in *Appendix 3, Overview of Oil Refining Process*) and does not need treatment for sulfur removal. This sweet gas oil is fed directly to the downstream fluid catalytic cracker unit without being treated by and fed from the FCC FHT.

Currently, and after the Modernization Project, approximately 92% of the gas oil that is fed into the FCC FHT is sent on to the fluid catalytic cracker for additional cracking (see *Appendix 3, Overview of Oil Refining Process*). The Modernization Project would increase the physical and permitted capacity of the FCC FHT from 65,000 to 80,000 barrels per day, which would enable the Facility to import and process higher sulfur crude oil and gas oil, as well as crude and gas oil blends with higher-sulfur concentrations. To allow the FCC FHT to process additional amounts of medium-sulfur and higher-sulfur gas oil, there would be a corresponding decrease in imported low-sulfur gas oil being fed to the fluid catalytic cracker. However, there would be no increase in capacity of the downstream fluid catalytic cracker itself, which would retain its current permitted annual limit of 80,000 barrels per day on a calendar basis.

The capacity of the FCC FHT would be increased by replacing or modifying pumps to push higher volumes through the unit, and adding, replacing, or modifying some heat exchangers. Such improvements would capture more waste heat to maintain temperatures without increasing furnace firing rates, while still recovering the additional heat generated by the FCC FHT's post-Project higher throughput. Internal components (trays) in a distillation column at the FCC FHT would also be modified to maintain the column's current separation efficiency at higher throughput and approximately 17,500 linear-feet of additional process and utilities piping would also be added at the FCC FHT to tie the new components to existing components. The pipe fitting counts associated with this piping and used as the basis for the fugitive emissions estimate in the BAAQMD permit for the FCC FHT are as follows: 15 pump seals, 3,633 valves, 35 pressure relief valves, 809 connectors, 1,792 flanges, and 2 process drains. The fitting counts reported to BAAQMD include hydrocarbon process fittings only (not utilities). Note that these counts are estimates and, per the BAAQMD permit conditions, are subject to reconciliation and finalization after construction of the Modernization Project (see Table 3-1).

As part of the FCC FHT process, about 7% to 8% of the gas oil fed into the FCC FHT is "cracked" by the FCC FHT itself and therefore is not sent to the fluid catalytic cracker for further cracking. Instead, it is separated and sent to other parts of the Facility to be further treated and blended into gasoline, diesel, and other products. This diversion of approximately 8% of the extra 15,000 barrel capacity of the FCC FHT which would occur as a result of the Modernization Project equates to approximately 1,200 extra barrels of gas oil processing capacity at the Facility, i.e., processing capacity not currently captured by the 80,000 barrels per day annual limit of the fluid catalytic cracker. If the Facility were to actually operate at full capacity as assumed under the 100% Utilization Scenario, the Modernization Project would result in a slight increase of less than 0.4% of the Facility's total capacity to process gas oils and crude oils.

3.3.2.2 Amine Absorber and Amine Regenerator

The FCC FHT, as well as other hydrotreaters described further in *Section 4.0.3.3.1 of Section 4.0, Introduction to Chapter and Methodology,* removes sulfur from the various hydrocarbon streams and bonds it with hydrogen to form H_2S gas. At the Facility, the H_2S gas created during the treatment process is routed to an “amine absorber,” which contains a solvent, diethanolamine, designed to absorb the H_2S molecules, effectively separating them from the hydrogen and hydrocarbon in the gas stream. From the amine absorber, a liquid consisting of a mixture of H_2S and diethanolamine is sent to an “amine regenerator,” where the H_2S and the diethanolamine are separated. The

diethanolamine is reused in the process and the H_2S is sent for sulfur recovery (described below).

In order to process additional sulfur in the feedstock, the Modernization Project proposes to install one additional amine absorber unit at the FCC FHT and one additional amine regenerator ("No. 6 H_2S Plant"). The new amine absorber and related equipment would be constructed on the FCC FHT's "recycle hydrogen stream," which contains the Facility's greatest concentration of removable sulfur. The new amine regenerator would be located adjacent to the sulfur recovery units. Neither the amine absorber nor the amine regenerator create or refine hydrocarbons, but instead are the next steps in the sulfur handling process once the sulfur is converted to H_2S by the FCC FHT.

3.3.2.3 Sulfur Recovery Units

The sulfur recovery units convert H_2S to elemental sulfur, a product sold for various agricultural and industrial uses. The existing sulfur recovery units consist of three parallel process units, or "trains," with a combined sulfur removal capacity of 600 long tons per day. The Facility's capacity to process sulfur in feedstocks is constrained by the capacity of the sulfur recovery units. The Modernization Project would add oxygen enrichment facilities to the sulfur recovery units—described in Table 3-1—that would enable the combined sulfur recovery capacity to be increased to 900 long tons per day.

The primary features of the modifications are the addition of oxygen storage tanks, and modifications to burners to handle the oxygen-enriched combustion air. These modifications would allow for higher levels of oxygen in the air feeding into the sulfur recovery units, which would allow the sulfur recovery units to process more H_2S than current levels, without increasing the physical size of the sulfur recovery unit trains. As provided in Table 3-1, the Modernization Project would also include numerous improvements that would offset or reduce emission increases related to the increase in the sulfur recovery units' overall capacity.

3.3.2.4 Sulfur Loading

The Facility stores elemental sulfur produced at the sulfur recovery units in existing sulfur storage tanks. The liquid sulfur is pumped from the storage tanks to a tank truck loading rack. Chevron is seeking a separate permit from the BAAQMD to replace-in-kind the Facility's liquid sulfur truck loading rack and related equipment. As part of this Project, Chevron is seeking to amend its permit to allow for truck loading of the additional elemental sulfur related to the increased capacity of the sulfur recovery units. The rack would have a canopy with the capability to load two trucks simultaneously. The installation would

include two new sulfur loading pumps, a new vent system with a water scrubber, caustic scrubber, circulation pumps, vent blower, and piping. New storage tanks for fresh and spent caustic would also be installed.

3.3.2.5 Construction

Following the City's approval of the 2008 Project, construction of the Sulfur Removal Improvements was initiated. Construction halted when the 2008 Project approvals were overturned by the California Court of Appeal. Consequently, the construction at the sulfur recovery units is approximately 10% complete. Minor structural steel supports for pipe racks and the vendor-supplied liquid oxygen storage tank and vaporizer have been set in place, but these units are not in operation. The new amine absorber vessel is on-site but has not been set in place. Approximately 50% of the piping for the unit at the FCC FHT has been installed, but modification of the pumps, heat exchangers, and distillation column trays at the FCC FHT has not commenced. For the sulfur truck loading rack, steel has been procured and is on-site, but construction has not begun.

3.3.3 Emission Reduction Project Components and Project Design Features

This section describes the Emission Reduction Project Components and Project Design Features that would reduce overall Project emissions. The emission reductions achieved by these components and features, are further described in *Section 4.3, Air Quality*, and *Section 4.8, Greenhouse Gases*. Any Project Design Feature proposed to reduce an environmental impact is also required to be implemented as a mitigation measure.

3.3.3.1 Overview of the Emission Reduction Components

Several components of the Modernization Project are designed to reduce air emissions from the affected units. Various Hydrogen Plant Replacement components are a large contributor to these reductions. In addition to the energy efficiencies described above, which effectively reduce greenhouse gas emissions, the Hydrogen Plant Replacement's reforming furnaces are equipped with emission control devices including low-NO_x burners and selective catalytic reduction units which reduce nitrous oxides and carbon monoxide (CO) emissions. Additionally, refinery process gas would be collected, treated with a zinc oxide scrubber, and routed as feedstock to the Hydrogen Plant Replacement resulting in a significant reduction in SO_2 emissions from the Facility. Other components of the Hydrogen Plant Replacement such as a steam turbine generator and the upgrading of the Facility's hydrogen compressors would reduce external electricity demand, and the associated greenhouse gas emissions, for these units.

Modifications at the sulfur recovery units would also help to offset emissions. The Modernization Project encompasses upgrades that include low-NO_x burners, flue gas recirculation, and other furnace improvements to help reduce nitrous oxides and CO emissions. To reduce particulate matter emissions, the sulfur recovery units would have new wet electrostatic precipitators installed on each unit. These emission reduction devices would also considerably reduce sulfuric acid mist, which is a TAC. As part of the sulfur removal project, heat exchangers and other equipment used to transfer heat energy at the FCC FHT would be modified and a power recovery turbine would be installed to generate power to operate plant equipment and avoid additional greenhouse gas emissions. Additional detail on these Emission Reduction Project Components is below.

3.3.3.2 Hydrogen Plant Replacement-Related Emission Reduction Components

The Modernization Project would include the replacement of the Facility's existing hydrogen production plant. As described in *Section 3.3.1*, the Hydrogen Plant Replacement would be equipped with newer technology, including pressure swing adsorption that is more fuel efficient. This increased fuel efficiency would result in reduced fuel usage per hydrogen product, and subsequently less NO_x, CO, PM_{10}, and VOC emissions compared to the existing plant. Additionally, three existing hydrogen plant furnaces would be replaced by two new furnaces. Currently, only one of the three existing furnaces is equipped with selective catalytic reduction emission controls, which reduces NO_x by converting NO_x to nitrogen and water. Both replacement furnaces would meet BAAQMD best available control technology requirements and be equipped with selective catalytic reduction units and low-NO_x emitting burners, which control the fuel and air mixture in the furnace to reduce NO_x formation.

As part of the Hydrogen Plant Replacement, the Project would install a steam turbine generator that creates electricity when higher pressure steam is reduced to lower pressure steam. This steam turbine generator has the potential to offset the entire electricity demand of the Hydrogen Plant Replacement, or even provide additional electricity for use in other parts of the Facility. Furthermore, the production of steam by the Hydrogen Plant Replacement can also be used by other parts of the Facility, reducing the amount of energy needed to create steam in one of the other Facility utility operations. This component would result in electricity savings and corresponding reductions of greenhouse gas emissions.

With a purer hydrogen gas stream from the Hydrogen Plant Replacement, the existing hydrogen compressors would be updated to process the purer hydrogen gas stream. Moreover, a lower volume of hydrogen gas would be needed to deliver an equivalent amount of hydrogen compared to the baseline period. This reduction would result in a reduced demand for electricity for the Facility steam

system per equivalent amount of hydrogen. The efficiencies realized from these upgrades and changes would result in a reduction of greenhouse gas emissions.

3.3.3.3 Sulfur Removal Improvements-Related Emission Reduction Components

The Modernization Project would include new low-NOx burners equipped with fuel induced recirculation as well as other miscellaneous changes in the sulfur recovery unit stack heaters that would improve the mixing and combustion efficiency of the units, as well as recirculate a portion of the exhaust gas into the incoming fuel, thereby allowing these components to meet best available control technology and reducing NO_x, CO, and VOC emissions. Furthermore, the existing thermal oxidizers at the sulfur recovery units would have a higher minimum operating temperature, resulting in a greater reduction in CO and VOC emissions. Higher operating temperatures will result in an increase in NO_x emissions, which will still be more than offset by the low-NO_x burners being installed; both of these effects were taken into account in the 2008 BAAQMD engineering evaluation when an overall SRU stack NO_x concentration limit was determined. These changes were accounted as part of the Project's future emissions in the Draft EIR.

The Modernization Project would also include the installation of wet electrostatic precipitators, which use electric charges to remove small droplets and particulates from an exhaust stream, on each of the existing sulfur recovery units. These abatement devices meet best available control technology requirements and reduce emissions of PM_{10}.

As a part of the Modernization Project, heat exchangers and other equipment used to transfer heat energy at the FCC FHT would be modified to improve energy efficiency, allowing for additional throughput without additional heat input at furnaces or NO_x, CO, SO_2, PM_{10}, or VOC emissions.

Finally, as part of the Sulfur Removal Improvements, a power recovery turbine for the portion of the system located in the FCC FHT would be installed. This turbine would utilize the changes in operating pressures within the unit to produce electricity for use within the operating unit, resulting in electricity savings and reduced greenhouse gas emissions.

3.3.3.4 Other Facility Equipment Emission Reduction Components

The Modernization Project would include the installation of low-NO_x burners on five furnaces, three in the hydrocracker unit (called the Taylor Katalytic DeNitrification Isomax) and two in the poly plant unit. The new burners would reduce NO_x emissions. In addition, the Modernization Project would involve the

collection of most of the refinery process gas (a pre-cursor to fuel gas) for use as feed to the hydrogen plant. The collected process gas stream would be passed through a zinc oxide scrubber (prior to use as feed in the new hydrogen plant) to further reduce sulfur to less than 100 parts per billion. Currently, the refinery process gas streams undergo sulfur removal at the existing H_2S plants (amine contactors) prior to being combined with natural gas to form fuel gas for use Facility process heaters. Additional imported natural gas, already low in sulfur, would be used to supplement the remaining refinery fuel gas streams used by the Facility's process heaters. This additional treatment of the refinery fuel gas stream would result in reduced SO_2 emissions.

3.3.3.5 Project Design Features that Reduce Emissions

The Modernization Project incorporates various Project Design Features that would result in reductions of emissions in support of the no net increase Project objective. These Project Design Features include a storage tank dome reducing volatile organic compound emissions, lighting fixture upgrades reducing greenhouse gas emissions, ship engine replacements reducing nitrogen oxide and diesel particulate matter emissions, water reuse projects reducing water consumption and discharge and reducing greenhouse gas emissions, fluid catalytic cracker cooling water tower motor upgrade reducing greenhouse gas emissions, marine engine upgrades reducing nitrogen oxides and diesel particulate matter emissions, funding for community greenhouse gas reduction measures, and participation in the Marin Clean Energy program reducing greenhouse gas emissions. Project Design Features that reduce environmental impacts are required to be implemented as Mitigation Measures.

3.3.3.5.1 *Storage Tank Dome*

The Facility has 70 organic liquid storage tanks that are fitted with external “floating roofs.” These roofs rest on the liquid surface and “float” up and down within the tank’s shell, or wall, as the level of organic liquid increases or decreases. Floating roofs are equipped with primary and secondary sealing systems on their outer circumference to minimize the gap between the edge of the roof and the tank shell. The sealing system is designed to minimize the amount of VOC emissions that escape to the atmosphere from the area between the tank wall and the outside edge of the external floating roof structure.

The Modernization Project would include the installation of a spherical, geodesic dome enclosure on tank T-1491 as a Project Design Feature. The dome would be self-supporting and constructed using aluminum framing, aluminum panels, and clear acrylic skylight panels to form a geodesic dome shaped covering on top of the tank. The dome would be of bolted construction and freely vented by circulation vents at the top of the roof. The selected tank is subject to and

compliant with BAAQMD Regulation 8, Rule 5 and was selected primarily by the vapor pressure of its liquid contents (tank emissions are a strong function of vapor pressure). The installation of a dome on an external floating roof tank reduces air emissions primarily by eliminating the effect of wind on the sealing system located inside the tank shell, not by acting as a vapor barrier.

3.3.3.5.2 *Energy-Reducing LED Lighting Retrofits*

Chevron plans to upgrade approximately 6,000 lighting fixtures in the Facility's Refinery Process Area with LED lighting. Upon completion, this Project Design Feature would reduce energy consumption, resulting in a corresponding reduction of greenhouse gas emissions.

The 6,000 lighting fixtures are located in and throughout the Refinery Process Area, which currently uses a mix of 70 watt (W)/100W high pressure sodium, 400W metal hydride, and 60-200W incandescent light fixtures. These existing lights would be replaced with an equivalent number of dark-sky compliant LED lights, which would emit a “cool white” colored light.

3.3.3.6 Water Conservation and Reuse

The Project Design Features include implementation of two Facility water reuse projects that were identified to reduce East Bay Municipal Utility District water consumption and wastewater discharge.

First, the Modernization Project would implement the reuse of stripped sour water[21] from the sour water concentrator at the existing sulfur recovery unit to supply storage vessel D-852 for use in the distillation and reforming area wash water system. This would displace the current use of boiler feed water in the distillation and reforming area wash water system. This requires two larger electric pumps at the sulfur recovery unit sour water concentrator and/or piping modifications at the distillation and reforming area wash water system.[22]

Second, the Modernization Project would implement the reuse of stripped sour water from sour water stripping plants (8 and 18 Plants) to supply storage vessel V-891 for use in the South Isomax process water system. This would displace the use of cold pump condensate in the South Isomax process water system. This requires installation of a heat exchanger at 8 Plant to cool the temperature of the

[21] Sour water is water in which ammonia and sulfur-bearing compounds are dissolved.

[22] The sulfur recovery unit sour water concentrator uses steam to remove H_2S and ammonia from sour water. Stripped sour water is a product of the sulfur recovery unit sour water concentrator. Boiler feed water is tertiary or fresh water that has been further treated to be suitable for use as feed in boilers to produce steam. D-852 is a storage vessel for water to supply water throughout the distillation and reforming area.

stripped sour water closer to the operating temperature of cold pump condensate.[23]

In addition to resulting in reductions in water consumption and wastewater discharge, these two water reuse projects would result in an electricity savings (from reduced water supply, treatment, distribution, and wastewater treatment), in turn resulting in reductions of greenhouse gas emissions. This water reuse Project Design Feature involves Facility operational activities that are further explained in *Appendix 3, Overview of Oil Refining Process*. Project Design Features that reduce environmental impacts are required to be implemented as mitigation measures.

3.3.3.7 Fluid Catalytic Cracker Cooling Water Tower Motor Upgrade

Chevron would upgrade the motors which drive the 14 cooling fans in the fluid catalytic cracker cooling water tower to adjustable speed direct drive cooling tower motors. In the existing configuration, all fans are driven by single speed (the motor is either on or off) induction motors through right angle gearboxes. Since the cooling water tower typically operates at a fraction of its design capacity, electricity can be saved by using adjustable speed motors. The use of direct drive systems also improves energy efficiency by eliminating the losses in the mechanical translation of energy in the existing right angle gearbox assemblies. This Project Design Feature is estimated to reduce electricity consumption by 3,400 megawatt hours per year (MWh/yr).

3.3.3.8 Marine Engine Upgrades

As a Project Design Feature, the Modernization Project would remove three Suezmax[24] vessels from West Coast service in 2014 and replace them with two newly built Suezmax ships. Chevron would outfit the new Chevron Suezmax ships with low-emission engine technologies that would reduce emissions below applicable emission control laws for ships built in 2014. Under current regulations, the replacement of the Suezmax ships requires installation of main ship and auxiliary ship engines with a level of emission control called "Tier 2" under the International Maritime Organization (IMO)[25] requirements for new engines that have been adopted by U.S. Environmental Protection Agency (EPA).

[23] V-891 is a storage vessel for water that supplies wash water throughout the South Isomax area. Cold pump condensate is steam that has been condensed to liquid water and further cooled.

[24] Suezmax – the term for an ocean-going tanker ship carrying from 120,000 to 200,000 tons and able to pass through the Suez Canal

[25] From the IMO, Revised MARPOL Annex VI. October, 2008. The Tier 2 MARPOL Annex IV emission standard (applicable to new engines from 2012 to 2015) requirement

By implementing this Project Design Feature, Chevron would install technologies that would lower emissions further than what is required for ships built in 2014 as follows: (1) the main ship diesel engines would be upgraded to meet the IMO Tier 3[26] standard (versus the required less-stringent Tier 2 standard), which would reduce nitrogen oxides emissions from the main ship engine beyond those required by regulation; and (2) auxiliary engines would be upgraded with turbogenerators to meet requirements more stringent than IMO Tier 3 standard, which would eliminate diesel particulate matter emissions (a TAC emission) and reduce nitrogen oxides emissions. Each of these two engine upgrade measures are described in greater detail in *Section 4.3, Air Quality*.

3.3.3.9 Marin Clean Energy Participation

Chevron would participate in Marin Clean Energy for Chevron facilities located or co-located at the Facility. Marin Clean Energy is a community choice aggregator under California law that provides lower-carbon dioxide source electricity to area residents and business within their service area. Marin Clean Energy delivers power via Pacific Gas and Electric Company (PG&E), which continues to maintain the power transmission and distribution infrastructure, deliver electricity, and handle billing. The electricity that Marin Clean Energy customers receive is deemed 50% to 100% renewable energy. By offering a much higher percentage of renewable energy than is available from PG&E, Marin Clean Energy lowers customers' greenhouse gas emissions associated with electricity generation.

Chevron's participation in Marin Clean Energy would be inclusive of its commercial accounts at the City, and may include its industrial accounts to the extent Marin Clean Energy can reasonably accommodate the variations in the Facility's energy consumption/generation operating scenarios. Commercial accounts provide approximately 300 MWh/yr of electricity to Chevron facilities. Industrial accounts provide approximately 60,000 MWh/yr of electrical energy to Chevron facilities. Implementation of this Project Design Feature would reduce greenhouse gas emissions as discussed in *Section 4.8, Greenhouse Gases*.

3.3.3.10 Community Greenhouse Gas Reduction Programs

As a Project Design Feature, Chevron would provide funding in the amount of $30 million ($3 million annually for 10 years) to help support community greenhouse gas reduction measures in the City and North Richmond. Greenhouse gas reduction measures supported under this Project Design Feature

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for a main diesel engine is 14.4 grams NOx per kilowatt-hour for engines less than 130 revolutions per minute.

[26] The Tier 3 MARPOL Annex VI emission standard (applicable to new engines in IMO defined emission control areas from 2016 on) requirement for a main diesel engine is 3.4 grams NOx per kilowatt-hour for engines less than 130 revolutions per minute.

may include, but are not limited to, those noted below and discussed in greater detail in *Section 4.8, Greenhouse Gases*.

- **Urban Forestry** – Enhance tree planting programs on private property, City parks, and City streets. Environmental program benefits include improved air quality and prevention of heat island effects. Greenhouse gas emissions are reduced through sequestering carbon dioxide and decreased building energy use due to shading effects.
- **Zero Waste Programs** – The City has an opportunity to increase the waste diversion percentage from its current 52% to 75% by 2020. This could be achieved by implementing cost effective programs such as free recycling bins to businesses and residents, and providing technical assistance and outreach services to facilitate recycling and composting. Benefits include local job creation and enhanced environmental sustainability.
- **Residential Energy Efficiency Rebate** – Provide home weatherization services and other home performance energy efficiency rebates to incentivize homeowners to improve the energy efficiency on their homes by the State's goal of 40%. Benefits include creating community wealth and resilience through less spending on utilities, local job creation, improved public health, and enhanced environmental sustainability.
- **Commercial Energy Efficiency Rebate** – Provide energy efficiency rebates to Richmond businesses to incentivize energy efficiency upgrades. The rebates would be structured to increase proportionally with greater energy reductions. Benefits include local job creation and decreased dependence on non-renewable sources of energy.
- **Residential Solar Rebate** – Provide solar rebates to incentivize homeowners to install photovoltaic panels on rooftops. Residents may leverage rebates from the State and the Marin Clean Energy program to make solar more cost competitive. Benefits include local job creation and decreased dependence on non-renewable sources of energy.
- **Commercial Solar Rebate** – Provide additional solar rebates to incentivize Richmond businesses to install photovoltaic panels. The rebates would be structured to increase proportionally with greater photovoltaic installation. Benefits include local job creation and decreased dependence on non-renewable sources of energy.
- **Pedestrian and Bicycle Master Plan Implementation** – Implement bicycle and pedestrian improvements identified in the Pedestrian and Bicycle Master Plans to encourage transportation via bicycle or walking rather than by car. Special attention would be made to focus these improvements in Priority Development Areas, areas expected to accommodate growth, near public

transit. Benefits include improved public health through physical activity, contribution to community wealth and resilience through less spending on vehicle fuel, improved public health through fewer vehicle emissions, and decreased dependence on non-renewable sources of energy.

- **Electric Vehicles** – Encourage the purchasing of electric vehicles by providing rebates to residents and businesses that install electric vehicles charging stations and/or provide direct rebates for the purchase of electric vehicles. Benefits include contribution to community wealth and resilience through less spending on vehicle fuel, improved community health through fewer vehicle emissions, and decreased dependence on non-renewable sources of energy.
- **Ride Share/Green Transportation** – Encourage the availability of low-greenhouse gas transportation alternatives, such as car-share and shuttle services, and transit service optimization, including improved transit stops and routing. Benefits include contribution to community wealth and resilience through less spending on vehicle fuel, improved community health through fewer vehicle emissions, and decreased dependence on non-renewable sources of energy.
- **Bicycle Program** – Provide access to reduced or no cost bicycle transportation. Benefits include improved public health through physical activity, contribution to community wealth and resilience through less spending on vehicle fuel, improved public health through fewer vehicle emissions, and decreased dependence on non-renewable sources of energy.
- **Transit Access** – Encourage participation in reduced cost, group purchased, and monthly public transportation access (e.g., reduced cost Clipper Card). Benefits include contribution to community wealth and resilience through less spending on vehicle fuel, improved community health through fewer vehicle emissions, and decreased dependence on non-renewable sources of energy.
- **Wetlands Creation** – Purchase and restoration of tidal wetlands in Richmond. Benefits include creation of habitats for plant and animal species, stormwater runoff mitigation, erosion control, and improved aesthetics.
- **Construction of utility-scale solar production facility or facilities**. The only facility currently proposed is a 2-megawatt (MW) facility that would be developed by Chevron on the Project site. This facility does not warrant full funding based on the proposed criteria for prioritizing funding on community greenhouse gas reduction programs, but some "gap" funding may be eligible for consideration. Like other measures, this is described in *Section 4.8, Greenhouse Gases*.

As a result of Chevron funding the selected community greenhouse gas reduction measures, a reduction in greenhouse gases would be realized. The estimated greenhouse gas emission measures and potential environmental effects are analyzed in *Section 4.8, Greenhouse Gases*.

3.3.3.11 Cap and Trade Allowances

Finally, the Project Design Features include securing an amount of cap-and-trade greenhouse gas allowances sufficient to fully offset any remaining greenhouse gas emissions increases from the Modernization Project, after accounting for reductions associated with all of the above described greenhouse reduction efforts. The California Air Resources Board's cap-and-trade program, and how it would be used for purposes of this EIR, is discussed in greater detail in *Section 4.8, Greenhouse Gases*.

3.3.4 Modernization Project Components and Project Design Features to Improve Facility Safety and Reliability

The Modernization Project proposes various components that are designed to enhance the Facility's overall safety and reliability. In general, all new construction at the Facility would meet all applicable Building and Fire Code standards, and comply with other applicable standards and requirements, including compliance with the seismic standards of the California Building Code. The following is a summary of the various project components that were designed to incorporate elements that enhance process safety and reliability. In addition, one Project Design Feature would further enhance process safety and equipment reliability, as described below.

3.3.4.1 Modernization Project Components that Enhance Facility Reliability and Safety

3.3.4.1.1 *New H_2S Absorber*

The Modernization Project includes the installation of a new H_2S absorber on the recycled hydrogen gas stream of the Facility's FCC FHT process unit (H_2S absorber referred to in Table 3-1 as Recycle Hydrogen Amine Contactor). The absorber uses a solvent (or amine solution) which, when it comes in contact with the gas stream, removes the H_2S from the gas. The removal of H_2S from this gas stream provides reliability improvements by eliminating a potential source of corrosion in the system.

3.3.4.1.2 *New Amine Regenerator (#6 H_2S Plant)*

To complement the additional H_2S absorber described above, the Modernization Project would also include the installation of a new amine regenerator which separates the H_2S from the amine solution. The Modernization Project would

implement an inherently safer design for these new components by locating the regenerating process near the sulfur removal units and not at the FCC FHT near the H_2S absorber, thereby limiting the length of the piping circuit that contains H_2S gas. Instead, the longer piping circuit between the FCC FHT and the sulfur removal units would contain a solvent/ H_2S liquid, or "rich amine solution." The potential impact of a loss of containment of rich amine solution, rather than H_2S gas, is significantly lower because the dispersion of the liquid is slower and more easily contained than the gas.

3.3.4.1.3 *New Emergency H_2S Scrubber*

The Modernization Project would include the installation of a new emergency scrubber, in addition to an existing scrubber, within the Facility's sulfur removal system. The new scrubber would be used in non-routine operating scenarios to safely absorb and process H_2S gas in the event it cannot be recovered by the sulfur removal units. The emergency scrubber offers an added layer of protection to the sulfur removal system by providing additional time for the Facility to shutdown/slowdown process units or divert H_2S gas.

3.3.4.1.4 *Replacement Hydrogen Recovery Plant*

The Hydrogen Plant Replacement design would incorporate modern pressure swing adsorption vessel technology that increases the reliability of the units by reducing the risk for pressure swing adsorption vessel fatigue. Moreover, the Hydrogen Plant Replacement's new pressure swing adsorption technology would eliminate the unit's use of MEA and arsenic, two toxic substances. Furthermore, individual units within the hydrogen manufacturing process, such as the reforming furnaces and their associated internals, would be replaced in their entirety. These completely new units would enhance Facility reliability and maintenance efforts by minimizing the risk of failure potentially associated with the older units they are replacing.

3.3.4.1.5 *Hydrogen Plant Replacement Flare and Cooling Water Tower*

The Hydrogen Plant Replacement would be served by independent flare and cooling water tower systems. The subsequent decommissioning of the existing hydrogen manufacturing plant would result in the elimination of a user of the existing cooling water tower and Facility flare gas system located in that processing area. This change would reduce the operational load on both of these systems and ensure that the Hydrogen Plant Replacement would not be impacted by potential operational changes within the existing cooling water or flare systems.

3.3.4.1.6 *Hydrogen Compressor Upgrades*

The Modernization Project would upgrade the Facility's main hydrogen booster compressors in order to handle a higher purity hydrogen gas stream. As part of this upgrade, the structures supporting these compressors would be retrofitted to reduce vibration. Future reliability of this equipment would be improved as a result of the decreased vibration, or stress, on the equipment.

3.3.4.1.7 *Ammonia as a Feedstock for Hydrogen Production*

The Facility produces ammonia as part of the refining process. Currently the ammonia is collected and used in the Facility's air emissions control devices, known as selective catalytic reduction units, or sold as a refinery product. As a result of the Modernization Project, the net number of Facility selective catalytic reduction units would increase by one and the new hydrogen production plant would include added flexibility to use ammonia, along with refinery process gas and import natural gas, as part of its feedstock. The additional selective catalytic reduction and feedstock flexibility would provide additional uses for refinery generated ammonia, thereby decreasing the amount of ammonia being sent off site via railcar as product.

3.3.4.2 Project Design Feature that Enhances Facility Reliability

The Project Design Features include implementation of a new Modernization Reliability Program designed to further enhance safety and reliability of Facility equipment and Refinery Operations. The Modernization Reliability Program commits Chevron to replacing numerous piping circuits, installing additional monitoring devices on certain carbon steel piping circuits, implementing new inspection, sampling, and monitoring regimes, and a system of verifying post-Project operating conditions when the sulfur content of crude oil being processed at the Facility reach specified levels. The Modernization Reliability Program also requires that process hazard assessments be conducted or revalidated prior to construction and again after construction prior to commencement of Project operations, and that these process hazard analyses include inherently safety systems analysis, layers of protection analysis, and damage mechanism evaluations. The Modernization Reliability Program requires Chevron to convene annual town hall meetings to brief the community on safety improvements, and requires Chevron to submit annual reports to the City on the status and progress of Reliability Program requirements. The Modernization Reliability Program is included in *Section 4.13, Public Safety*, and *Appendix 4.13-PROG*.

3.4 CONSTRUCTION, DECOMMISSIONING, AND DISMANTLING

This section discusses the Facility construction, decommissioning (ceasing operations) and dismantling activities associated with the Modernization Project, along with related topics including site preparation, construction labor force, materials, and services. Construction activity is anticipated to begin in January 2016 and last for 2 years. The construction duration (planned period required for construction) and construction sequence (order in which different components of the Modernization Project would be constructed and/or demolished) are shown in Table 3-2.

3.4.1 Site Preparation

The locations of the various project components are depicted on Figure 3-1. Some existing equipment (e.g., pipe supports; underground obstructions) has already been dismantled and/or removed. A small quantity of additional equipment (e.g., piping) would be removed when the Modernization Project resumes construction, including piping, valves, flanges, pipe supports, electrical conduit, wiring, pumps, and foundations that are currently located in areas where Modernization Project components would be constructed and installed. Cranes, manlifts, forklifts, and medium and light duty flatbed trucks would be used to facilitate equipment removal. Equipment dismantling and removal and disposal of wastes from various construction activities (e.g., asbestos-containing insulation, lead-containing blasting grit from paint removal, containers from paint applied at new/modified units) have been, and would be, conducted in accordance with well-established Facility procedures and all applicable regulatory requirements.

Based on preliminary civil engineering studies prepared for the 2008 EIR, Chevron conservatively estimates that, under a "worst-case" scenario, up to 500 tons of potentially hazardous soil still needs to be excavated in and around the Hydrogen Plant Replacement and Sulfur Removal Improvement sites prior to and during construction of the remaining elements of the Modernization Project. Any soil excavated at the Hydrogen Plant Replacement site for foundations, footings, or similar purposes, however, would occur in clean soils. During construction of the 2008 Project, the location of the Hydrogen Plant Replacement was excavated to a depth of approximately 6 feet, which was then refilled with clean soil.

TABLE 3-2 MODERNIZATION PROJECT CONSTRUCTION SCHEDULE

Major Modernization Project Components	Construction Duration[a]	Construction Sequence
Hydrogen Plant Replacement	15 months	Foundations; mechanical equipment; piping supports; piping; electrical equipment and instrumentation; painting and insulation.
Sulfur Removal Improvements	24 months	Foundations; mechanical equipment; piping supports; piping; electrical equipment and instrumentation; painting and insulation.
Hydrogen Tie-Ins	9 months	Foundations; pipe racks; piping supports; piping.
Other Emission Reduction Project Components: ▪ FCC FHT heat exchangers ▪ FCC FHT motor upgrades ▪ FCC FHT power recovery turbine ▪ Low NOX burners on 3 furnaces in hydrocracker unit and 2 furnaces in poly plant ▪ Facility fuel gas collection and treatment	All construction to be completed within 24 months.	N/A
▪ Project Design Features1 Storage Tank Dome ▪ Water Reuse Projects ▪ LED Lighting ▪ Marine Engine Upgrades ▪ Community Greenhouse Gas Reduction Programs – Menu of Measures ▪ Fluid catalytic cracker cooling tower upgrades	All construction to be completed prior to operation of Hydrogen Plant Replacement.	Water Reuse: Install piping modifications. Tank Dome: Install dome frame and panels.
Dismantling the Existing Hydrogen Plant	24 months	Remove insulation; remove electrical equipment; remove piping and piping supports; remove mechanical equipment; structural supports.

[a] All project component construction can start simultaneously at the start of construction with the exception of dismantling the existing hydrogen plant which would occur no earlier than after the Hydrogen Plant Replacement is fully operational.

As of issuance of the Writ, the 2008 Project had been under construction for approximately 15 months (3Q08 through 3Q09). Activity in 3Q08 consisted of mobilization and site preparation and activity in 3Q09 consisted only of demobilization.

Source: Chevron Data Transmittal #20, 2013.

When construction resumes and soil is excavated, it would be stockpiled and reused if it does not contain hydrocarbons above approved limits. If it is contaminated and cannot be reused, it would be shipped off-site for disposal. Soil excavation is required primarily for equipment (e.g., pumps) foundations and pipe racks. Backhoes, graders, and excavators, would be used for soil excavation. Dump trucks would be used to transport excavated soil. Approximately 157,000 tons of clean engineered fill have already been imported, and then compacted and engineered, for grading and geotechnical purposes at various Modernization Project component sites, primarily at the Hydrogen Plant Replacement site. Graders, rollers, and compactors were used to place and compact the imported soil at the sites (Chevron Data Transmittal #36B, 2012).

Soil needs to be excavated for installation of structural support footings, equipment foundations, and to ensure level grade for any required paving. Any excavated soil would be tested for hydrocarbons and managed in conformance with the Facility's Regional Water Quality Control Board (RWQCB)-approved Soil Management Program for handling and disposition. Also as required, excavated soil that is contaminated would be managed in accordance with BAAQMD Regulation 8 (Organic Compounds), Rule 40 (Contaminated Soil). Soil determined to be hazardous was, and would continue to be, transported by licensed haulers to approved off-site hazardous waste disposal facilities. Transportation off-site would be in trucks with end dump trailers equipped with roll-off bins. During transit, hazardous waste soil would be covered to prevent particulate air emissions while the vehicle travels on public roads. Non-hazardous soil would be stockpiled and later reused on-site, or would be sent off-site as a designated waste, as required by regulations.

The Facility would implement BAAQMD guidelines to control fugitive emissions from all construction activities (e.g., watering of exposed soil). Construction activities resulting in the actual or potential disturbance of regulated asbestos-containing material would be conducted in accordance with applicable regulations to ensure worker health and safety.

3.4.2 Construction Labor Force

Over the Modernization Project's construction period, the Facility would require a maximum of:

- Approximately 370 workers per day for Hydrogen Plant Replacement construction.
- Approximately 475 workers per day for Sulfur Removal Improvements construction.
- Approximately 125 workers per day for hydrogen plant tie-ins construction.

- Approximately 14 workers per day for the Water Reuse Project Design Feature.
- Approximately 6 workers per day for the Storage Tank Dome Project Design Feature.
- Approximately 40 workers per day for the Solar Project, if it is implemented.
- Approximately 10 workers per day for dismantling the existing hydrogen plant.

The contractors would employ a skilled workforce that includes a variety of crafts, including cement finishers, ironworkers, pipe fitters, welders, carpenters, boilermakers, electricians, riggers, painters, operators, and general laborers. The entire contractor construction workforce is expected to come from the construction labor pool available in the Bay Area.

3.4.3 Construction Materials and Services

During construction of the Modernization Project, deliveries of materials such as concrete, structural steel, pipe and fittings, mechanical and electrical equipment, insulation, and construction services equipment (e.g., portable toilets) would be required. Materials would be delivered by truck and offloaded at existing equipment laydown, staging, and assembly areas. Cranes and forklifts would be used to transfer equipment from delivery trucks to laydown, staging, and assembly areas.

It is estimated that a maximum of approximately 17 truck deliveries (one-way trips) per day would occur during the peak construction period. Delivery trucks would be a mix of light, medium, and heavy duty. During process unit turnarounds, which may coincide with Modernization Project construction, an additional maximum of 20 truck deliveries (40 one-way trips) per day are possible.

Other construction equipment that would be used include pile drivers to install pile supports for pipe racks, concrete trucks to deliver concrete used for footings and foundations, cranes to lift and place equipment, and a mix of light-, medium-, and heavy-duty trucks to transport equipment and materials from laydown, staging, and assembly areas to specific work locations.

3.4.4 Construction Traffic and Parking

No permanent physical changes or improvements to entrances, roadways, or intersections would be needed to accommodate construction traffic volume. Construction contractors would be required to notify their employees to use the Richmond Parkway or Interstate 580 for arrival at and departure from the Facility

in order to avoid travel through the Richmond community, and to carpool if possible. Modernization Project construction workers would park in the Gate 91 lot located within the Project site boundary and then be bused to Modernization Project and Project Design Feature construction sites. Contractor work schedules would be arranged to avoid the peak traffic periods to the maximum extent possible.

3.4.5 Construction Areas

All construction would take place within the Project site's existing boundaries, with the exception of certain mitigation measures and project features designed to reduce project impacts, including the proposed ship/vessel upgrades, and greenhouse gas reduction measures, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 3.3.3.4*. Three construction staging areas are proposed to be utilized while the Project is under construction. All of the construction areas are located within the Project Site: one is within the Process Area and two are outside of the Process and Tank Farm areas as shown on Figure 3-1.

Equipment that would be used in construction areas includes excavators and backhoes for grading and excavation, cranes, forklifts and utility trucks for movement and placement of equipment, and power generators, welding machines, air compressors, and light stands for use by workers in assembling and installing equipment.

3.4.6 Decommissioning and Dismantling

Although constructing the Modernization Project components would not require demolition of any existing Facility process units, other than as described below, some minor equipment (e.g., piping and foundations) would be dismantled and removed.

After the Hydrogen Plant Replacement is constructed and fully operational, the existing hydrogen plant would be shut down, decommissioned, and dismantled. Cranes, forklifts, and a mix of light-, medium-, and heavy-duty trucks would be used in dismantling the existing hydrogen plant.

Once it is shut down, the existing hydrogen plant would be isolated from other operating units in accordance with energy and material input isolation procedures, known by federal and state standards as "The Control of Hazardous Energy," or "Lockout/Tagout" and defined by federal standard 29 CFR 1910.147 and state standard 8 CCR 3314. All materials would be removed from piping and

equipment and transferred to existing Facility effluent and/or waste handling systems for proper management.

Any hazardous materials removed from piping and equipment would be managed in accordance with all applicable regulatory requirements. As a final step, sections of piping would be cut and removed from the unit in order to create physical "air gaps" that isolate the unit and render it completely unusable.

Dismantling of the existing hydrogen plant would take approximately two years. The work would be executed by an estimated maximum of 10 workers who would use various trucks, cranes, excavators, manlifts, and related tools and equipment. Steel and metal would be recycled, and non-recyclable materials properly disposed of at approved disposal sites. Applicable storm water pollution prevention plan requirements would be implemented during dismantling activities. Excavation work would be minimized to limit dust emissions.

The BAAQMD and the California Division of Occupational Safety and Health would be notified as required and appropriate measures taken to ensure that all applicable regulatory requirements for asbestos abatement are met. In addition, building permits would be obtained as required from the City.

3.5 REQUIRED PERMITS AND APPROVALS[27]

3.5.1 City of Richmond

Implementation of the Modernization Project would require certain approvals by the City. As discussed above, in 2010, the California Court of Appeal issued a decision invalidating the EIR, and in 2011 the Contra Costa Superior Court issued a Writ that ordered the 2008 EIR and the City approvals be vacated until the City prepares a revised EIR and determines whether to issue approvals for the Modernization Project. On March 1, 2011, the City Council adopted Resolution No. 15-11, encouraging Chevron to proceed with an application for the Modernization Project, directing the City Manager to prioritize processing of a new or amended permit, and directing the City Manager to meet with Chevron staff to develop a permit process and timeline and to report regularly to the Council and community. On May 23, 2011, Chevron submitted to the City a new application for the Modernization Project, which excludes several components of the 2008 Project.

[27] This discussion addresses new or revised permits that would be required for the Modernization Project. The Facility's ongoing compliance with existing permits is discussed throughout the EIR in relevant topic sections, such as the Facility's National Pollutant Discharge Elimination System permit, which is discussed in *Section 4.9, Hydrology and Water Quality*.

City permits required for the Modernization Project would include the following major approvals:

- Conditional Use Permit
- Design Review
- Encroachment Permit
- Building Permit
- Grading Permit
- Construction permit pursuant to California Fire Code

These approvals and permits would be reviewed in accordance with applicable City codes and regulations, including the Municipal Code of the City of Richmond, the Richmond Zoning Ordinance, the Fire Code, and the Building Regulations Administrative Code.

3.5.2 Bay Area Air Quality Management District

Emission sources associated with the Modernization Project require authority to construct permits issued by the BAAQMD. Authority to construct permits are generally required before a project can commence construction, and contain requirements designed to protect air quality and ensure compliance with BAAQMD and EPA rules and regulations. Chevron obtained authority to construct permits in 2008 for the emission sources anticipated to be constructed as part of the 2008 Project. Prior to commencing construction, Chevron would need to obtain BAAQMD authorization to begin construction (e.g., confirmation that the previously issued construction permits remain valid). In addition, amendments to some authority to construct permits would be required to update certain equipment descriptions for the hydrogen plant and the sulfur recovery unit. In each case, the capacity of these units would be equal to or smaller than the capacity currently listed in the authority to construct permits and would involve either no change or a reduction in emissions compared to the emissions permitted in the 2008 authority to construct permits. Additionally, installation of a tank dome over an existing tank would require a new authority to construct permit.

Once Modernization Project equipment has been constructed, Chevron is required to notify BAAQMD to allow for an inspection to ensure that equipment was installed as proposed and is operating properly. Once the BAAQMD confirms this, the authority to construct permits are converted into permits to operate. Chevron is then required to renew these permits to operate on an annual basis. Permits to operate for Modernization Project equipment must also be incorporated into the Title V Operating Permit for the Facility. Chevron submitted an application for a significant revision of its Title V permit along with its

authority to construct application, and Chevron would submit another application for revision of its Title V permit when it applies for the additional authority to construct permit described above. When the authority to construct permits convert to permits to operate, the BAAQMD would process the Title V permit revisions.

As noted in *Chapter 3, Project Description* of the Draft EIR, Chevron partially completed construction of several project components following certification of the 2008 EIR and approval by the City of the Conditional Use Permit (CUP) and other required construction approvals. BAAQMD also issued Authority to Construct (ATC) permits authorizing this Project construction activity. The lawsuit that directed the City to vacate permits issued by the City did not challenge the BAAQMD ATC approvals, which remained in effect and were renewed in 2012 by BAAQMD pursuant to applicable BAAQMD rules that allow ATC renewals where substantial construction has taken place in reliance on the original ATC (McKay, Jeff 2014 [attached]). On June 5, 2014, Community for a Better Environment (CBE) and other parties filed a lawsuit against BAAQMD alleging that the 2012 permit renewal was unlawful and raising other claims relating to BAAQMD rules and regulations (CBE Petition, 2014).

The environmental analysis and mitigation requirements included in the EIR do not assume, and are not dependent on, the status of the BAAQMD ATC permits or the validity of the 2012 ATC permit renewals. Technical engineering evaluations completed by BAAQMD as part of the ATC permit process were independently evaluated by the EIR preparers, in consultation with BAAQMD technical staff, to calculate emissions of CAPs, TACs and GHG from Project components that remained part of the Modernization Project. Since construction of these components was halted by the writ, and operation of these Project components requires issuance of a different form of BAAQMD permit that has not been approved (a "Permit to Operate"), the EIR does not assume that Chevron had any legal right to recommence construction or begin operation of any Project component, without regard to the legal status of the original ATCs or 2012 ATC renewals. The CBE lawsuit against BAAQMD was accordingly determined to be irrelevant to the legal sufficiency of the EIR under CEQA, either generally or with respect to the impacts analysis or mitigation measures for air emissions that fall within BAAQMD's jurisdiction.

3.6 REFERENCES—PROJECT DESCRIPTION

Chevron has provided numerous submittals in support of its applications.

Chevron Data Transmittals (2011 – 2014), all of which have been made available on the City's website for the Modernization Project: chevronmodernization.com.

CHAPTER 4.
ENVIRONMENTAL SETTING, IMPACTS, AND MITIGATION MEASURES

This section has been added to provide an introduction to Chapter 4, Environmental Setting, Impacts, and Mitigation Measures. The 2008 EIR did not include a similar section.

This chapter contains an analysis of the environmental topics relevant to the Modernization Project, and, as such, constitutes the major portion of this Draft EIR.

Section 4.0 describes the format and organization of the environmental topic sections of this chapter. It also provides background information on the impact analysis methodology and the context for Refinery Operations. This information is useful in understanding the technical aspects of the Project impact and cumulative impact analyses.

Sections 4.1 through 4.17 are the environmental topic sections of this chapter. They describe the existing setting for each topic relevant to the Project, the potential impacts that could result from implementation of the Project, relevant City policies that would minimize potential adverse effects that could result from implementation of the Project, and mitigation measures necessary to reduce impacts of the Project.

4.0 INTRODUCTION TO CHAPTER AND METHODOLOGY

This section has been added to provide an introduction to Chapter 4, Environmental Setting, Impacts, and Mitigation Measures. The 2008 EIR did not include a similar section.

4.0.1 Environmental Topics

This section provides an overview of the scope of the analysis included in this chapter, the organization of the sections, the methods for determining which impacts are significant, and the applicability of mitigation measures.

The following environmental topics are analyzed in this chapter:

4.1 Aesthetics, Visual Quality, Light, and Glare
4.2 Agricultural Resources
4.3 Air Quality
4.4 Biological Resources
4.5 Cultural Resources
4.6 Energy
4.7 Geology, Soils, Seismicity, and Mineral Resources
4.8 Greenhouse Gases
4.9 Hydrology and Water Quality
4.10 Land Use, Plans, and Policies
4.11 Noise
4.12 Employment, Population, and Housing
4.13 Public Safety
4.14 Public Services
4.15 Parks and Recreation
4.16 Transportation and Traffic
4.17 Utilities and Service Systems

Each of the environmental topics included in Appendix G of the CEQA Guidelines is considered in this chapter.

4.0.1.1 Format of Topic Sections

Each environmental topic section generally includes six main subsections: (1) Introduction; (2) Setting; (3) Significance Criteria and Methodology; (4) Impacts and Mitigation Measures (including construction and operational period); (5) Cumulative Impacts; and (6) References. Additionally, at the top of the first page of each environmental topic section is a paragraph (formatted with *italic* type) that highlights how the section included in this EIR compares to the

corresponding section included in the Chevron Hydrogen and Energy Renewal Project EIR Consolidated Volume (2008 EIR).

Identified less-than-significant and significant adverse impacts are numbered and shown in **bold type**; the corresponding mitigation measures are numbered and indented. Impacts and mitigation measures are numbered consecutively within each topic and begin with the chapter number for the impact section (e.g., Impact 4.1-1, Impact 4.1-2, etc., within *4.1 Aesthetics, Visual Quality, Light, and Glare*).

The following notations are provided after each impact statement:

- LTS = Less than Significant
- LTS after Mitigation = Less than Significant after Mitigation

There are no impacts that are considered significant and unavoidable. For some impacts, Improvement Measures are included to further minimize impacts that are already less than significant or to further minimize impacts that can be reduced to a less-than-significant level with mitigation.

4.0.1.2 Determination of Significance

Section 15382 of the CEQA Guidelines defines "significant effect on the environment" as "a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project…" Each impact evaluation in this chapter is prefaced by criteria of significance, which are the thresholds for determining whether an impact is adversely significant. These criteria have been developed using Appendix G of the CEQA Guidelines and the City's independent determination to use thresholds of significance approved by the Bay Area Air Quality Management District (BAAQMD) for certain air quality and greenhouse gas emission impacts. This EIR also considers impacts in relation to applicable City policies, and applicable local, regional, state, and federal laws and regulations.

The Applicant has also committed as a Modernization Project Objective, to further reduce air quality and greenhouse gas impacts that are already less than significant under the Appendix G thresholds. Specifically, the Applicant has pledged that, if the Modernization Project is implemented, the Facility will achieve "no net increase" (NNI) of criteria air pollutant (CAP) emissions, greenhouse gas emissions, and health risks associated with the emission of toxic air contaminants (TACs), as compared to the 2008-2010 baseline period. This EIR also addresses Modernization Project impacts against this NNI Project Objective, evaluates Applicant-proposed Project Design Features to reduce impacts, and

requires as mitigation measures implementation of Project Design Features as well as other mitigation measures to achieve this NNI Project Objective.

4.0.2 Cumulative Impact Analysis Methodology

4.0.2.1 Context

Section 15355 of the CEQA Guidelines defines cumulative impacts as "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." Section 15130 of the CEQA Guidelines requires that an EIR evaluate whether a project's incremental impact is cumulatively considerable. "Cumulatively considerable" means that the incremental impacts of an individual project are considerable when reviewed in connection with the impacts of past projects, the impacts of other current projects, and the impacts of probable future projects. These impacts can result from a combination of a proposed project together with other projects causing related impacts. Section 15355 of the CEQA Guidelines states that "the cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects."

In this chapter, the analysis of cumulative impacts is located near the end of each environmental topic section. The overall cumulative impacts methodology is based on a consideration of known and reasonably foreseeable projects in the vicinity of the Modernization Project, local and regional growth plans—including principally the Richmond General Plan 2030 (General Plan 2030), Plan Bay Area (the regional plan guiding Bay Area land use and transportation planning), and other Bay Area projects involving petroleum refining activities that are collectively under evaluation by the BAAQMD. This analysis considers reasonably foreseeable projects to be those: (1) for which an application has been submitted or informal municipal review is started; (2) for which environmental review is underway; and/or (3) that are partially completed.

The methodology used for assessing cumulative impacts varies depending on the specific topic being analyzed. If a Modernization Project impact could cumulatively contribute to a primarily localized and temporary impact caused by reasonably foreseeable projects and growth, as is the case for example with construction-related Modernization Project traffic, then a combination of projects and regional plans is evaluated to determine the significance of such construction-related cumulative traffic impacts.

On the other hand, if a Modernization Project impact has the potential to have a more regional or long-term impact, as could be the case for example with air

emissions and greenhouse gases, then the scope of the cumulative impacts analysis is dependent upon the extent to which such cumulative conditions would make the Modernization Project's impacts "cumulatively considerable." Since the Modernization Project will result in NNI in CAPs, greenhouse gases, and public health risks from TACs, there are no Modernization Project impacts that would contribute to a "cumulatively considerable" impact.

Finally, where the Modernization Project does have a potentially significant adverse impact, as is the case with the Modernization Project's need for increased water supplies, cumulative impacts are assessed in relation to other projects as well as regional plans for protecting and managing relevant resources (e.g., the Urban Water Management Plan), in evaluating whether the Modernization Project's incremental impact is "cumulatively considerable" in relation to projects contributing to the same impact. In this water supply example, because the Modernization Project will be served by reclaimed water produced by an existing facility that has the capacity to do so, and the Modernization Project's water demands, as mitigated, are included in the approved Urban Water Management Plan, which confirms the availability of adequate reclaimed water supplies for the Facility even in times of drought, the Modernization Project does not result in a significant adverse cumulative impact.

Each topical section of this chapter addresses cumulative impacts, as appropriate based on the topic. This EIR concludes that there are no significant unavoidable cumulative impacts.

4.0.2.2 General and Regional Plans Considered in the Cumulative Impact Analysis

The cumulative impact analysis considers the specific environmental aspects of adopted plans, listed below, that would interact with identified Modernization Project adverse impacts within the same geographic area. To determine the cumulative impacts of these adopted plans along with the Modernization Project, the analysis considered the following planning documents:

- City of Richmond General Plan (2030), adopted April 2012
- Contra Costa County Transportation Authority (CCTA) Countywide Transportation Plan, adopted June 2009
- Plan Bay Area, adopted July 2013
- East Bay Municipal Utility District's Richmond Advanced Recycled Expansion (RARE) Water Project, 2007

- East Bay Municipal Utility District's Urban Water Management Plan, adopted June 2011
- Bay Area 2010 Clean Air Plan, adopted September 2010

These adopted local and regional plans are prepared by cities, counties, and agencies in California to meet the requirements of state law and/or achieve desired policy objectives. These plans are comprehensive, long-term plans for the physical development of the city, county, or region. For example, the General Plan 2030, includes specific policies to preserve and enhance existing development and to provide for orderly and appropriate new development through approximately 2030. City land use and development actions and approvals must be consistent with the General Plan 2030.

The City of Richmond calculated a buildout projection based on a regional share approach. Using the Association of Bay Area Governments (ABAG) projections, the City estimated the future population and job growth in Richmond. The scenario also incorporated local information and input regarding the locations for growth and change within the city including past, present, existing, pending, and reasonably foreseeable future development in the surrounding area. Growth and development were analyzed by subareas of the city—traffic analysis zones—to more accurately analyze how trips are distributed in Richmond. Transportation analyses used the Contra Costa Countywide Travel Demand Model, which required inputs at the traffic analysis zone level. The scenario also included existing development conditions within the baseline and growth projections for adjacent jurisdictions.

4.0.2.3 Specific Projects Considered in the Cumulative Impact Analysis

The cumulative impact analysis also considers specific development projects, including: (1) probable future projects at the Facility; (2) non-Chevron Facility refinery and pipeline projects in the Modernization Project site vicinity; (3) other non-Chevron Facility projects in Richmond; and (4) other non-Chevron Facility projects in other jurisdictions. These four categories of projects are described below. The EIR considers the interaction of these other projects with the Modernization Project.

4.0.2.3.1 *Probable Future Projects at the Facility*

As of the time of writing this EIR, the following projects, that are not part of the Modernization Project, were being undertaken or proposed to be undertaken at the Facility and were considered for the purpose of analyzing cumulative impacts in this EIR:

- Sulfur Tank Replacement
- Sulfur Loading Rack Replacement
- Dredge Spoils to 250-Foot Channel
- Hensley Street and Kelham Warehouse Redevelopment Project
- Maintenance Shops Building
- Major Facility Turnaround
- Long Wharf Maintenance and Reliability Project
- Storage Tank Replacement Project

For more detailed information on these projects, please see *Appendix 4.0*, Table A4.0-2.

4.0.2.3.2 *Non-Chevron Refinery-Related Bay Area Projects*

The cumulative impact analysis in this EIR also considers the following known or potential non-Chevron Bay Area refinery- and pipeline-related projects:

- Valero Improvement Project
- Valero Crude by Rail
- WesPac Pittsburg Energy Infrastructure Project
- Phillips 66 Propane and Butane Recovery Project
- New Shell Crude Oil Tank Construction
- Shell Green House Gas Reduction Project
- Praxair 21.5 Mile Hydrogen Pipeline Project
- International-Matex Tank Terminals Richmond Wharf Seismic Upgrades
- Tesoro Amorco Marine Wharf Terminal Lease Consideration
- Tesoro Avon Marine Wharf Terminal Lease Consideration

For more detailed information on these projects, please see *Appendix 4.0*, Table A4.0-3.

4.0.2.3.3 *Other Projects in Richmond*

Other development projects within the City of Richmond that are included in the cumulative impact analysis are as follows:

- Parkway Commerce Center
- Point Molate Project
- Interstate 580 Scofield Avenue and Western Drive Bridge Deck
- Elevated Bay Trail
- Filbert Townhomes
- Nevin Court
- Metro Walk Transit Village
- Nystrom Village

- Richmond Wet Weather Storage Project
- Westshore Marina
- Terminal One/Point Richmond Shores
- Shea Homes Bottoms Property
- Ferry Terminal
- Marina Way Live /Work
- "Moody Underpass" Marina Bay Parkway Grade Separation
- University of California, Berkeley and Lawrence Berkeley National Laboratory (UCB LBNL) Richmond Bay Campus
- Miraflores Housing Development

For more detailed information on these projects, please see *Appendix 4.0*, Table A4.0-4.

4.0.2.3.4 *Non-Facility Projects in the Modernization Project Vicinity Outside Richmond*

The cumulative impact analysis includes the following additional development projects outside of the City of Richmond:

- Interstate 80 Integrated Corridor Mobility
- Rumrill Sports Park
- Interstate 80/San Pablo Dam Road Interchange Improvements
- Eden Senior Housing Mixed-Use Apartments
- Ohlone Garden Mixed-Use Residential
- 801 Bates Avenue
- Creekside

For more detailed information on these projects, please see *Appendix 4.0*, Table A4.0-5.

4.0.3 EIR Methodology Addressing Court of Appeal Decision

In 2009, the Contra Costa Superior Court invalidated the 2008 EIR and the Permits, and issued an injunction halting further construction. At the time construction was halted, none of the new equipment was complete or operational. Following an appeal, in 2010, the California Court of Appeal affirmed in part and reversed in part the Superior Court decision (Appellate Court Court Decision) and, on March 14, 2011, the Contra Costa Superior Court issued a writ of mandamus (Writ) ordering that the 2008 EIR and the Permits be set aside on certain grounds[1]. The Appellate Court concluded that the project

[1] The Appellate Court Decision and writ of mandamus (Writ) is used interchangeably in this EIR.

description was unclear and did not, for example, address the extent to which the project would allow the Facility to process different types of feedstocks (e.g., heavier gravity crude oil), or the emission consequences of refining different feedstocks. The Appellate Court also concluded that the EIR was deficient with regard to analyzing and mitigating for greenhouse gas emissions.

Later in 2011, the City Council of the City of Richmond adopted a resolution encouraging Chevron to resubmit its application, and directing the city manager to make processing a new or amended permit a high priority (City Resolution No. 15-11). The Resolution identified several City policy goals for the Project

- Implement the Project in a safe, healthy, and environmentally responsible manner
- Comply with local, state, and federal laws and regulations
- Avoid, minimize, and mitigate environmental and community impacts to the maximum extent feasible
- Increase economic welfare in the Richmond area by creating construction jobs and employing local residents
- Maximize energy efficiency
- Maximize the protection of public health and safety

Chevron responded to this Resolution by submitting a new application to the City for a revised project (Modernization Project or Project) that includes only two of the Chevron Hydrogen and Energy Renewal Project (2008 Project)'s major components, the Hydrogen Plant Replacement and a collection of new equipment improvements that remove naturally occurring sulfur contained in feedstocks processed at the Facility (collectively, the Sulfur Removal Improvements, as further described in *Section 3.3.2*, below).[2] Following this application, the City began preparation of this EIR in order to comply with the Writ and to analyze the potential environmental impacts that could result from the Modernization Project.

[2] In the 2008 EIR, the Sulfur Removal Improvements were referred to as the "Hydrogen Purity Improvements." The 2008 Project's proposed catalytic reformer replacement, power plant replacement, and various other Facility improvements have been eliminated from the proposed Modernization Project. Also, a storage tank replacement project that was originally part of the 2008 Project, which involved the replacement of five organic liquid storage tanks and construction of one new firewater storage tank at the Facility, has been separately permitted and is currently under construction.

This EIR now includes a comprehensive evaluation of the potential for, and environmental impacts associated with, changing the type of crude oils refined at the Facility. Specifically, the Unit Rate Model (see *Appendix 4.3-URM*) estimates how the Facility's processing units could potentially be used under post-Project conditions. The Unit Rate Model then evaluates a wide range of potential crude oil feedstocks (including crude oil that is heavier, lighter, and more sour than the crude blend processed at the Facility during the 2008-2010 baseline period). In brief, the Unit Rate Model demonstrates that the Facility is designed to operate within the lighter end of the intermediate range of crude oils, and that the Facility's capacity to refine crude oils with higher sulfur concentrations will change with the Modernization Project but that there will be no change in the Facility's capacity to process crudes that are heavier (or lighter). The Unit Rate Model also demonstrates that, if the Facility does accept crude oils with gravity levels that are significantly heavier or lighter than existing crude blends, then the Facility can process less feedstock (and produce lower quantities of refined products). Using the Unit Rate Model's estimations, *Sections 4.3, Air Quality*, and *4.8, Greenhouse Gases*, then evaluate Facility air emissions that would result from using different blends of crude and gas oils. Most significantly, these sections demonstrate that emission levels are the highest when the Facility is operating at or near its maximum permitted operations. If the Facility refines crude oils that are too heavy, or too light, to allow for full Facility utilization, then the emissions from refining these crude blends are lower.

This Facility, like other refineries, has not operated at 100% of its permitted capacity on an annualized basis. As explained in the Unit Rate Model, during its recent operational history (2008–2010), the Facility crude unit operated at an average annual utilization level of just under 89%. As explained further in *Section 4.3, Air Quality,* refineries in the Western United States collectively averaged annual utilization levels as high as 93%.

To assess whether different types of crude oils could be refined using a more reasonably foreseeable utilization rate of 93% instead of the permitted maximum of 100% utilization, both the Unit Rate Model and *Sections 4.3, Air Quality* and *4.8, Greenhouse Gases,* evaluate both a 93% Utilization Scenario and a 100% Utilization Scenario for a range of crude oil blends.

Finally, this EIR confirms that, depending on the source of the crude, increases in sulfur concentrations can have a correlation to increases in API gravity. The Unit Rate Model, and *Sections 4.3, Air Quality* and *4.8, Greenhouse Gases*, identify a project crude blend that has fractional characteristics of the crude oil blend likely to be processed by the Facility if the Modernization Project is approved. The project crude blend has a higher sulfur concentration (consistent with the

Modernization Project Objectives) and a slightly lower gravity level (heavier crude, but still within the intermediate-light range) than the crude blend typically processed at the Facility during the 2008-2010 baseline period. *Sections 4.3, Air Quality* and *4.8, Greenhouse Gases* calculate emissions from this project crude blend.

Other parts of the EIR also consider, when relevant, differences between the 93% and 100% Utilization Scenarios, and differences in refinery feedstocks.

For example, emissions of volatile organic compounds (VOCs) in the 100% Utilization Scenario are higher and will therefore require more mitigation to be less than significant for CEQA purposes, and achieve the applicant's NNI Project Objective. The primary mitigation measure for this type of air emission is the installation of domes over existing storage tanks. These domes are visible, and more domes are needed under a 100% Utilization Scenario than under a 93% Utilization Scenario. *Section 4.1, Aesthetics* evaluates the aesthetics impacts of installing enough domes to mitigate for both a 93% and 100% Utilization Scenario.

Another example of how the EIR evaluates different feedstocks is *Section 4.13, Public Safety*, which evaluates the potential for crude or gas oils with different concentrations of chemicals (primarily sulfur, but also other chemicals such as nitrogen) to cause corrosion or other types of damage and corresponding public safety risks. *Section 4.13, Public Safety* evaluates foreseeable levels of sulfur and other constituents, but also considers extremely high and unrealistic sulfur levels to assure that corrosion protection measures are sufficiently robust. Chevron included in its Reliability Program all of the recommendations made by the City's refinery safety expert in a report included as an appendix to *Section 4.13, Public Safety*.

Addressing the Court's direction that this EIR must evaluate a range of potential refinery feedstocks required the completion of technically complex evaluations and reports. As discussed in *Chapter 1, Introduction,* the City completed outreach workshops (e.g., Refinery 101, Greenhouse Gas, etc.) during the EIR preparation period, and more workshops will be held during the public comment period, to help the members of the public better understand the Modernization Project in the context of refinery processing, and this EIR's evaluation of impacts and mitigation measures.

The Modernization Project's physical components, and a general overview of how these and other Modernization Project attributes relate to Facility operations, is included in *Chapter 3, Project Description*. A more detailed description of Refinery Operations is included in *Appendix 3, Overview of Oil Refining Process.*

The remainder of this *Section 4.0* describes the operational characteristics of the Facility that are most relevant to the Court's direction to consider the potential for changes to the Facility's feedstocks and the impacts associated from such changes.

4.0.3.1 Background on Facility Operations and Feedstock

Chevron purchases crude and gas oils in the global marketplace and transports these materials, called feedstocks, to the Facility for processing into transportation fuels and lubricant base oils. Generally, different crude oils are blended and then fed into the crude unit, where they are divided into fractions for processing into various product streams. Imported gas oil, as well as gas oil produced by the crude unit, are directly fed to various Facility units for conversion into end products. The Facility also imports natural gas for use as fuel and as a feedstock for generation of hydrogen. See Figure 3-2 in *Chapter 3, Project Description* for a diagram of Facility processes.

Additionally, the Facility typically imports small amounts of material known as blendstocks. These materials are not considered Facility feedstocks since they are not processed by the Facility; instead they are blended with other materials into finished products that leave the Facility. Cutter and blendstock are described further in *Section 4.0.3.1.1.4*, below.

Because the Modernization Project includes a proposed increase in the sulfur content of crude oils and gas oils, this section begins with a description of the general characteristics of crude oil and gas oil, including constituents such as sulfur. This section then explains the current crude oil blends and gas oil processing capability at the Facility, and the relationship of the Modernization Project to the Facility's ability to process feedstocks following construction and operation of the Modernization Project. This section also describes natural gas usage pre- and post-Project.

While the Modernization Project would improve the Facility's flexibility to process reliable supplies of globally available crude and gas oils with higher sulfur content, it would not alter the Facility's capacity for processing intermediate-light American Petroleum Institute (API) gravity crudes. Because the Modernization Project would provide the Facility with increased flexibility to process higher-sulfur crude oils, which may fall at either the higher or lower end of the intermediate-light gravity range, this EIR analyzes the potential environmental impacts of processing crude oil blends at both the higher and lower ends within the intermediate-light range, and also conservatively outside of (above or below) that intermediate-light range.

4.0.3.1.1 *Crude Oil and Gas Oil Facility Feedstock*

4.0.3.1.1.1 *Crude Oil*

Crude oil is the Facility's primary feedstock, the raw material used to make refined petroleum products. Crude oil is found deep beneath the earth's surface in natural underground reservoirs. The Facility receives crude oil via tankers and barges that discharge at the Facility over the Long Wharf. Crude oil is stored in tanks at the Facility before being processed at the Facility. Crude oil is a mixture of many different hydrocarbons, and is classified typically by its gravity and sulfur content. Additional description of crude oil is provided in *Appendix 3, Overview of Oil Refining Process.*

4.0.3.1.1.1.1 *Gravity*

Density is the amount of mass contained in a certain volume. The density of a crude oil is determined by the average weight, or gravity of its component molecules. Heavy crude oil is denser than light crude oil. In general, when a facility processes lighter crude oil blends, higher value products can be produced in fewer steps. The term API gravity describes the density of a crude oil compared to the density of water. The lower the API gravity, the heavier the crude.

Definitions for light and heavy crude oils are based on their specific gravity[3] or API gravity.[4] The following are generally accepted definitions for the crude oil gravities (Sheridan, 2006):

- **Heavy Crude.** Crude oils with API gravity of 18 degrees (º) or less are characterized as heavy. The oil is viscous and resistant to flow, and tends to have a lower proportion of volatile components.
- **Intermediate Crude.** Crude oils with an API greater than 18º and less than 36º are referred to as intermediate.
- **Light Crude.** Crude oils with an API gravity of 36º or greater are referred to as light. Light crude oil produces a higher percentage of lighter, higher-priced premium products.[5]

[3] The specific gravity equals the weight of the compound divided by weight of an equal volume of water.

[4] The API gravity, measured in degrees (º), is defined as equal to (141.5 divided by specific gravity) – 131.5. As a result, the higher the API gravity, the lighter the compound. Note that water has an API gravity of 10º, so any hydrocarbon crude with an API gravity greater than 10º is less-dense (lighter) than water.

[5] These API breakpoint values are not applied universally. Other petroleum industry sources use varying breakpoints for heavy and light crude oils. The term intermediate is also used interchangeably with the term medium when referring to mid-range gravity crudes.

The density or gravity of crude oil is important to the refining process in several ways. When the mixture of compounds in a crude oil is heated, lighter hydrocarbon compounds will begin to vaporize (turn into gas), and heavier hydrocarbons will not. As the temperature is increased, heavier hydrocarbons will begin to vaporize. This physical characteristic of crude oil is important to the first step in the refining process, distillation, in which crude oil is heated in a furnace and sent to a large steel column to separate out the different hydrocarbons. Different hydrocarbons boil at different temperature ranges and are grouped together in fractions based on these temperature ranges, as further described in *Appendix 3, Overview of Oil Refining Process*.

4.0.3.1.1.1.2 *Sulfur*

Sulfur occurs naturally in crude oil, but sulfur content in finished products is restricted by federal and state air quality laws. To meet these regulatory restrictions, sulfur is removed from the various fractions of crude oil during the refining process. The sulfur content of crude oil determines whether the crude is considered "sweet" or "sour." Sweet crude typically has a sulfur content of 0.5% or less, whereas sour crude typically has a sulfur content of 2.5% or more. "intermediate sweet" or "intermediate sour" crudes have sulfur contents that fall between sweet and sour.

The variation in the sulfur content and API gravity of different types of crude oils occurs naturally throughout the world, as shown in Figure A4.3-MET-1a in *Appendix 4.3-MET*, which compares the gravity and sulfur content of crudes found from various agencies and commercial sources.[6] There are more heavier (i.e., lower gravity) high sulfur crudes and fewer lighter (i.e., higher gravity) high sulfur crudes. Generally, as the crude oil gets lighter, the maximum sulfur in the crude oil declines until an API gravity of about 45°, where the crude oils typically appear to be uniformly sweet with sulfur contents well below 0.5%.

4.0.3.1.1.1.3 *Other Compounds in Crude Oils*

Crude oils also naturally contain other constituents, such as metals and aromatics, that vary by production area and can also vary within production

[6] Capline Pipeline (http://caplinepipeline.com/PDF/report1.pdf). Environment Canada (http://www.etc-cte.ec.gc.ca/databases/OilProperties/oil_prop_e.html). BP PLC (http://www.bp.com/productslistsearch.do?categoryId=16002740&contentId=7020300). Total Oil Trading SA (http://www.totsa.com/pub/crude/crude_assays.php?rub=1). Exxon mobile Corporation (http://www.exxonmobil.com/crudeoil/about_crudes_alphabet.aspx). Statoil (http://www.statoil.com/en/OurOperations/TradingProducts/CrudeOil/Crudeoilassays/Pages/default.aspx). Eni S.p.A. (http://www.eni.com/en_IT/company/operations-strategies/trading-shipping/trading-shipping-crude-assays/trading-shipping-crude-assays-downloads.shtml).

areas. Since the Modernization Project would allow Chevron greater flexibility to remove more sulfur and process a broader gravity range of crude oils, Facility operations relating to addressing these other constituents are also examined.

Crude oil typically contains a variety of metals in trace amounts (tens of parts per million [ppm] or less). The metals from the crude oil are removed during the refining process in the hydrotreating stage. Metals content in fuels can vary widely, as described in greater detail in *Appendix 4.3-MET.* The variation in the metals content and gravity of different types of crude oils occurs naturally throughout the world.

4.0.3.1.1.1.4 *Modernization Project Metal Removal*

As with sulfur removal, the refining process includes steps to remove metals from finished products. Generally this involves a catalyst removal process, as described further in *Appendix 3, Overview of Oil Refining Process*. The catalyst effectively filters out metals from gasoline and other finished products. No metal removal equipment changes are proposed or required as part of the Modernization Project; however, the catalyst used to remove metals would need to be regenerated more frequently if the Facility is operated at higher utilization levels than the 89% average utilization rate during its recent operational history (2008–2010).

Further information about metal removal is provided in *Appendix 3, Overview of Oil Refining Process*, with metal-related impacts and mitigation measures addressed in *Sections 4.9, Hydrology and Water Quality* and *4.17, Utilities and Service Systems.*

4.0.3.1.1.1.5 *Volatile Compounds*

Higher sulfur content, and heavier gravity crudes, do not generally have elevated levels of VOCs. New North American crude sources (including for example from North Dakota and partially refined crudes shipped from Canada) are increasingly available to United States refineries by rail and shipping, with pending proposals outside California to increase pipeline shipment capacity. Many North American crudes tend to have higher gravity levels and lower sulfur content, and the Modernization Project has not been designed to change existing rail or shipping operations or capacity, or refining equipment or capacity, for these crude blends. Nevertheless, because the Facility has accepted North American crudes and it is reasonably foreseeable that this will continue to occur in the future, the EIR also addresses constituents of concern, including VOCs, in such crudes.

4.0.3.1.1.1.6 *Facility Crude Oil Type and Quality*

Chevron purchases crude oil in the global market place and imports it to the Facility by ship. Various crude oils are then blended together for purposes of processing. In the 1970s, the Facility primarily processed a blend of Californian, Indonesian, and Middle Eastern crudes. In the 1980s, the Facility was modified to process greater amounts of oil from the Alaskan North Slope. Since the late 1990s, the Facility has processed more crudes from the Middle East to make up for the declining supply of the Alaskan North Slope production.[7]

On an annualized average basis over the 3-year baseline period of 2008-2010, the sulfur content of the crude oil blends processed by the Facility was 1.58 weight percent (wt%) sulfur. The Modernization Project would enable the Facility to process crude oil blends with approximately 3 wt% sulfur on an annualized basis, compared to current annualized average capacity of 2 wt% sulfur, and the 1.58 wt% sulfur annual average that was processed during the 2008-2010 baseline period. Because the 3-wt% sulfur is an annualized number, there could be short durations, or spikes, during which the Facility processes crude oil blends with greater than 3 wt% sulfur. The potential environmental impacts of processing 3 wt% sulfur on an annualized basis, as well as potential spikes in sulfur content, are analyzed in this EIR.

During the baseline period (2008-2010), the average gravity of crude oil processed at the Facility was an API gravity of approximately 33.7°. The Facility has the capacity to process crude oil blends with gravity at the lighter end of the intermediate range (intermediate-light), and would remain configured in the same manner to process such crude oil blends after the Modernization Project is implemented. However, the Modernization Project would provide increased flexibility to process crude oil blends at either the higher or lower end of the intermediate-light gravity range, and therefore, this EIR analyzes the potential environmental impacts of processing crude oil blends at both the higher and lower ends within the intermediate-light range, and also conservatively outside of (above or below) that intermediate-light range.

Specifically, two units provide operational constraints on the heaviness and lightness of crude oil blends capable of being processed at the Facility on a sustained basis. Heavier crude oil contains a proportionately larger share of

[7] Oil fields in the Alaskan North Slope produce a wide range of crude oils. API gravities from different fields range from 22° to 40°. Alaskan refineries located along the Trans Alaska Pipeline System (TAPS) top the crude oil to produce light petroleum products and return residual products to the line. The resulting blended crude oil stream is referred to as Alaskan North Slope oil. The Alaskan North Slope is an intermediate sour crude with an average API gravity of 29 to29.5 degrees and sulfur content of 1.1%. Alaskan North Slope production has been declining since the mid-1990s (Sheridan, 2006).

heavier fractions, including the heaviest fraction vacuum residuum, which is taken from the bottom of the crude unit and processed by the solvent de-asphalting (SDA) unit. Similarly, lighter crudes contain a proportionately higher share of lighter fractions, including naphtha and are primarily processed by the naphtha hydrotreater unit. Therefore, the Facility's flexibility to process heavier or lighter crudes is limited by the capacities of these processing units. Since the Modernization Project would not alter the operational capacity of the SDA unit or the naphtha hydrotreater unit, the Modernization Project would not change the Facility's operational capability regarding crude gravity.

Following construction and operation of the Modernization Project, it is reasonably foreseeable that, in running crude oil blends with increased sulfur content, the Facility may run some crude oil blends that have more vacuum residuum compared to the 2008-2010 baseline period. However, these crude oil blends would still be within the existing capacity of units that limit the heaviness of crude oil blends that can be processed at full refinery utilization and within existing BAAQMD air permit limits.

If the crude unit were to be operated at less than full capacity, it is possible for the Facility to process crude oil blends outside the intermediate-to-light range, though still subject to the limitations imposed by the SDA and naphtha hydrotreater units. This operational capability exists at the Facility today and would continue to exist after construction and operation of the Modernization Project. However, this mode of operation is not reasonably foreseeable since it is not efficient from an operational standpoint to run the crude unit at reduced levels, and the Facility did not run crude oil blends outside the intermediate-light range during the 2008-2010 baseline period. Nevertheless, the environmental impacts of running heavier crude are analyzed in this EIR since it is a currently possible mode of operation within permit limits.

4.0.3.1.1.2 *Gas Oil*

Gas oil is the term used to describe the fraction of crude oil that is heavier (more dense) than gasoline, diesel, and jet fuels, and lighter (less dense) than residuum. This material has no practical use as a finished product and must be converted into desirable transportation fuels and lubricants through the conversion processes in the Facility. Gas oil fractions are produced by the crude unit and feed various other process units such as the hydrocracker (called the TKN Isomax), the fluid catalytic cracker, and the Richmond lube oil plant.

While the primary source of the gas oil fed to conversion units is gas oil separated from the crude oil blends processed by the crude unit, these conversion units have a greater processing capacity for gas oil than the Facility

can supply from the crude unit alone. As part of the Facility's existing design, the Facility has the flexibility to import gas oils from outside the Facility (typically from other refineries) to supplement the gas oils separated by the crude unit. Imported (or externally sourced) gas oils are fed directly to the conversion units and processed along with gas oils from the crude unit. This provides the Facility the flexibility to use the various processing units' full permitted capacity.

The Facility's capacity for imported gas oils varies depending on the quantity of gas oils produced from the crude unit. Nonetheless, all of the Facility's conversion units have Title V permitted throughput capacities and, regardless of whether gas oil is produced by the crude unit or imported, these units cannot exceed those limits.

The Modernization Project proposes an increase in the Facility's Title V Permit limits for the hydrogen plant (from 181.1 million standard cubic feet per day [scfd] to 244 million scfd), for the sulfur recovery units (from 600 long-tons/day) to 900 long-tons/day), and for the fluid catalytic cracker feed hydrotreater (FCC FHT) (from 65,000 to 80,000 barrels per day of gas oil). The Facility is concurrently seeking to reduce the annual permit limit on its SDA unit from 56,000 barrels per day to 50,000 barrels per day. The Modernization Project is not increasing its crude unit processing capacity of 257,200 barrels per day.

As described above, the Modernization Project would increase the maximum feed capacity of the FCC FHT. This would allow the Facility to import higher sulfur gas oils to be processed by the FCC FHT, in lieu of low-sulfur gas oils for direct processing by the fluid catalytic cracker. The Modernization Project would enable a less-than-1% increase of the Facility's current gas oil processing capacity. The Modernization Project would not change the current capacity or operational flexibility of the hydrocracker, fluid catalytic cracker, or Richmond lube oil plant units. Additionally, the Modernization Project would provide the Facility flexibility to process higher sulfur purchased gas oil along with gas oil fractions from higher sulfur crude oil blends processed by the crude unit. As described in *Chapter 3, Project Description,* the additional sulfur will be effectively removed for conversion into salable sulfur product. Any additional sulfur in purchased gas oils is removed and treated in the same manner as if it came from the crude oil blends processed by the crude unit.

4.0.3.1.1.3 *Natural Gas*

The Facility also imports natural gas for raw material and energy use at an approximate rate of 97.1 million scfd (Chevron Data Transmittal #72 (Rev #2), 2014). Natural gas is a raw material for the Facility for use as fuel for its operation, and for generation of hydrogen to supply its hydrotreating and

hydrocracking processes. Natural gas consumption after construction and operation of the Modernization Project is expected to increase by 30–40% compared to the 2008-2010 baseline period, primarily to support the new hydrogen plant.

4.0.3.1.1.4 *Blendstocks*

In addition to feedstocks imported by the Facility for processing into transportation fuels and lubricant base oils, the Facility imports a small amount of blendstocks to be used in making final products that leave the Facility. The Facility imports two main types of blendstocks, a fuel oil blendstock called cutter and light product blendstocks, both of which are imported over the Long Wharf. Once on site, blendstocks are not processed by the Facility, but rather serve as one of the components when mixing other Facility produced blendstocks into finished products.

Cutter is used by the Facility to lower the viscosity of fuel oil product. The Facility has several process units that create material that can be used as cutter (e.g., cycle oil), and the Facility can always produce sufficient quantities to meet the Facility's overall cutter demand. However, there are times, such as when another facility has a surplus of cutter, in which the Facility may import material from other facilities (including other Chevron refineries) to be used as cutter instead of using internal sources. During the 2008-2010 baseline period, the Facility imported approximately 3,000 barrels per day of cutter.

Similarly, depending on market conditions, light product blendstocks can be imported into the Facility to supplement the various blendstocks or products that are produced by the Facility process units. These blendstocks (e.g., iso-octane) are used in the blending of finished products, such as gasoline, but again are not used as feed to the process units. During the baseline period (2008-2010), the Facility imported less than 8,000 barrels per day of product blendstock.

4.0.3.2 Modernization Project and Facility Production Capacity and Utilization

This section discusses the relationship of the Modernization Project to the production capacity and utilization of the Facility.

4.0.3.2.1 *Production Capacity*

The Facility's production capacity is defined by two primary constraints: (1) the Facility's physical capability, based on the physical specifications of Facility equipment and technical operational constraints; and (2) the Facility's legal operating limitations, based on applicable Facility permits including the BAAQMD

and Title V air permits governing main Facility components such as the crude unit (discussed in greater detail in *Section 4.3, Air Quality*).

Pursuant to its Title V permit, the Facility is authorized to process up to 257,200 barrels per day of crude oil. The Modernization Project would not change either the existing permit authority to refine up to 257,200 barrels per day of crude oil or the Facility's physical crude oil processing capacity.

There is no similar barrels per day permit limit for gas oil. Rather, the Facility's capacity to process gas oil is constrained by the Title V throughput limits on the conversion units that convert gas oils to lighter products.

As explained in *Section 3.3.2*, the Modernization Project would increase the gas oil processing capacity of the FCC FHT (which feeds the fluid catalytic cracker) by 15,000 barrels per day. About 7–8% of the 15,000 barrels per day (1,200 barrels per day) would be cracked by the FCC FHT into smaller, lighter hydrocarbons like gasoline and jet fuel and would therefore not be fed to the fluid catalytic cracker for further cracking. However, the capacity of the fluid catalytic cracker and other hydrotreating units would remain unchanged. The Modernization Project would thus increase the overall Facility production capacity by approximately 1,200 barrels per day that can be newly processed by the expanded FCC FHT. As explained in *Chapter 3, Project Description, Section 3.3*, this would be a 0.4% increase in the Facility's total processing capacity for crude oil blends and gas oils combined.

4.0.3.2.2 *Utilization*

Facility utilization is the ratio of actual production levels to maximum production capacity. Refineries within the United States typically operate between 75% and 100% of their production capacity.[8] Utilization, rather than crude gravity or sulfur levels, is the primary driver of a Facility's emissions.

The utilization of the Facility has varied significantly over its 110-year history, based on the availability of different kinds of crude oil and gas oil, the demand for different types of refined products, economic considerations such as the relative pricing of imports and finished products, and downtime for maintenance and repairs. During the baseline period (2008-2010), the Facility did not operate at 100% of its existing permitted capacity. The utilization rate during this 3-year

[8] Since 1985, U.S. facility utilization as a percentage of operable crude distillation capacity has fluctuated between a monthly low of 73.7% (March 1985) and a high of 99.9% (August 1998) per facility (EIA, 2014).

period was approximately 88.6% of the Facility's permitted capacity to process crude oil.[9]

Chevron is legally authorized to operate at the BAAQMD and Title V maximum levels of 257,200 barrels per day of crude oil with or without the Modernization Project. Further, the Facility is authorized to operate its various conversion units up to their maximum permitted capacity, which are set forth and explained in *Section 4.3, Air Quality*. Even if the Modernization Project does not go forward, Chevron is currently authorized to increase production levels up to permitted limits.

Nevertheless, in order to assess the potentially significant adverse impacts of processing higher sulfur crudes at both the baseline scenario and maximum utilization following construction and operation of the Modernization Project scenario, this EIR uses two impact assessment methodologies:

- **Emission Impact Assessment Methodology for Annual Average Utilization of West Coast Refinery Facilities (93% Utilization Scenario)**. This methodology analyzes post-Project Facility operations on the basis of a utilization scenario (93% Utilization) that assumes that certain primary process units (the crude unit, and all gateway units that accept imported gas oils) will operate at an average annual rate of 93% of their maximum permitted capacity, under the Post-Project revised air permit limits. This 93% utilization rate is the maximum average annual utilization rate for refineries in the Western United States, and it represents a material increase from the 88.6% utilization that occurred during the 2008-2010 baseline period and other recent years. Accordingly, the 93% Utilization Scenario represents a reasonable and conservative post-Project utilization rate at the Facility.
- **Emission Impact Assessment Methodology for Full Facility Utilization (100% Utilization Scenario).** As described above, the Facility is legally permitted to run at maximum annual capacity. Accordingly, in addition to the 93% Utilization Scenario, this EIR also analyzes Modernization Project impacts assuming full production. This 100% Utilization Scenario assumes that

[9] Taking crude oil and gas oil separately, the Facility's average crude unit utilization for the 2008–2010 baseline Period was 88.6% (relative to the crude unit's Title V capacity of 257,200 barrels per day), which was higher than the average crude unit utilization of 84.9% for U.S. Refineries and 82.9% for PADD 5 Refineries (U.S. West Coast, Hawaii, and Alaska). While there is no single permitted limit for gas oil, the Facility's average utilization of the fluid catalytic cracker was 88.1% during 2008–2010 (70,500 barrels per day compared to 80,000 permitted capacity of the fluid catalytic cracker). References in this EIR to the Facility's utilization level during the 2008-2010 baseline period should be understood as describing the average utilization level of the crude unit during the 2008–2010 baseline period.

Facility units that process crude oil blends and externally sourced gas oil will operate at all times up to their maximum permitted capacity following construction and operation of the Modernization Project.[10]

This EIR also considers a variety of Alternatives, including several No Project variants under which the Modernization Project is not approved or implemented, and the Facility crude unit operates at its: (1) baseline rate of 89% utilization; (2) an increased utilization of 93%; and (3) an increased utilization of 100%.

4.0.3.3 Relationship between Modernization Project and Facility Operations

The Facility is a complex industrial operation, and the process by which the feedstocks described in *Chapter 3, Project Description, Section 3.4* are refined into end products generally involves five main process steps: distillation, treatment, cracking, reshaping, and blending.

This section provides a brief overview of these five major process steps in Facility operations, and explains how the Modernization Project would affect any of these steps. This section also describes how units in the Facility are affected by the ability to process feedstocks with higher sulfur content. Given the complex nature of the refining process, a more detailed description of the refining process is included as *Appendix 3, Overview of Oil Refining Process*.

4.0.3.3.1 *Refining Process*

4.0.3.3.1.1 *Separation: Dividing the Fractions of Crude Oil*

Typically, the first step in the refining process involves the separation of crude oil blends into its constituent parts, known as boiling point fractions, by distillation. The distillation process occurs in the Facility's crude unit, which uses two main distillation columns. The first distillation column—the atmospheric column—distills the crude oil blend near atmospheric pressure. The heavier portion of the crude oil that cannot be distilled in the atmospheric column is distilled in the second distillation column—the vacuum column—at a lower (vacuum) pressure. The fractions separated by the crude unit are used as input for other process units within the Facility in the manufacture of end products.

The heaviest fraction of crude oil, or vacuum residuum, is sent for additional separation in the Facility's SDA unit. By mixing the vacuum residuum with a solvent, the SDA unit extracts deasphalted oil, which is a type of gas oil, for further refining. The remaining residuum becomes fuel oil blendstock, which is a Facility product.

[10] These gateway units for receiving imported gas oil are the fluid catalytic cracker, the FCC FHT, the hydrotreater, and the two lube hydrocrackers, referred to as the heavy neutral hydrocracker and the light neutral hydrocracker.

The Modernization Project does not propose any new distillation equipment or modifications to the crude unit or SDA unit. However, this EIR analyzes operation of the crude unit and SDA at maximum permitted capacity pursuant to the 100% Utilization Scenario. The Modernization Project would allow the Facility to process crude oil blends and gas oils with higher sulfur content. Depending on process conditions such as temperature, higher sulfur content could affect the mechanical integrity of the crude unit and SDA unit. The potential impact of the increased sulfur in feedstock on the Facility's mechanical integrity is discussed in *Section 4.13, Public Safety*. As discussed above, although the Modernization Project would not change the Facility's current ability to process crudes in the intermediate-light gravity range, this EIR analyzes the potential environmental impacts of processing crude oil blends at both the higher and lower ends within the intermediate-light range, and also outside of (above or below) that intermediate-light range. As part of this analysis, this EIR discusses possible emissions associated with moving and heating heavier crudes from ships to the crude unit, as described in *Section 4.3, Air Quality*.

4.0.3.3.1.2 *Treatment: Removing Sulfur and Other Natural Impurities*

Hydrocarbons separated in the crude unit distillation process and SDA contain naturally occurring sulfur and other natural impurities such as nitrogen and metals. A treatment process is needed to remove these impurities in order to prevent them from interfering with other Facility processes and to enable the Facility to produce finished fuel blendstocks and products that comply with stringent fuel standards, such as Ultra Low Sulfur Diesel and California's clean fuel gasoline standards (California Air Resources Board [CARB] Gasoline).

The treatment process is conducted in one of the five Facility hydrotreaters listed below. Each hydrotreating unit uses hydrogen, as hydrotreatment involves the chemical reaction of hydrogen with hydrocarbon compounds in the presence of pressure, heat, and a catalyst, to treat different fractions of the crude oil. The five hydrotreaters are as follows:

- Naphtha hydrotreater—treats naphtha, a lighter-end fraction of crude oil, from the crude unit.
- Jet hydrotreater—treats jet fuel from the crude unit.
- Diesel hydrotreater—treats diesel from the crude unit.
- Gasoline hydrotreater—treats heavy gasoline from the Facility's fluid catalytic cracker. See the discussion on cracking below.
- FCC FHT—treats gas oil from the crude unit/SDA unit and gas oil that is externally sourced primarily for input into the fluid catalytic cracker unit.

Of the five hydrotreaters at the Facility, only the FCC FHT is proposed to be modified as part of the Modernization Project, as described in *Chapter 3, Project Description, Section 3.3.2.1*. The Modernization Project would allow the Facility to process crude oil blends and gas oils with higher sulfur content. This has the potential to affect the mechanical integrity of the hydrotreating units, depending on process conditions, such a temperature. The potential impact of increased sulfur on the mechanical integrity of the hydrotreating units is discussed in *Section 4.13, Public Safety*.

The Modernization Project would significantly modify the sulfur removal process, which occurs during this part of the refining process. The treatment process also removes nitrogen, which bonds with hydrogen to form ammonia (NH_3). See *Section 4.3, Air Quality* for further discussion.

4.0.3.3.1.3 *Conversion: Cracking Remaining Heavier Hydrocarbon Molecules into Lighter Hydrocarbons*

After hydrotreating to remove natural impurities including sulfur and metals, many of the crude oil fractions processed by the Facility are suitable for blending (discussed below) prior to sale as products (e.g., gasoline blendstock, diesel, jet fuel, etc.), or are ready to be blended into specialty products (e.g., lubricant base oils).

In order to produce gasoline, diesel, and other high demand petroleum products, the gas oil fractions or imports, some of which have been hydrotreated by the FCC FHT, must undergo an additional refining process. This additional refining process thermally or chemically cracks the long chains of hydrocarbon molecules that comprise these heavy hydrocarbon fractions.

The Facility uses two types of cracking technology: catalytic cracking and hydrocracking.

The Facility's catalytic cracking unit is called the fluid catalytic cracker. The fluid catalytic cracker unit receives gas oil from: (1) the FCC FHT; and (2) imported gas oil or crude already low in sulfur. The fluid catalytic cracker unit uses high temperatures and catalysts (made up of small particles that behave fluidly) to convert or crack gas oils into light products.

As described in *Chapter 3, Project Description, Section 3.3.2*, the fluid catalytic cracker would continue to operate within its existing operating range, and no modifications to the fluid catalytic cracker are proposed in the Modernization Project. Any increases in the sulfur content of the gas oil fractions from the

Facility's crude unit as a result of the Modernization Project would be removed by the FCC FHT. Thus, the fluid catalytic cracker would not receive increased sulfur levels following construction and operation of the Modernization Project.

4.0.3.3.1.3.1 *Hydrocracking (TKN Isomax Unit)*

The second method of cracking used at the Facility, hydrocracking, involves chemical reactions between hydrogen gas and hydrocarbons, in the presence of a catalyst, and under high pressures on the order of 1,000 to 3,000 pounds per square inch. The Facility's hydrocracker is called a TKN Isomax.

The hydrocracking in the Facility's hydrocracker is a two-stage process that removes impurities from gas oil in the first stage) and then cracks the gas oil in the second stage. The first stage within the hydrocracker receives the lighter gas oils produced by the crude unit in addition to externally sourced gas oils.

As part of the Modernization Project, one of the hydrogen compressors at the hydrocracker would be modified by installing a faster steam turbine to handle the lower-density (purer) hydrogen available from the new hydrogen plant. In addition, as discussed below, the existing burners on three of the hydrocracker furnaces would be modified with new low nitrogen oxide (NO_x) burners. (The rest of the hydrocracker furnaces are already equipped with low NO_x burners.) No other modifications to the hydrocracker are proposed in the Modernization Project.

The hydrocracker throughput capacity would not change as a result of the Modernization Project. However, the Modernization Project would give the Facility flexibility to process crude oil blends and gas oils with higher sulfur content. Depending on process conditions such as temperature, construction and operation of the Modernization Project could affect the mechanical integrity of the hydrocracker. This potential impact is discussed in *Section 4.13, Public Safety*. Nonetheless, the TKN hydrocracker is designed for a range of sulfur in the feed, and the sulfur composition and quantity after the Modernization Project would be within the existing operating ranges for this unit.

4.0.3.3.1.4 *Reforming: Increasing Octane Levels in Gasoline*

Reforming is a process primarily designed to increase the octane of the gasoline blend pool. The reforming process in the Facility is conducted in one of two reforming process units (called catalytic reformers, or the #4 and #5 rheniformers).

The reforming process takes a previously hydrotreated feed that is in the gasoline weight range but has low octane and, using hydrogen in the presence of

catalyst, reforms its molecular structure into higher-octane gasoline molecules. Although hydrogen is used in the reforming process, the process yields a net increase in hydrogen that can be used in other processing units throughout the Facility.

The catalytic reformers would not be physically modified by the Modernization Project, and no operational impact to the catalytic reformers is expected to result from the Modernization Project since any added sulfur from higher sulfur crude oil blends processed is removed by the naphtha hydrotreater and hydrocracker that feed the catalytic reformers.

4.0.3.3.1.5 *Specialty Facility Operations: Lubricant Base Oil Production*

The Facility is a major national producer of lubricant base oils. This requires a specialty process consisting of gas oil hydrocracking and hydrofinishing. Gas oil from the crude unit is routed to the lube unit hydrocrackers, which use hydrogen in the presence of catalyst to produce material used as input to the lube hydrofinishers. The lube hydrofinishers also use hydrogen to treat this material and ultimately produce a base oil blendstock that would be mixed with other base stocks to produce lubrication oil with the desired physical properties such as viscosity and density.

The Modernization Project would not affect the physical equipment, operation, or quantity and range of lubricant base oils produced by the Facility. However, since the Modernization Project would give the Facility flexibility to process crude oil blends and gas oils with higher sulfur content, it is possible that, depending on the process conditions such as temperature, the Modernization Project could affect the mechanical integrity of some of the Richmond lube oils plant units. This potential is discussed in *Section 4.13, Public Safety*. Nonetheless, the Richmond lube oils plant is designed for a range of sulfur in the feed, and the sulfur composition and quantity after the Modernization Project would be within the existing ranges for this unit.

As with other hydrogen-consuming units throughout the Facility, hydrogen compressors serving the lube oil units would be modified by adding faster motors to accommodate the lighter, purer hydrogen stream. No other modifications are proposed to the lube oil units.

4.0.3.3.1.6 *Blending and Final Product Production Process*

The above-described Facility processes produce hydrocarbon products ready for shipment, as well as hydrocarbon fractions that require blending with other hydrocarbon fractions before being ready for shipment as products. As described above, the Facility imports a small amount of blendstocks to be used in making

final products that leave the Facility. The Facility imports two main types of blendstocks, a fuel oil blendstock called cutter, and light product blendstocks, both of which are imported over the Long Wharf. Once on site, blendstocks are not processed by the Facility, but rather serve as one of the components when mixing other Facility produced blendstocks into finished products. All of the Facility's hydrocarbon products are produced either by one or more of the Facility process steps described above, or by blending cutter or blendstock with refined hydrocarbons produced by one of the Facility process steps described above. Consequently, the removal of sulfur and other impurities in the Facility's feedstock has already taken place prior to blending occurring. The Modernization Project would not modify the blending processes at the Facility.

A list of Facility products is provided in Table 4.0-1. How much of any particular product is produced varies based on market factors, but the Facility has consistently served as a primary supplier of gasoline, jet fuel, and lubricant base oils in the region.

4.0.3.3.2 *Hydrogen Production*

Chapter 3, Project Description, Section 3.3.1 describes the Facility's production and use of hydrogen. As described, hydrogen plays an important role in many of the Facility processes, including in the catalytic processes for removing sulfur in the hydrotreater, breaking bonds and forming new bonds in the hydrocracker, and cracking and treating the lubricating oils. Hydrogen gas is produced on site in an existing hydrogen plant as well as from the catalytic reformers (#4 and #5 rheniformers). The Modernization Project would replace the existing hydrogen production facility with a new, more energy-efficient one capable of producing purer hydrogen.

The new hydrogen plant would be designed with pressure swing adsorption technology, and it would produce a higher quantity of hydrogen (244 million scfd versus 181 million scfd) and a purer hydrogen stream (99% instead of the existing 94% pure). In addition to the hydrogen produced at the hydrogen plant, the new hydrogen recovery unit would be permitted to recover 50 million scfd of hydrogen. The new hydrogen plant would thus be permitted to generate up to 294 million scfd of hydrogen gas, an increase in production and recovery capacity of 63 million scfd from the existing plant. This increase in hydrogen gas is needed to provide the Facility with the flexibility to remove larger quantities and higher concentrations of sulfur in feedstocks that may be refined following construction and operation of the Modernization Project. In some operational circumstances, the Facility itself may use all or most of the hydrogen production capacity of the new hydrogen plant. However, there may be other circumstances

TABLE 4.0-1 FACILITY PRODUCTS

Gasoline	Gasoline made at the Facility is a blend of many components produced in various Facility processes. The Facility primarily produces three grades of motor gasoline, differentiated by octane, by blending the many components produced at the various Facility units. Each component has different properties that, when blended in the correct proportions, results in a product that meets the CARB or federal specifications for motor gasoline.[a]
Aviation Gasoline	The Facility produces aviation gasoline used in non-jet fuel planes that meet or exceed stringent requirements for worldwide fuel handling and products standards set by industry and government groups.
Jet Fuel	The Facility produces jet fuels that meet or exceed stringent requirements for worldwide fuel handling and products standards set by industry and government groups.
Diesel	The Facility produces Chevron's Ultra Low Sulfur Diesel fuel that meets federal and state fuel regulations and can be used in all diesel engines.[b]
Lubricant Base Oils	Base oils are the primary ingredient in oil and grease (e.g., grease typically has 70–94% base oils, with the remaining ingredients consisting of various types of additives)
Liquefied Petroleum Gas/ Propane	The Facility produces liquefied petroleum gas (propane) to serve the local California market.
Fuel Oil/Blend Stock	The heaviest component of crude is residuum, which is blended with stock from the fluid catalytic cracker cracking process and/or imported cutter to produce an industrial fuel oil blendstock or bunker fuel, which is sold as blendstock to be used as fuel for ships.
Polypropylene Tetramer	Propylene tetramer is a branched olefin produced by the polymerization of propylene. Propylene tetramer is used in the production of many different specialty products. The Facility does not make any of those specialty products but sells the tetramer to specialty chemicals manufacturers.
Ammonia	Nitrogen in the feeds to the Facility is converted to NH_3 in the hydrotreating and hydrocracking processes, and this NH_3 is recovered for use in the Facility and sale to fertilizer manufacturers.
Sulfur	Sulfur is a building block of many chemical processes in manufacturing materials, such as fertilizers. Sulfur in the form of hydrogen sulfide gas is recovered from the hydrotreaters and hydrocracker, and then converted in the sulfur recovery unit into elemental sulfur (stored in heated tanks as a liquid to prevent solidification of the sulfur) for sale to fertilizer manufacturers and other customers.

[a] California reformulated gasoline: Finished motor gasoline formulated for use in motor vehicles, the composition and properties of which meet the requirements of the reformulated gasoline regulations promulgated by the CARB. This type of finished gasoline usually contains 5.7% ethanol as an oxygenate or in a few areas may contain no oxygenate. This category excludes California reformulated gasoline blend stock for oxygenate blending.

[b] CARB Ultra Low Sulfur No. 2 Diesel Fuel: No. 2 diesel fuel that has a sulfur level no higher than 0.0015% by weight (15 ppm) and the aromatic hydrocarbon content is limited to 10% by volume. This fuel meets specifications adopted by CARB in 2003. It is used primarily in motor vehicle diesel engines for on-highway and off-highway use. This fuel replaced CARB Low Sulfur Diesel (500 ppm sulfur) in June 2006.

in which excess hydrogen from the plant is available for sale and export to third parties, such as other refineries.

4.0.3.3.3 *Other Facility Processing Operations*

Appendix 3, Overview of Oil Refining Process describes the core processing units at the Facility. The Facility also includes other major equipment and activities that are integral to Facility operations but not technically part of the Facility's process for producing products. Other major categories of Facility operations described in this section include the Facility's flaring system, power plant and cogeneration units, wastewater treatment plants, storage tanks, and transportation methods for receiving feedstocks and shipping products at the Facility.

4.0.3.3.3.1 *Furnaces*

Heating devices provide heat to various liquid or gas streams such as water, process streams (e.g., crude oil), or air. In general, these heating devices are referred to as furnaces or process heaters. A component of these heating devices is a burner assembly, which is where the fuel (i.e., natural gas or refinery fuel gas) is combusted with oxygen from the air to form a flame and hot combustion gases. The combustion process for all heaters produces air pollutants. The pollutants produced depend on the chemical composition of the fuel and combustion air and can include CAPs, TACs, and greenhouse gases.

The Modernization Project includes the installation of two new reaction furnaces for the new hydrogen plant and decommissioning of feed and reaction furnaces of the existing hydrogen plant. In addition, the Modernization Project would include replacement of burners in five existing process heaters (located in the hydrocracker plant and the poly plant with new low-NO_x emitting burners).

4.0.3.3.3.2 *Heat Exchangers*

A heat exchanger is a piece of equipment whereby a hotter process stream transfers heat to a cooler process stream. The two process streams do not come into direct contact with each other (i.e., they are not mixed). Rather, they are generally separated by a metal wall that conducts the heat from one stream to another. Heat exchangers are designed such that the surface area of the wall separating the two streams is maximized in order to maximize the amount of heat transferred. There are no emissions associated with heat exchangers because there is no combustion occurring. For example, the hot gases that exit the sulfur recovery unit enter into a heat exchanger where it transfers heat to a stream of water, converting the water to steam.

The Modernization Project includes the installation of new heat exchangers and modification of existing heat exchangers at the FCC FHT, in order to process higher volumes of gas oil through that unit (an increase of 65,000 barrels per day to 80,000 barrels per day as described above).

4.0.3.3.3.3 *Flares*

The Facility is designed and operated so that there will be an optimum balance between the rates of gas production and consumption within the processing units. Under normal operations, gases that are not recovered as products (predominantly methane, ethane, and hydrogen) are routed to the Facility fuel gas system, allowing them to be used for combustion in Facility heaters and boilers. The Facility's fuel gas systems are configured so that the fuel gas pressure is maintained by making up with purchased natural gas to meet the Facility's fuel demand. This provides a simple way to keep the system in balance so long as gas demand exceeds the volume of gaseous products produced.

A header for collection of vapor streams is included as an essential element of nearly every Facility process unit. At the Facility, these are typically referred to as relief gas headers, since the system, which is generally at near-atmospheric pressure conditions, receives gases relieved from higher pressure operations within the unit. The primary function of the relief gas header is safety. Each relief gas header has connections for equipment depressurization and purging related to maintenance turnaround, startup, and shutdown, as well as pressure relief devices and other safety control valves to handle upsets, malfunctions, and emergency releases.

The main relief gas header is connected to both a flare gas recovery system and to one or more flares. Normally all vapor flow to the relief gas header is recovered by flare gas recovery compressors, which increases the pressure of the flare gas allowing it to be first routed to gas treatment for removal of contaminants such as sulfur, and then delivered to the Facility fuel gas system. Gas in excess of what can be handled by the flare gas recovery compressor(s), the treatment systems, and/or the fuel gas system end users flows to a Facility flare so it can be safely combusted.

The Facility currently operates two flare gas systems, and associated Flare Gas Recovery, one covering the North Yard of the Facility and the other covering the South Yard. The existing hydrogen plant is connected to the South Isomax flare. With the Modernization Project, that existing connection would be dismantled and would be replaced with the addition of a new flare for the new hydrogen plant. The new hydrogen plant flare would have a dedicated emergency flare to ensure no impact on the existing relief system during hydrogen plant startup,

shutdown, emergencies, upset, or breakdown. Consistent with the BAAQMD Best Available Control Technology guidelines, the new hydrogen plant would use an elevated flare, with staged combustion, having a precursor organic compound destruction efficiency exceeding 98%.

The utilization of the existing South Isomax flare would be reduced once the existing hydrogen plant is disconnected, but the flare would remain in service to serve other equipment that would remain connected to the flare.

No modifications are being made by the Modernization Project to existing Facility equipment that would significantly increase the frequency of routine flaring activity. The efficiency and operational reliability of the new hydrogen plant and other improvements being made would be greater than that of the old hydrogen plant being shut down. Additionally, the advanced technology of the new flare system would ensure a higher level of safety. As a result, the Facility would be anticipated to have less overall flare activity in its daily operation.

4.0.3.3.3.4 *Power and Steam Generation, Including Boilers*

The Facility is designed to generate most of the power it needs to operate on site. During the baseline period of 2008-2010, the Facility imported a net average of approximately 2 megawatts (MW) of electricity, compared to a total of approximately 115 MW of electricity generated by the Facility.

Electric power is generated at the Facility by two gas turbines, one steam turbine generator, and the fluid catalytic cracker power recovery system. The gas turbines generate electricity through the combustion of fuel, which moves the blades of a turbine, providing mechanical power to operate the electric generator.

A steam turbine generator creates electricity when higher pressure steam is reduced to lower pressure steam, resulting in mechanical power to operate the electric generator. Steam is produced by two heat recovery steam generators at the cogeneration plant as well as five fired boilers in the No. 1 power plant.[11] (The combination of the gas turbines, the heat recovery steam generators, and the duct burners comprise the cogeneration plant.)

Steam is also generated by process units throughout the Facility, by using the heat generated in the processes to convert water into steam. In addition to being used to generate electricity in the steam turbine generator, steam is also piped

[11] The five boilers are called the No. 1 power plant because the unit was built in 1937. Today, the No. 1 power plant consists of boilers only and generates only steam power.

throughout the Facility and is injected into various processing equipment to be used for heating in the refining process (similar to radiator heat in a house) or for direct contact with hydrocarbons during the refining process.

The Facility uses approximately 2,500,000 pounds of steam per hour, and the boilers in the No. 1 power plant generate only about 10% of that amount; the remaining steam is produced by Facility processes. No modifications to the No. 1 power plant or cogeneration plant are proposed as part of the Modernization Project.

The new hydrogen plant and hydrogen recovery equipment would use approximately 15 MW of power at full capacity. However, this power would be at least partially supplied by a new condensing/extracting steam turbine located at the new hydrogen plant. Up to 300,000 pounds per hour of high-pressure steam is generated in the new hydrogen plant as a byproduct of the process. A portion of this high-pressure steam is extracted and condensed across a steam generator, resulting in electricity generation. The new condensing/extracting steam turbine can generate up to 17 MW net of electrical energy, capable of fully supplying the entire hydrogen plant and hydrogen recovery equipment electrical requirements, with the balance sent to the other parts of the Facility to meet the Facility's electrical needs.

The other portion of the new hydrogen plant high-pressure steam production is sent elsewhere in the Facility to meet the Facility's steam needs. Approximately 6 MW of additional steam-generated power would be generated when the high-pressure steam is let down to lower pressures across the Facility cogeneration unit steam turbine generator at full hydrogen plant use.

The Facility's power generation and balance are further described in *Section 4.6, Energy*. The Modernization Project will have no impact on the import of electricity.

4.0.3.3.3.5 *Cooling Towers*

Process streams require cooling that is usually provided by water in a heat exchanger. Water that picks up heat in the process is sent to a cooling tower where the water is dispersed into thin streams through which air is passed. The air evaporates a small amount of the water and the evaporation cools down the water, which is then pumped back to the heat exchanger again for reuse. The Facility currently has eight cooling towers. The Modernization Project does not propose any physical changes to these towers, but does not add a new cooling water tower at the hydrogen plant.

4.0.3.3.3.6 *Storage Tanks*

The Facility currently operates approximately 160 aboveground storage tanks (including pressurized spheres) containing raw materials, feedstocks, intermediate material, and final products. There are a number of small auxiliary tanks located throughout the Facility that are not depicted as part of the simplified Facility flow process diagram.

The tanks range in capacity from under 1,000 barrels to over 650,000 barrels. Over long periods of time (e.g., annually) the average amount of material stored in tanks is approximately constant, but the quantity of material flowing through the tanks on any given day increases or decreases as the feedstock tanks are emptied into the Facility (or product is produced by the Facility feed rate and production volumes change).

The change in Facility capacity of approximately 1,200 barrels per day of gas oil after installation of the Modernization Project would cause a corresponding increase in flow through certain storage tanks. This increase is small when compared to the existing total flow through these tanks. This EIR analysis considers the flow through storage tanks in a variety of post-Modernization Project cases relative to the baseline.

4.0.3.3.4 *Transportation*

Facility operations include transporting crude oil, gas oil feedstocks, cutter, blendstocks, products, and other materials from around the world to the Facility. Operations also include transporting products, cutter, blendstocks, gas oil feedstocks, and other materials from the Facility to customers and markets in California, other Western states, and to a lesser extent, other global locations.

Modes of transportation include ships and barges, pipeline, rail car, and tanker trucks. Ships and barges are escorted to and from the Facility wharf and through San Francisco Bay by Bay Area-based tug boats. The Modernization Project would not involve any physical changes to these shipping activities, except that the environmentally beneficial Modernization Project components, included as mitigation measures, would involve modifying shipping equipment, including the new ships described in *Chapter 3, Project Description, Section 3.3.3.4*. Rail cars are transported through the Union Pacific and Burlington Northern Santa Fe rail yards adjacent to the Facility. Tanker trucks primarily transport materials to and from the Facility at the co-located Richmond Marketing Terminal and Richmond Lubricants Packaging Plant.

The EIR analysis considers the transportation of all materials in to and out of the Facility in a variety of post-Project cases relative to the baseline.

4.0.3.3.4.1 *Inbound Transportation*

The bulk of inbound transportation is for crude oil and gas oil, and to a much lesser extent blendstocks, from ships and barges that dock at the Long Wharf.

Other inbound materials include liquefied petroleum gases (LPGs), lubricant base oils, lubricant additives, and fuel additives. LPGs primarily arrive at the Facility by rail car and occasionally by trucks. Lubricant base oils and lubricant additives arrive at the co-located Richmond lubricants packaging plant by rail car and trucks. Fuel additives are brought into the co-located Richmond marketing terminal by trucks.

The Modernization Project would enable oxygen enrichment of the air used in the sulfur recovery units process. This additional oxygen would be transported into the Facility by truck and therefore would increase truck traffic. All other inbound transportation volumes and traffic are independent of the Modernization Project but generally fluctuate with Facility utilization.

4.0.3.3.4.2 *Outbound Transportation*

The bulk of outbound transportation is for light products (gasoline, aviation gas, jet fuel, diesel, and tetramer). Chevron exports much of its light products on ships and barges that dock at the Long Wharf. The remaining light products are transported via pipeline and truck.

Other outbound petroleum products include cutter, blendstocks, gas oils, LPGs, lubricant base oils, lubricants, and NH_3. Gas oils and blendstocks are transported via ship and barge and pipeline. LPGs are transported via truck and rail car. Lubricant base oils are transported via ship and barge, truck, and rail car. Lubricants are transported via truck and rail car. Ammonia is transported via rail car.

The Modernization Project would increase the amount of elemental sulfur the Facility can produce, and likewise could increase truck traffic related to sulfur transportation. All other outbound transportation volumes and traffic are independent of the Modernization Project, but generally do fluctuate with the Facility utilization.

4.0.3.3.4.3 *Rail Transport*

Rail traffic at the Facility includes both inbound and outbound rail transportation. In a representative year, the materials transported by rail are LPGs, lubricant base oils, lubricants, lubricant additives, and NH_3. From baseline to date, the Facility did not receive gas oils or crude oil by rail. In order to receive gas oils or

crude oil by rail for use as continuous feedstock, the Facility would at a minimum require equipment additions and/or modifications that are not part of the Modernization Project. The Facility currently has no plans to pursue a project that would enable it to import crude or gas oil by rail (Chevron Data Transmittal #36G (Rev #1), 2013).

4.0.3.3.5 *Facility Maintenance Activities*

Operation of the Facility requires ongoing, routine, and preventative maintenance activities to ensure that process units operate safely, reliably, and efficiently within their intended design parameters. These maintenance activities are also essential for continued production of products that meet quality and regulatory specifications. Regular maintenance activities include inspecting pipelines, steel chambers, and vessels where refining process activities occur, along with equipment such as valves, flanges and pumps, and electrical equipment. Further information about safety programs and practices is provided in *Section 4.13, Public Safety*. In addition to routine, ongoing maintenance activities, scheduled large-scale maintenance turnarounds are also necessary. A turnaround is a scheduled shutdown of a Facility process unit or group of process units for a predetermined length of time for the purpose of performing maintenance repairs, compliance equipment inspection, boiler recertification, and capital projects that cannot be performed while the unit is on line. Turnarounds are considered major when significant portions of the Facility (i.e., several process units) are shut down for extended periods of time (3 to 6 weeks). Minor turnarounds affect fewer units or smaller portions of the Facility for shorter periods of time (1 to 2 weeks).

During a turnaround, the process unit is shut down; isolated from other units, utility systems, and other energy sources; and then it is opened, cleaned, inspected, and repaired as needed. In some cases, catalyst may be replaced or regenerated, and modifications or tie-ins for anticipated future modifications may be made.

To reduce the disruption to Facility operation, turnarounds are typically planned well in advance, sequenced in a logical order, and limited to work that cannot be performed while the process units are on line. All work is defined about a year before the turnaround date.

The time between turnarounds at each process unit varies from 9 months to 5 years, depending upon the equipment. As a result, there is typically some turnaround activity in the Facility almost every quarter.

Since many process units are integrated with one another, turnarounds are often grouped; i.e., several process units are taken down together. This grouping, referred to as clustering, is based on bringing down units that depend closely upon the operation of other units (e.g., a unit that produces feed for or processes products generated by another unit will often be brought down together with the dependent unit). A major cluster turnaround typically has a large impact on Facility operations, but it is a lesser impact than would occur if the units were to be taken down individually. Major cluster turnarounds can last up to 6 weeks.

In other cases, only a single process unit may be brought down. For example, in a plant with redundant process units, only one may be brought down at a time. This results in a lower impact on Facility operations because the other plant(s) of the same type continue in operation.

Similarly, some cases allow for only part of a process unit to be shut down. For example, in a plant with multiple reactors, a single reactor or train of reactors may be shut down to replace or regenerate catalyst while the remainder of the plant continues in operation.

Planning for a turnaround includes ensuring all necessary supplies and equipment are on site and available when needed. Facility maintenance and technical staff, and additional contract maintenance staff, work in shifts up to 24 hours per day to minimize the duration of a turnaround.

Following construction of the Modernization Project, the turnaround scheduling process would remain generally the same as present.

4.0.4 References—Environmental Setting, Impacts, and Mitigation Measures

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4.1 AESTHETICS, VISUAL QUALITY, LIGHT, AND GLARE

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) changes to relevant plans and policies, including the adoption of a new Richmond General Plan. These revisions do not change the 2008 EIR's conclusions that there are no significant adverse aesthetic, visual quality, or light and glare impacts for the Modernization Project.

IMPACT SUMMARY

- The aesthetics, visual quality, and light and glare impacts that would result from the implementation of the Modernization Project would be less than significant.
- The Modernization Project would primarily be developed within the Refinery Process and Tank Farm areas, which are part of an active industrial facility that has been in operation for more than 100 years. Development within this industrialized area would not significantly affect any scenic vistas or scenic resources.
- The Modernization Project would not substantially degrade the existing visual character or quality of the Facility and its surroundings, as the modifications that would occur as a result of the Project would generally not be noticeable from outside of the Facility and would be consistent with the character of the existing Facility.
- The Project would not significantly alter existing light and glare conditions on the Project site.
- Flaring events and water vapor plumes associated with the Project would not create significant visual or aesthetic impacts.

4.1.1 Introduction

This section includes a description of existing visual conditions and an evaluation of potential aesthetic impacts associated with construction and operation of the Modernization Project.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the

Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities. For example, as described in *Chapter 3, Project Description*, *Section 3.3* construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

Computer-generated visual simulations illustrating "before" and "after" visual conditions at the Facility as seen from eight representative vantage points are included and discussed as part of this analysis. In addition to daytime views of the Facility, nighttime views from the six representative vantage points from which the light-emitting diode (LED) lights can be seen simulate the conversion to LED lighting included as an emission reducing Project Design Feature (Transmittal #48B, 2013). Digitized photographs and computer modeling and rendering techniques were utilized to prepare the simulation images, which are based on plans and Modernization Project drawings provided by the Project applicant. Additionally, an assessment of visible water vapor plume formations associated with Refinery Operations has been included as part of this analysis.

4.1.2 Setting

4.1.2.1 Regional and Project Setting

4.1.2.1.1 *Visual Character*

The assessment of visual attributes and patterns of setting features in this report is organized according to the following general descriptive categories: site location and spatial organization; land form; land use; vegetation; surface waters; and light and glare. Flare emission visibility as well as water vapor are also addressed. The Project site does not contain any individual structures or natural features (e.g., heritage trees) that have aesthetic significance.

Atmospheric and lighting impacts influence the existing site character to a relatively limited degree. In addition to evaluating the components of the Facility's existing visual character, this analysis discusses available views of the Facility from various public viewpoints.

4.1.2.1.2 *Site Location and Spatial Organization*

The approximately 2,153-acre Project site occupies a substantial area of western Richmond including a major portion of the Point San Pablo Peninsula. The Facility is bordered by Interstate 580 (I-580) to the south; Point Molate and San Francisco Bay to the west; the San Pablo Bay waterline and the terminus of Point San Pablo Peninsula including Terminal 4 (no longer in use), an active landfill site to the north; and industrial developments including the Santa Fe Intermodal Facility and rail yards to the north and east. In addition to the Point Richmond residential area to the south, residential neighborhoods of Central and North Richmond are located further east and north of the Project site. Santa Fe and Atchison Village neighborhoods are approximately 0.75 and 0.25 mile east of the Project site boundary. North of Atchison Village, the Iron Triangle neighborhood's western edge ranges from approximately 0.25 mile to 1 mile east of the Project site. Shields-Reid neighborhood is approximately 0.25 mile east of the Project site and Parchester Village is approximately 1.75 miles northeast. The Project site is situated at the eastern terminus of the Richmond-San Rafael Bridge.

The entire Project site occupies an expanse of low-lying land next to the Bay, including marsh and mudflat areas, and the northwesterly trending Point San Pablo Peninsula that protrudes into the San Pablo Bay waters. A northwesterly trending ridge extends at elevations up to approximately 380 feet above mean sea level though the Facility and along the Peninsula, visually terminating along the water line at the northwestern tip of the Point San Pablo Peninsula. The ridge affords prominent views, screens parts of the Facility in views from the south and west, and provides a major element of visual contrast to the lower-lying areas surrounding the Facility property. Unobstructed views of the Facility facilities along the northeastern slopes and the crest of the ridge are generally available from viewpoints to the east and northeast; development to the southwest of the ridgeline is not visible from those points. Similarly, visual features of the southeastern portion of the Facility are highly prominent from viewpoints to the south and east, although the ridge obstructs most views of the Facility to the north and west of the ridge. A visual corridor extends northerly from the I-580 freeway, affording relatively open, mobile views of the Facility to motorists. The corridor is defined by the 380-foot-high ridge to the west and intervening development to the east (which, in concert with a drop in roadway elevation, obstructs further views of the lower elevations of the Facility). The corridor

focuses views of the southeastern Bay Plain area of the Facility, with San Pablo Bay views and northern Richmond Hills in the background. The marine terminal and wharf (Long Wharf) are located on the southern boundary of the Project site on San Francisco Bay. The Long Wharf is over 1 mile long and receives and unloads crude oil and other raw materials, and serves for loading of refined products produced at the Facility for shipment elsewhere.

4.1.2.1.3 *Landform*

Landform substantially determines the overall sense of visual space in the vicinity of the Project site and frames and focuses major views of the Facility. As discussed above, there are two major component landform types: Bay Plain, occurring mostly in the eastern and northeastern portions of the Project site (primarily comprised of the Refinery Process Area); and hills, occurring along the southern portion of the Project site and along the axis northwesterly of the Peninsula (primarily comprised of the Tank Farm Area). The Bay Plain areas north of the Project site are generally undeveloped marsh and Bay mudflats (and are covered with seasonal plants and water). Adjacent to the ridge, the Bay Plain is developed with heavy-industrial facilities, equipment, and ancillary land uses such as storage areas and oxidation ponds. Visible along either side of the ridge itself are heavy-industrial facilities, most prominent among which are more than a dozen large cylindrical storage tanks. The ridges appear partially developed, as Tank Farm Area occupies the slopes along with grasses, shrubs, and trees.

4.1.2.1.3.1 *Land Uses*

The Project site occupies a substantial area of western Richmond, including a major portion of the Point San Pablo Peninsula. Major surrounding land uses include heavy industrial facilities, residential developments and open space. The area west of the Project site includes the Point Molate and Castro Ranch areas and undeveloped open space; there are plans to provide public access to this area through extension of the Bay Trail as well as some mixed-use development in the future.

4.1.2.1.3.2 *Vegetation*

Existing vegetation on the Project site is a positive visual component that helps minimize the industrial character of the Facility and provides visual buffer in areas between the heavy-industrial uses of the Facility and the visually prominent natural features surrounding it, including Bay waters, marshes and hills. From off-site viewpoints, the ridges appear naturally vegetated in places not occupied by storage tanks or related facilities. Vegetation on the slopes includes grasses and shrub species, such as coyote brush, French broom and toyon, and trees, including Monterey pine and eucalyptus. The hillside vegetation both minimizes

the appearance of industrialization along the Point San Pablo Peninsula and partially obstructs some views of industrial equipment. The marshes and mud flats in the northern portion of the Project site include a range of vegetation typical of that habitat, including cattails and pickleweed. These plants are generally grayish brown except during the growing season, late summer to early autumn, when they exhibit shades of green.

4.1.2.1.3.3 *Surface Waters*

Surface water surrounding the Project site provides a dominant visual element in the field of view and contrasts with the industrial nature of the Facility. The waters to the west, north, and south of the Project site provide a distinct visual edge to the industrialized peninsula. The Project site is surrounded by San Francisco Bay waters to the south and southwest and San Pablo Bay waters to the north and northwest. Tidal waters and marshlands extend directly north of the Point San Pablo Peninsula. The salt marshes covering the northern area of the Project site are subject to some tidal flooding and contain pools of surface water throughout the year. In addition to providing a visual edge to the Facility, Bay waters accentuate views of the Facility by providing extended unobstructed surfaces across which the Facility can be seen from great distances. Wildcat Creek is a meandering channel that runs westerly across the Wildcat marsh area to Castro Creek, which in turn runs northerly between marshland and mud flats to San Pablo Bay.

4.1.2.1.3.4 *Light and Glare*

At night, the Facility constitutes the principal outdoor illumination source in the western Richmond area. Night lighting at the Facility consists of flood lighting that provides illumination for general and non-process areas, and focused or spot lighting in operation areas that require higher light intensities.

Glare is produced on the Project site in places where reflective surfaces are exposed to direct or indirect lighting. Glare is most noticeable during the day, when surface water, metallic or brightly colored surfaces of processing facilities, tanks, pipes, equipment, vehicles, and windows may all reflect sunlight. Because of the Project site's location adjacent to San Francisco and San Pablo Bays, which are themselves expansive open reflective surfaces; site glare is diminished in its relative prominence in the vicinity of the west Richmond area.

4.1.2.1.3.5 *Flare Emission Visibility*

Flares play a critical safety role in Refinery Operations. Chevron has identified situations or activities likely to cause flaring, including releasing gases to prevent equipment from becoming over pressured. A "flare" is typically a tall stack that is

a safety combustion device designed to provide relief by burning combustible gases in a controlled manner with an open flame. This flare technology is designed to very quickly and very efficiently consume hydrocarbon gas, with minimal air pollution (see *Appendix 3, Overview of Oil Refining Process,* for a more detailed explanation).

Flaring could have visual impacts, depending on the magnitude of the flaring event, existing atmospheric conditions, and the time of day (or night) of the event. The Facility had eight flaring events during the Baseline period (2008 to 2010) for which causal analyses were performed per Chevron's Flare Management Plan (Chevron Data Transmittal #36M (Rev #2), 2014). More detail regarding these events is provided in *Appendix 4.3-OP*. In addition, the Facility had seven flaring events during the years 2011 to 2012 (Chevron Data Transmittal #36M (Rev #2), 2014).

Most flaring events are minor in duration and size, and are frequently imperceptible to the public. A discussion of Facility flare emissions with respect to the Modernization Project follows in *Section 4.3*, *Air Quality*. The existing flare system, the Flare Minimization Plan, and changes to the system under the Flare Management Plan, and Modernization Project are described in more detail in *Appendix 3, Overview of Oil Refining Process at Chevron Richmond Refinery.*

4.1.2.1.3.6 *Water Vapor Plume Visibility*

Whenever steam is used in manufacturing processes, water vapor plumes are formed. At the Facility, steam is generated and used in many process units. Sometimes, depending on the Refinery Operations, excess steam is vented in various parts of the Facility. Water is used to cool other Facility process streams and is itself cooled in Facility cooling water towers so that it can be reused, leading to the potential for visible water vapor plumes to be formed.

The formation of visible water vapor plumes from Facility cooling water towers is a function of varying local meteorological conditions; including air temperature, wind speed and atmospheric humidity, as well as variation in the actual Facility process itself. These plumes typically appear directly emanating from the cooling water towers. Plumes of this type are generally white in color and are typically composed mostly of small, condensed water droplets. If the requisite atmospheric conditions exist (generally low temperature with calm winds and relative high humidity), it is possible for a water vapor plume to form. The plume would remain visible until the water in the plume evaporates into the local air surrounding the plume. The plume would extend away from its formation point flowing downwind in the direction of the local wind flow. As it moves it may spread out both vertically and horizontally, dependent again on the existing local

meteorological and process unit conditions. In actuality, plume formation/ dissipation is a continuous process of creation, movement, and dispersion and is typically of short duration.

4.1.2.1.4 *Scenic Highways and Local Scenic Vistas and Resources*

California's Scenic Highway Program was created in 1963, and the scenic highway designation serves to protect and enhance California's natural scenic beauty and to protect the social and economic values provided by the State's scenic resources. Interstate 80 (I-80) and I-580 are not designated as Scenic Highways within the City of Richmond, according to California Scenic Highway mapping system.

The Richmond General Plan 2030 (General Plan 2030) states that surrounding hills and the San Francisco and San Pablo Bays are prominent scenic areas in Richmond, but does not formally identify any specific scenic vistas or resources.

4.1.2.2 Public View Locations and Corridors

4.1.2.2.1 *Public View Locations*

View corridors are formed by physical elements, such as buildings, that guide lines of sight and control view directions available to pedestrians and motorists. View corridors include the total field of vision from a specific viewpoint. Public view corridors are areas in which views are available from publicly accessible places, such as city streets, parks, and other public spaces.

The Facility is visible from many public view locations. Photographs were taken at eight representative public viewpoints, as shown on Figure 4.1-1, Viewpoint Location Map and described, starting under Section 4.1.2.2.1.1. The photographs referenced in the following discussion are available in figures located at the end of this section of the EIR, starting on page 4.1-22.

The discussion of existing view corridors considers three categories of views of the Facility: short-range (up to about 0.75 mile from the Facility), medium-range (between about 0.75 and 1.5 miles from the Project site), and long-range (more than 1.5 miles from the Project site). Representative short-range view corridors are from viewpoints along I-580 looking north and from Castro Street looking west (see Figures 4.1-2a through 4.1-5 and 4.1-10a through 4.1-10c). Representative medium-range view corridors are from two elevated viewpoints in residential portions of the Point Richmond community immediately south of the



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T38 r1, T48Ar2, T48B, and T54)

Figure 4.1-1
Chevron Refinery Modernization Project EIR
Viewpoint Location Map

Project site (from Crest and Buena Vista Avenues), and one view from a public trail along Wildcat Creek northeast of the Facility (see Figures 4.1-8a through 4.1-9). Representative long-range view corridors are available from the Richmond Parkway to the north of the Project site and from the Richmond/San Rafael Bridge to the west of the Project site (see Figures 4.1-11a through 4.12b). In addition, nighttime views are analyzed for consideration of light and glare.

On Figures 4.1-2a, 4.1-3a, 4.1-4a, 4.1-6a, 4.1-7a, 4.1-8a, 4.1-10a, 4.1-11a, photos from 2008 are included to show the Project site before partial construction of components from the 2008 Project. Photos taken in 2014 are also included to show current conditions with the partially constructed Project components.

Specific areas of the Facility are generally visible from viewpoints to the north and northeast, although views of the easternmost area of the Facility are also available from viewpoints to the south. Views of the Refinery Process Area from the west are blocked by the hills along the Point San Pablo Peninsula. Portions of the Tank Farm Area is visible from the west, but are limited due to the lack of publicly accessible viewpoints, the steep change in topography between the viewer and the Tank Farm (the Tank Farm being about 150 feet higher in elevation from the nearest viewpoints), and the location of the San Francisco Bay in this area. Portions of the Tank Farm are visible to eastbound travelers on the lower deck of the Richmond/San Rafael Bridge (I-580), but only for brief periods at freeway speeds, and these views are partially obscured by the overhead roadway deck of westbound I-580. The Long Wharf is visible from Point Richmond and the westbound Richmond/San Rafael Bridge approach from the east, and to eastbound travelers on the lower deck of the Richmond/San Rafael Bridge. The 2008 EIR included a viewpoint from the bridge, but this viewpoint has been eliminated as none of the components of the Modernization Project would be visible from the bridge.

4.1.2.2.1.1 *Viewpoint 1*

Viewpoint 1, represented in Figure 4.1-2a, shows the Facility from westbound I-580 looking north, from a slightly elevated viewpoint in Richmond. Photo 1 represents the existing conditions in 2008, prior to partial construction of the 2008 Project. Photo 2 was taken in 2014 and represents existing conditions after partial construction of 2008 Project components. This viewpoint represents a relatively short-range view of the Facility as viewed from a heavily traveled freeway. Brief glimpses of the Facility are available while driving westbound on I-580 at freeway speeds, lasting from one to two seconds in length. In the foreground, as shown on the figure, the rail yards of the Santa Fe Intermodal

Facility are visible, with wide expanses of pavement, railroad tracks, fencing, and open storage yards. In the middle ground, views of the Facility's large, low-rise industrial buildings are visible, as well as about 22 tall and narrow structures that are stacks, flares or other components of the Refinery Process Area. The existing stacks range in height from approximately 125 to 237 feet. At least four steel lattice towers that support high-voltage electrical transmission lines can also be seen. The mid-ground views from this vantage point also reveal about four storage tanks on the southeastern slopes of the hill formed by the Point San Pablo Peninsula, to the left of the photo (Chevron Data Transmittal #48A (Rev #2), 2014). As labeled on Photo 2, the partially-constructed hydrogen plant is in the background. Limited views of the hills in the distance are available from this viewpoint. Streetlamps and illuminated Facility buildings and structures are visible in the nighttime views from this viewpoint in Figure 4.1-2c, Photo 1.

4.1.2.2.1.2 *Viewpoint 2*

Viewpoint 2, represented in Figure 4.1-3a, is taken from roughly 0.5 mile east of Viewpoint 1 on westbound I-580 looking northwest. Photo 1 represents the existing conditions in 2008, prior to the partial construction of the 2008 Project. Photo 2 was taken in 2014 and represents existing conditions post partial construction of 2008 Project components. In the foreground of Figure 4.1-3a are various industrial buildings blocking much of the view of the Refinery Process Area. As shown in Photo 2, the recent installation of solar panels on the building adjacent to I-580 further blocks the view of the Refinery Process Area. In the background, several storage tanks are visible on the southeastern slopes of the hill. Due to the limited views of the Refinery Process Area from this viewpoint, no nighttime views are included.

4.1.2.2.1.3 *Viewpoint 3*

Viewpoint 3a, represented in Figure 4.1-4a, shows the Facility from Castro Street at a railroad overpass. This slightly elevated viewpoint represents a short-range view of the Facility as viewed from a nearby public roadway. Short-range views of the Facility from this location are generally obstructed by the landscaped berm to the west of Castro Street, which effectively screens most of the Refinery Process Area from view as one travels north or south on Castro Street. Short range westerly views of the Facility are only available intermittently through gaps in existing vegetation and then only briefly (less than 1 second) as one travels by automobile at arterial speeds on this portion of Castro Street, as shown in the figure. Northwesterly views from this location reveal roadside landscaping along Castro Street, with the Facility's paved yards and fencing in the immediate foreground. The Refinery Process Area is visible in middle ground views, with about 32 tall stacks or stack-like-structures, about 8 tanks, and other industrial

facilities and equipment. Numerous overhead power lines and a steel lattice tower supporting a high-voltage electrical transmission line are also in view. Distant views are limited to the elevated slopes of the southernmost hills along the Point San Pablo Peninsula. Overhead lights and illuminated Facility buildings and structures are visible in the nighttime views of this viewpoint in Figure 4.1-4c. Figure 4.1-5, Photo 1, shows the nighttime view from Viewpoint 3b, which faces farther west from Viewpoint 3a.

4.1.2.2.1.4 *Viewpoint 4*

Viewpoint 4a, represented in Figure 4.1-6a, shows the Facility from Crest Avenue looking northwest. Viewpoint 4 is an elevated viewpoint in a residential neighborhood in the Point Richmond community and represents a mid-range view of the Facility. In the foreground through the mid-ground, hillside vegetation and single family homes are visible. The 7-story Chevron Technology Center office building is visible on the right, with the Refinery Process Area appearing immediately behind this building. Tall narrow stacks and stack-like structures are visible in the background. Most prominent in this figure are the spherical storage tanks on the hillside in the mid-ground view. Due to the limited views of the Refinery Process Area from this viewpoint, no nighttime views are included.

Viewpoint 4b, represented in Figure 4.1-7a, shows the Facility from Crest Avenue looking north. In the foreground, hillside vegetation and single family homes are visible. In mid-range views, the 7-story Chevron Technology Center office building at Redwood Way and Castro Street is clearly visible in the center of the view, with the Refinery Process Area appearing immediately behind and above this building, with about 35 tall and narrow stacks and stack-like structures and white spherical tanks. About 8 steel lattice towers that support high-voltage electrical transmission lines also can be seen. The middle ground views from this vantage point also reveal about 16 storage tanks on the southeastern slopes of the hill formed by the Point San Pablo Peninsula to the left of the view shown in the photograph, as well as many of the large, low-rise industrial buildings associated with the Facility. In general, the Facility appears as an intensely developed industrial lowland set against a hillside lined with tanks and intermittent vegetation. Beyond the Facility, the West Contra Costa Sanitary Landfill is seen as a series of low hills. In the distance, views of the Bay and gently rolling hills beyond can be seen. Streetlamps and illuminated Facility buildings and structures are visible in the nighttime views of this viewpoint in Photo 1 of Figure 4.1-7c.

4.1.2.2.1.5 *Viewpoint 5*

Viewpoint 5a, represented in Figure 4.1-8a, shows the Facility from Buena Vista Avenue looking west-northwest. Viewpoint 5 is another elevated mid-range view of the Facility from a residential neighborhood in the Point Richmond community. In the foreground, hillside vegetation, single family homes, and 2- to 3-story commercial buildings along East Richmond Avenue are visible. The heavily vegetated Judge George D. Carroll Community Park is also visible in the foreground. The 7-story Chevron Technology Center office building at Redwood Way and Castro Street is clearly visible in the center of the view. The Refinery Process Area is visible right of center, with about 21 tall and narrow stacks and stack-like structures and white spherical tanks, as well as many of the Facility's large, low-rise industrial buildings. About 8 steel lattice towers that support high-voltage electrical transmission lines also can be seen. A portion of the elevated I-580 freeway is also visible in the middle ground to the far right of the view. The middle ground views from this vantage point also reveal about 32 Facility tanks on the southeastern slopes of the hill formed by the Point San Pablo Peninsula to the left of center. In the distance, views of the gently rolling hills beyond the Facility can be seen. Overhead lights and illuminated Facility buildings and structures are visible in the nighttime views of this viewpoint in Figure 4.1-8c, Photo 1.

Figure 4.1-9, Photo 1, shows a similar nighttime view looking north from Viewpoint 5b. This figure shows overhead lights and illuminated Facility buildings and structures from a more zoomed in perspective with less foliage blocking views of the Facility than Viewpoint 5a.

4.1.2.2.1.6 *Viewpoint 6*

Viewpoint 6, represented in Figure 4.1-10a, shows the Facility from the publicly accessible Bay Trail along Wildcat Creek looking south. This viewpoint represents a mid-range view of the Facility as viewed from a public trail. In the foreground, wetland vegetation associated with Wildcat Creek is visible. In the mid-ground, the Refinery Process Area is visible in the center, with a small, white plume of water vapor rising from the cooling water tower to the left of center of view, and about 13 tall and narrow stacks and stack-like structures clustered in the center of view. There is also a separate steam plume at ground level further to the left. Photo 2 clearly shows the partially constructed hydrogen plant next to the white spherical tanks on the right hand side of this mid-ground view. In the distance, views of the vegetated hills of the Point San Pablo Peninsula are visible as a backdrop to the Refinery Process Area. Numerous storage tanks on the southern and eastern slopes of this hillside can be seen to the right of center in the distance, some of which are silhouetted against the ridgeline. In total, about 31

tanks of various kinds are visible. In this view, the Refinery Process Area appears as a relatively compact skyline of industrial equipment clustered at the foot of the Point San Pablo Peninsula hills, and surrounded by open space. Overhead lights and illuminated Facility buildings and structures are visible in the nighttime views of this viewpoint in Figure 4.1-10c, Photo 1.

4.1.2.2.1.7 *Viewpoint 7*

Viewpoint 7, represented in Figure 4.1-11a, shows the Facility from Richmond Parkway over 1 mile from the Facility. This viewpoint represents a distant view of the Facility as seen by a motorist on a major arterial roadway in north Richmond, headed in a southerly direction. In the foreground, the Richmond Parkway and roadside vegetation are visible. In the middle ground, the Richmond Parkway Bridge over San Pablo Creek is visible to the right of the center, and low-rise industrial buildings are visible to the left of center. The West Contra Costa County Sanitary Landfill also can be seen in the far middle ground to the right of the Parkway. The Refinery Process Area is visible in the distance, with the most prominent visual element being the plume of white water vapor rising from the cooling water tower in the approximate center of view. Most of the Facility's stacks are not visible at this distance, and appear to blend into the hills of Point San Pablo Peninsula, which appear prominently in the background. Overhead lights and illuminated Facility buildings and structures are visible in the nighttime views of this viewpoint in Figure 4.1-11c, Photo 1.

4.1.2.2.1.8 *Viewpoint 8*

Viewpoint 8, represented in Figure 4.12a, shows the Facility from the Richmond-San Rafael Bridge looking east. This viewpoint shows the perspective of a motorist traveling east on the Richmond-San Rafael Bridge approaching Richmond. The foreground of Figure 4.1-12a shows the roadway and streetlamps. In the mid-ground view are naturally vegetated hillsides with approximately eleven storage tanks on the right side near I-580. Distant views of the Richmond hills are in the background of this viewpoint. Because none of the partial construction from the 2008 Project is visible from this viewpoint, there is no 2014 photo included for this viewpoint. Due to the limited views of the Refinery Process Area from this viewpoint, no nighttime views are included.

4.1.2.3 Regulatory Setting

4.1.2.3.1 *Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan 2030), including Plan elements relevant to this section, is addressed in Section 4.10, Land Use and in *Appendix 4.10, General Plan Consistency Evaluation*. There are

no inconsistencies between the Modernization Project and the General Plan 2030.

4.1.2.3.2 *Richmond Municipal Code*

The following code, in particular, applies to this Modernization Project with respect to visual concerns:

15.04.930 Design Review – Describes the design review process.

4.1.3 Significance Criteria and Methodology

4.1.3.1 Significance Criteria

Consistent with Appendix G of the CEQA Guidelines, a significant adverse visual impact would occur if the Modernization Project were to do the following:

(A) Have a substantial adverse effect on a scenic vista;

(B) Substantially damage scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway;

(C) Substantially degrade the existing visual character or quality of the site and its surroundings; or

(D) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

Additionally, for purpose of this analysis, the Modernization Project would constitute a significant visual impact if it would:

- Create a water vapor plume that would be a visual obstruction to motorists or pedestrians; or,
- Cause a substantial increase of plume formation during the year.

4.1.3.2 Impact Assessment Methodology

The significance determination in visual analyses is based on consideration of: (1) the extent of change related to Modernization Project visibility from key public vantage points; (2) the degree of visual contrast and compatibility in scale and character between Project elements and the existing surroundings; and (3) Project conformance with public policies regarding visual and urban design quality. The methodology employed for assessing aesthetic impacts includes consideration of the viewshed and development of computer-generated visual simulations.

As stated previously, photographs were taken at eight representative public viewpoints. As an aid to visualizing the change in character and potential impacts related to light and glare, each viewpoint has one or more simulations illustrating possible future conditions. These photo simulations are included as an aid to readers and are not exact representations of future conditions. Rather, these renderings provide a photorealistic interpretation of anticipated changes.

The simulations show the maximum construction under both the 93% Utilization Scenario and the 100% Utilization Scenario to illustrate the additional tank domes that may be required if Air Quality Mitigation Measure 4.3-5f is implemented. A maximum of 14 additional storage tank domes could be constructed under the 93% Utilization Scenario, and a maximum of 29 additional tank domes could be constructed for the 100% Utilization Scenario.

The methodology used to evaluate the significance of visual impacts is also explained in the context of each impact, as discussed further below.

4.1.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

Review and comparison of the Modernization Project to the environmental setting clearly shows that the Project would create no impacts related to the following environmental topics listed in CEQA Guidelines Appendix G.

A. Potential of the Project to have a significant adverse impact on a scenic vista

The Modernization Project consists of the addition of process units to distributed locations within the matrix of the existing Facility. As discussed in *Section 4.1.2.1*, the City has not formally designated any scenic vistas. The General Plan 2030 states that surrounding hills and the San Francisco and San Pablo Bays are prominent scenic areas in Richmond, but does not formally identify any specific scenic vistas or resources. The Facility is visible from San Francisco and San Pablo Bays, but none of the Modernization Project components would be visible from San Francisco or San Pablo Bays. Thus, the Project would have no impact on scenic vistas.

B. Potential of the Project to substantially damage scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway

Development of the Modernization Project would occur almost entirely within the developed portion of the Project site and would not affect any known scenic resource. See discussion in (A) above. Also as discussed above, I-80 and I-580 are the only highways in the vicinity of the Project site and neither is designated

as a Scenic Highway within the City of Richmond, according to the California Scenic Highway mapping system. Although components of the Modernization Project would be visible from I-580, it is not designated as a scenic highway. As a result, no impact would occur.

4.1.4 Impacts and Mitigation Measures

Impact 4.1-1: The Modernization Project would add new equipment and facilities in developed, industrial portions of the Project site. These new facilities, which would be visible from public view corridors, would slightly alter but would not significantly degrade the visual character of the setting. The new equipment would represent a relatively minor incremental visual change compared to the size and extent of existing Facility equipment. The visual and aesthetic impact would therefore be less than significant and no mitigation is necessary. (LTS)

The Modernization Project would occur almost entirely within the active, developed areas of the Project site (primarily within the Refinery Process and Tank Farm areas), areas already utilized for heavy industrial uses. As discussed in *Chapter 3*, *Project Description*, the Modernization Project would involve completion of the new hydrogen plant, demolition of the existing hydrogen plant, and modification and upgrades to several process units and support equipment; the proposed new and modified units would be very similar in nature, size, and appearance to the numerous existing facilities that would surround them.

Most of the Modernization Project equipment and facilities would be obscured by or indistinguishable from the existing Facility equipment. The following discussion focuses on only those units and tanks that could be prominent when observed from locations outside of the Facility.

As shown in the simulations discussed above, existing views would be altered with the completion of the new hydrogen plant and removal of the existing hydrogen plant within the Refinery Process Area, and doming of some of the existing tanks in the Tank Farm Area. The Sulfur Removal Improvements and related tie-ins would generally be integrated into existing Modernization Project equipment and would not change the existing visual setting or character of the Facility. Construction of the new hydrogen plant is approximately 48% complete, with most major equipment and required footings and foundations already installed. These partially constructed project components are visible in the 2014 photos, which are included in the pre-Modernization Project figures. The new hydrogen plant flare and the majority of ancillary equipment still need to be

installed. The flare stack, approximately 195 feet tall, would be contained within the existing Refinery Process Area and would be a visible new addition to the existing stacks that are located in this area from middle ground views (see Figure 4.1-2b).

The most prominent addition to the Facility's "skyline" would be the hydrogen plant flare. Visible in six of the eight views used in the assessment of visual impacts (Viewpoints 1, 3a, 4a/4b, 5a, 6, and 7), this Modernization Project component would be more conspicuous because it would be taller than surrounding buildings and thus could be perceived as a change from existing conditions (see Figures 4.1-2b, 4.1-4b, 4.1-6b, 4.1-7b, 4.1-8b, 4.1-10b, and 4.1-11b). However, this Modernization Project component still would be consistent with the heavy industrial character of the existing Facility and the general setting and would not substantially alter the visual character of the Facility.

Simulations in Photo 1 of each figure referenced above show the maximum construction if Air Quality Mitigation Measure 4.3-5f were implemented for the 93% Utilization Scenario (up to 14 tank domes). Photo 2 simulates the maximum construction if Air Quality Mitigation Measure 4.3-5f were implemented for the 100% Utilization Scenario (up to 29 tank domes). The domes for the storage tanks are proposed to be a brushed or muted light aluminum color, which appears white under some conditions but would weather and dull over time.[1] Given the existing heavy industrial character of the Facility, the introduction of the domes would not substantially alter the visual character of the Facility.

In summary, the proposed Modernization Project would not substantially degrade the character of the area, would be constructed in already industrialized areas on the Facility property, and would be of the same materials as existing equipment. Because the proposed development would occur primarily within the existing Facility footprint, further development would visually relate to the existing Facility structures and would not substantially obstruct predominant visual elements of the area that include the hills, San Pablo Bay or San Francisco Bay, and the vast expanses of the adjacent open or lightly developed areas. Thus, impacts related to altering existing viewsheds would be less than significant.

Mitigation Measure 4.1-1: None required.

[1] The light color of the domes, as opposed to a dark color, would cause less dramatic changes to dome temperature, which would increase stabilization of the atmosphere above the dome and reduce fugitive emissions. The domes would not be painted, as painting causes safe access issues, results in volatile organic compound emissions, increases the heat generated, and, as the paint wears, the domes would become "splotchy" and unattractive.

Impact 4.1-2: Operations as a result of the Modernization Project would not be expected to increase the frequency and/or magnitude of flaring events at the Facility. This impact would be less than significant and no mitigation is necessary. (LTS)

The Facility currently operates two flare gas systems, complete with flare gas recovery systems, one covering the "north yard" of the Facility and the other covering the "south yard." The existing hydrogen plant is connected to the South Isomax flare. With the Modernization Project, the Hydrogen Plant Replacement includes construction of a new dedicated emergency flare to ensure there would be no impact on the Facility's existing relief system during hydrogen plant start-up, shutdown, emergencies, upsets, or breakdowns. The existing South Isomax flare, to which the existing hydrogen plant is connected, would remain, though its utilization would be reduced once the existing hydrogen plant is disconnected.

No modifications are being made by the Modernization Project to existing Facility equipment that would significantly increase the frequency of routine flaring activity. As discussed in greater detail in *Section 4.13, Public Safety,* the efficiency and operational reliability of the new hydrogen plant and other improvements being made would be greater than that of the old hydrogen plant being shut down. Additionally, the advanced technology of the new flare system would ensure a higher level of safety. As a result, it is anticipated that the Facility would have less overall flare activity in its daily operation.

Mitigation Measure 4.1-2: None required.

Impact 4.1-3: Operation of the Modernization Project could create water vapor plumes visible to surrounding residents and motorists. Steam would be generated as a part of the Modernization Project and used in the proposed process units. The formation of visible water vapor plumes from Facility process units is a function of varying local meteorological conditions, including air temperature, wind speed, and atmospheric humidity, as well as variation in the actual Facility process itself. This impact would be less than significant and no mitigation is necessary. (LTS)

As simulated in Figure 4.1-2b, the new hydrogen plant would include installation of one new cooling tower approximately 45 feet tall. Simulations of a water vapor plume from the new cooling tower are shown in Figures 4.1-3b, 4.1-8b, and 4.1-10b. Because of the small size of the estimated plume, it is difficult to see the simulated plumes in these simulations. Plumes from the proposed cooling tower would only be visible under specific meteorological conditions when existing

plume activity would also be visible. Water vapor plumes become visible in atmospheric conditions that cause fog and high humidity, thus minimizing contrast and prominence of plumes. In addition, plume activity would not be obvious from the closest publicly accessible roadway, Castro Street, due to the relatively far distance from the new cooling towers (about 0.5 mile and 1.2 miles). Based on the above factors, the addition of new visible plumes rising above these cooling towers under Modernization Project implementation would be a less-than-significant impact, and aesthetic impacts related to vapor plume emissions would be less than significant.

Mitigation Measure 4.1-3: None required.

Impact 4.1-4: The Modernization Project would introduce new lighting on the Project site. Additionally, existing lighting would be replaced with LED lighting. Nighttime construction, if undertaken, may also temporarily increase nighttime lighting on the Project site. These changes would not significantly alter existing light and glare conditions on the Project site. The impact would be less than significant and no mitigation is necessary. (LTS)

The Facility currently illuminates facilities in order for operations to continue throughout the night. Safety and security lighting would be installed internally around new equipment and at the perimeter near new equipment.

Construction of the Modernization Project would primarily take place during the day. There are no plans to work a night shift to construct the Modernization Project. However, in the event that weather or other factors significantly adversely affect the Modernization Project construction schedule, Chevron may decide some work activities would be necessary at night. Because there are cost increase and logistics issues raised by performing work at night, plus additional worker safety considerations and precautions that must be taken, the decision to work at night is a significant one, and Chevron would only undertake work at night if absolutely necessary, and for only as long as necessary and in consultation with the City. Work would be limited to ensure minimal noise generation and lighting/glare potential. In the event that such night work would be performed for the Modernization Project, there would potentially be a minor and temporary increase in night lighting at the Facility during the construction period. This would be due to the lighting necessary to continue construction during the night hours, which would most likely involve area flood lighting near construction sites and laydown areas. Night lighting of this kind would be considered a temporary disturbance to adjacent residential areas such as the Atchison Village, Iron Triangle, and Shields-Reid neighborhoods, portions of which are approximately 0.25 mile to the east of the Project site, as well as Point

Richmond, immediately south of the Project site. However, in addition to the fact that the Facility already has night lighting because it operates round the clock, nighttime work shifts (and temporary increases in night lighting) are common during Facility maintenance turnarounds, which occur regularly. For these reasons, the temporary increase in night lighting is not considered significant.

The Modernization Project would not significantly alter the amount of light or glare associated with operation of the Facility. Structures that would be illuminated would be within existing areas of the Facility, would be surrounded by existing lighted equipment and would not affect adjacent residential or industrial uses. New equipment lighting would be directed appropriately to avoid disturbance to motorists. Area, or flood lighting, is not proposed as part of the long-term operation of this Modernization Project.

Figures 4.1-2c, 4.1-4c, 4.1-5, 4.1-7c, 4.1-8c, 4.1-9, 4.1-10c, 4.1-11c show existing night lighting in Photo 1 and simulations of how the LED lighting might look in Photo 2. As discussed above and shown in the visual simulations, the conversion of existing lighting to LED lighting would change the existing view of orange lighting to more cool white lighting on some Facility buildings and structures. The cool white LED lighting would be similar to lighting that already exists on some of the Facility stacks and structures and would not represent a substantial change in brightness or glare. The LED lighting has a cool temperature, with a Kelvin rating of approximately 5,000, and appears to have a blue tint when photographed (Transmittal #47A (Rev #6), 2014). To the naked eye, the LED lighting is a cool white color and appears similar to new LED street lighting in the City of Richmond. Although the Modernization Project would increase the amount of lighting and alter the type of lighting at the Project site, the increase or changes would not significantly alter the already industrial aesthetic of the lighting at the Facility and would not significantly adversely impact adjacent uses. As a result, this impact would be considered a less-than-significant impact.

The Modernization Project proposes structures that would not include large areas of highly reflective material that would produce glare. Therefore, the Modernization Project would not affect the amount of daytime glare in the area.

Mitigation Measure 4.1-4: None required.

4.1.5 Cumulative Impacts

The cumulative impacts of the Modernization Project in relationship to existing aesthetics, visual quality, light, and glare when considered together with past, present, existing, pending, and reasonably foreseeable future projects on site

and in the Project vicinity would not be significant. As a result, the Modernization Project would not make a considerable contribution to a significant cumulative aesthetics, visual quality, light, or glare impact. The Richmond General Plan 2030 EIR did not identify any cumulative aesthetics, visual quality, light, or glare impacts.

As discussed above, the visual changes that would result from the Modernization Project would be consistent with the character of the existing Facility and the general setting and would not substantially alter the visual character of the Facility.

Because the Modernization Project would have no significant adverse Project impacts under the Appendix G thresholds, the Project would have no cumulatively considerable aesthetic impacts. Accordingly, the Modernization Project, together with past, present, existing, pending, and reasonably foreseeable future projects, would not result in cumulatively considerable aesthetics, visual quality, light, or glare impacts.

See *Section 4.0, Introduction to Chapter and Methodology,* for a detailed discussion of the approach and methods of the cumulative analysis.

The construction of the other non-Facility cumulative projects, together with all of the reasonably foreseeable projects at the Facility, would be consistent with the industrial appearance of the overall complex as well and the northwest portion of the City of Richmond. The development of the other, non-Facility cumulative projects, such as planned residential and commercial projects in the City of Richmond (see *Appendix 4.0, Cumulative Projects*), including future development according to the General Plan 2030, also would result in changes to City viewsheds in the vicinity of the Facility and throughout the northwestern portions of the City. These new facilities would very slightly change the already industrialized appearance of the Facility property and northwest Richmond. While noticeable, these visual changes would be dispersed throughout the immediate region, but would not be collectively perceptible as a substantial visual change when compared to existing conditions. During construction, staging and laydown areas would be visible and would incrementally add to the overall extent of disturbed, graded areas in the vicinity, but this cumulative impact would be less than significant as it would not significantly alter the industrial appearance of the area. The Praxair 21.5 Mile Hydrogen Pipeline Project would not contribute to visual impacts because it would be entirely underground.



Photo 1: Photo taken in 2008, prior to construction of 2008 Project

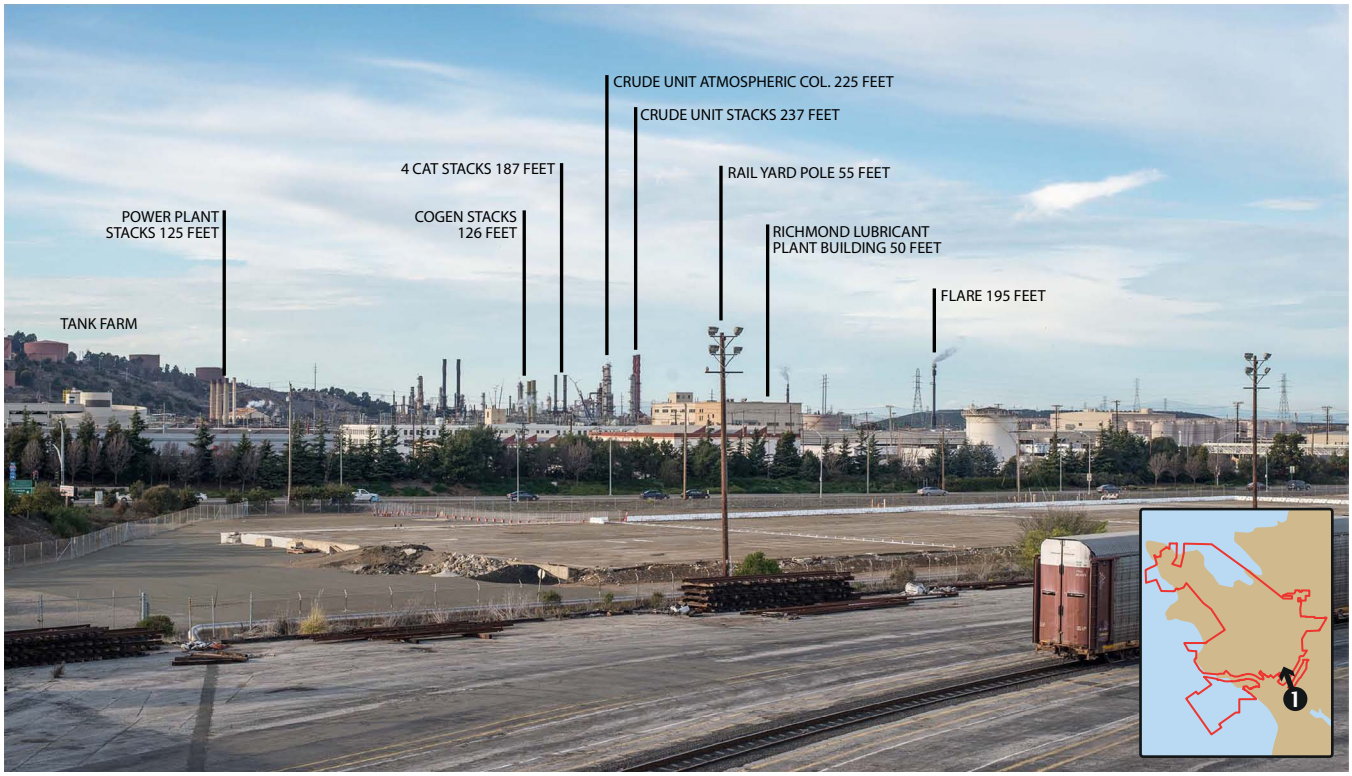


Photo 2: Photo taken in 2014, prior to construction of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-2a
Chevron Refinery Modernization Project EIR
Viewpoint 1: Pre-Modernization Project View of Facility,
Looking North from I-580 (2008 & 2014)



Photo 1: Simulation illustrates the maximum construction under the 93% Utilization Scenario



Photo 2: Simulation illustrates the maximum construction under the 100% Utilization Scenario

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-2b
Chevron Refinery Modernization Project EIR
Viewpoint 1: Simulated View of Facility,
Looking North from I-580 (93% and 100%)



Photo 1: Existing view of Facility



Photo 2: LED simulated view of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48B)

Figure 4.1-2c
Chevron Refinery Modernization Project EIR
Viewpoint 1: Night-Time View of Facility,
Looking North from I-580 (Existing 2014, Simulated)



Photo 1: Photo taken in 2008, prior to construction of 2008 Project



Photo 2: Photo taken in 2014, prior to construction of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-3a
Chevron Refinery Modernization Project EIR
Viewpoint 2: Pre-Modernization Project View of Facility,
Looking Northwest from I-580 (2008 & 2014)



Photo 1: Simulation illustrates the maximum construction under the 93% Utilization Scenario



Photo 2: Simulation illustrates the maximum construction under the 100% Utilization Scenario

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-3b
Chevron Refinery Modernization Project EIR
Viewpoint 2: Simulated View of Facility,
Looking Northwest from I-580 (93% and 100%)



Photo 1: Photo taken in 2008, prior to construction of 2008 Project

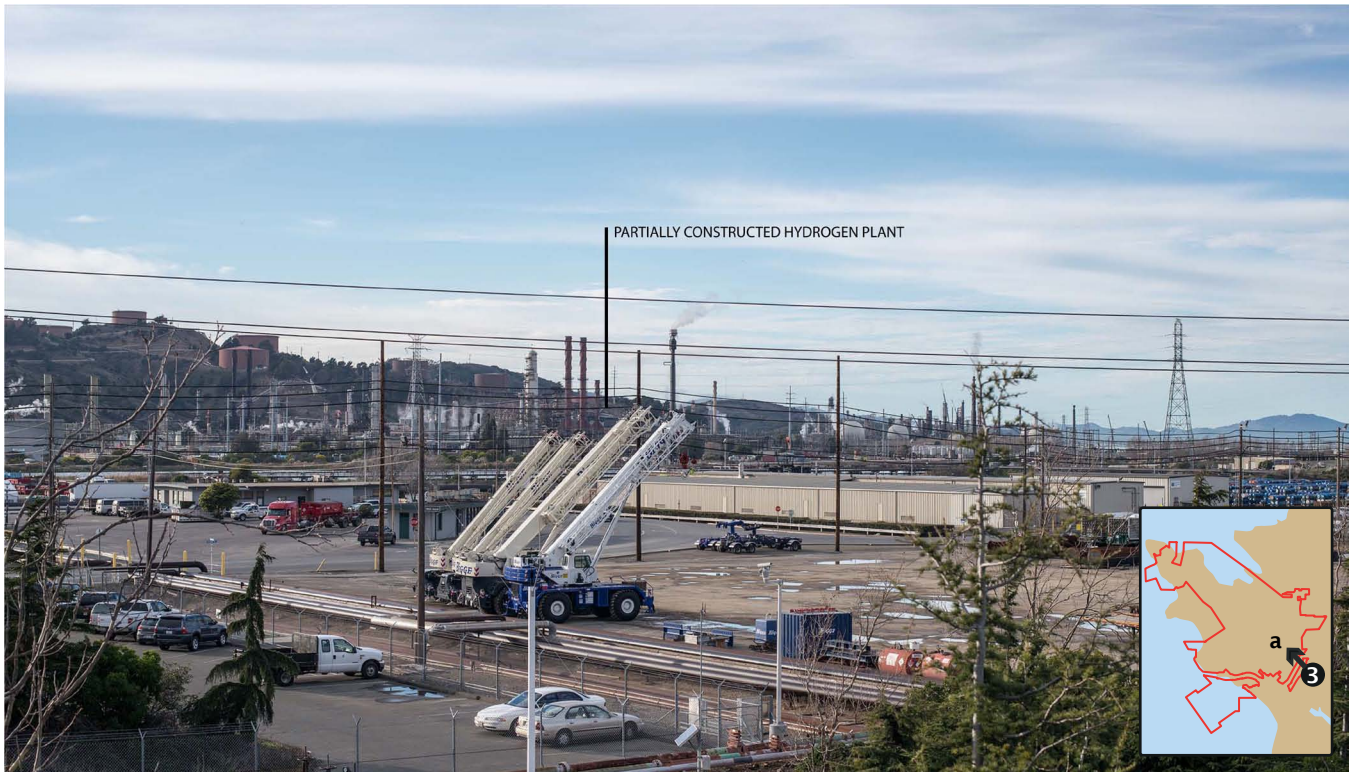


Photo 2: Photo taken in 2014, prior to construction of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-4a
Chevron Refinery Modernization Project EIR
Viewpoint 3a: Pre-Modernization Project View of Facility,
Looking Northwest from Castro Street (2008 & 2014)



Photo 1: Simulation illustrates the maximum construction under the 93% Utilization Scenario



Photo 2: Simulation illustrates the maximum construction under the 100% Utilization Scenario

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-4b
Chevron Refinery Modernization Project EIR
Viewpoint 3a: Simulated View of Facility,
Looking Northwest from Castro Street (93% and 100%)



Photo 1: Existing view of Facility



Photo 2: LED simulated view of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48B)

Figure 4.1-4c
Chevron Refinery Modernization Project EIR
Viewpoint 3a: Night-Time View of Facility,
Looking Northwest from Castro Street (Existing 2014, Simulated)

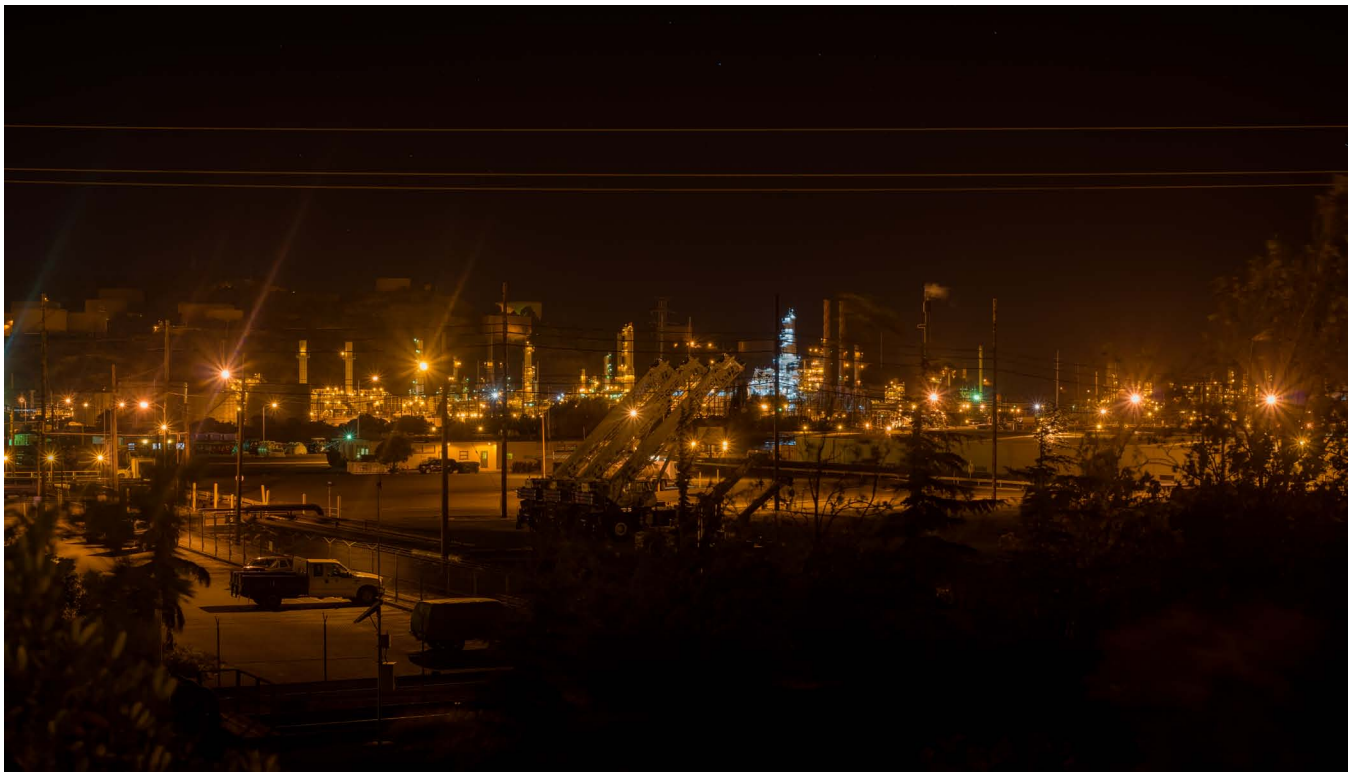


Photo 1: Existing view of Facility

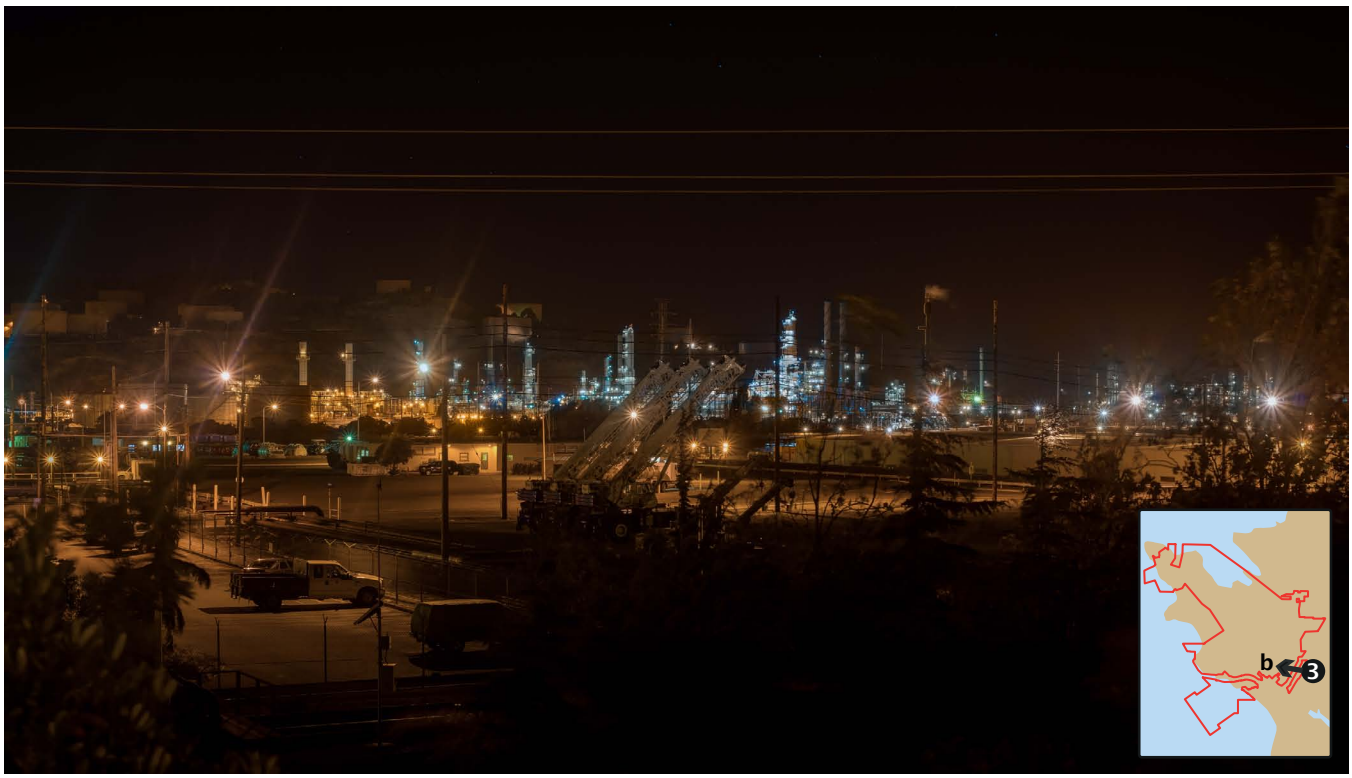


Photo 2: LED simulated view of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48B)

Figure 4.1-5
Chevron Refinery Modernization Project EIR
Viewpoint 3b: Night-Time View of Facility,
Looking West-Northwest from Castro Street (Existing 2014, Simulated)



Photo 1: Photo taken in 2008, prior to construction of 2008 Project



Photo 2: Photo taken in 2014, prior to construction of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-6a
Chevron Refinery Modernization Project EIR
Viewpoint 4a: Pre-Modernization Project View of Facility,
Looking Northwest from Crest Avenue (2008 & 2014)



Photo 1: Simulation illustrates the maximum construction under the 93% Utilization Scenario.



Photo 2: Simulation illustrates the maximum construction under the 100% Utilization Scenario

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-6b
Chevron Refinery Modernization Project EIR
Viewpoint 4a: Simulated View of Facility,
Looking Northwest from Crest Avenue (93% and 100%)



Photo 1: Photo taken in 2008, prior to construction of 2008 Project



Photo 2: Photo taken in 2014, prior to construction of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-7a
Chevron Refinery Modernization Project EIR
Viewpoint 4b: Pre-Modernization Project View of Facility,
Looking North from Crest Avenue (2008 & 2014)



Photo 1: Simulation illustrates the maximum construction under the 93% Utilization Scenario



Photo 2: Simulation illustrates the maximum construction under the 100% Utilization Scenario

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-7b
Chevron Refinery Modernization Project EIR
Viewpoint 4b: Simulated View of Facility,
Looking North from Crest Avenue (93% and 100%)



Photo 1: Existing view of Facility



Photo 2: LED simulated view of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 2a-7c.indd

Source: Vallier Design Associates, Inc.; Chevron (T48B)

Figure 4.1-7c
Chevron Refinery Modernization Project EIR
Viewpoint 4b: Night-Time View of Facility,
Looking North from Crest Avenue (Existing 2014, Simulated)



Photo 1: Taken in 2008, prior to construction of 2008 Project



Photo 2: Taken in 2014, prior to construction of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-8a
Chevron Refinery Modernization Project EIR
Viewpoint 5a - Pre-Modernization Project View of Facility,
Looking West-Northwest from Buena Vista Avenue (2008 & 2014)

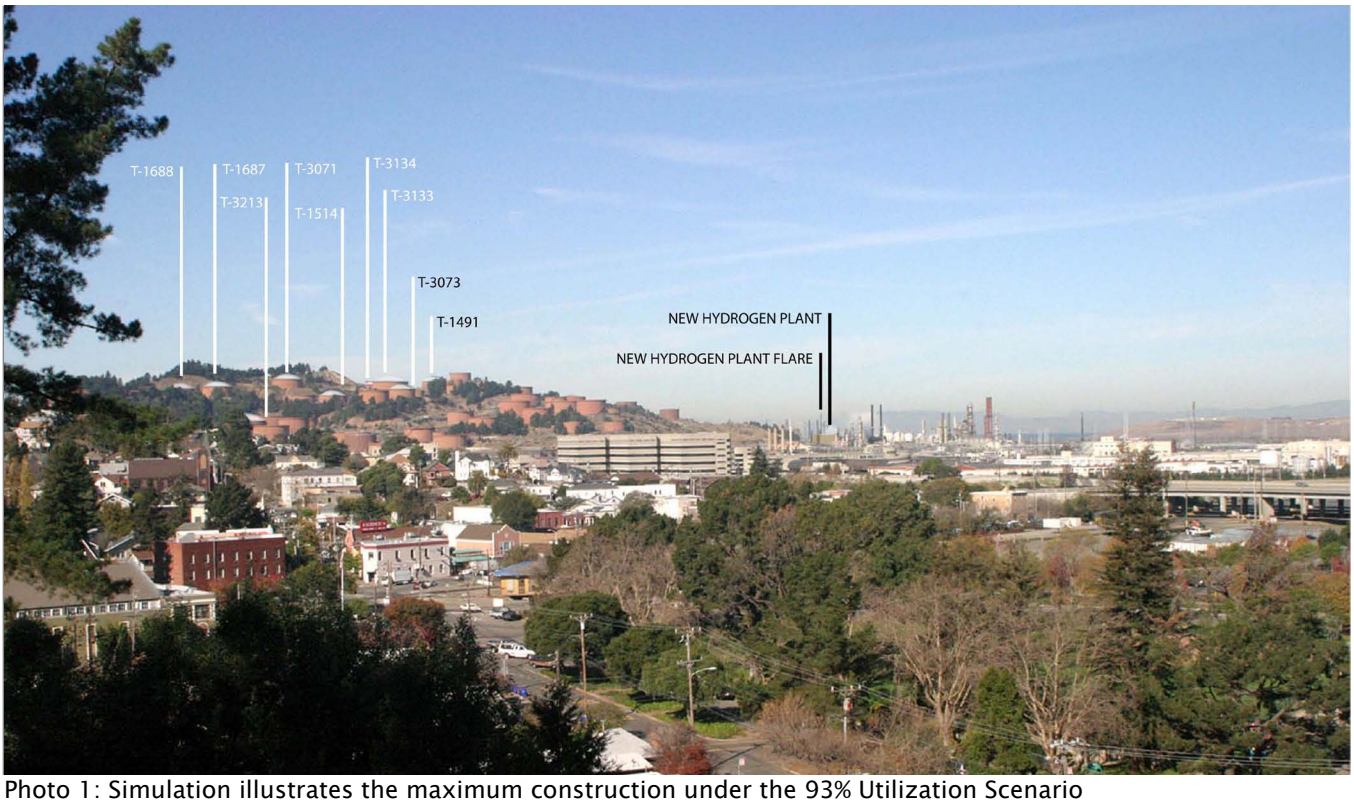


Photo 1: Simulation illustrates the maximum construction under the 93% Utilization Scenario

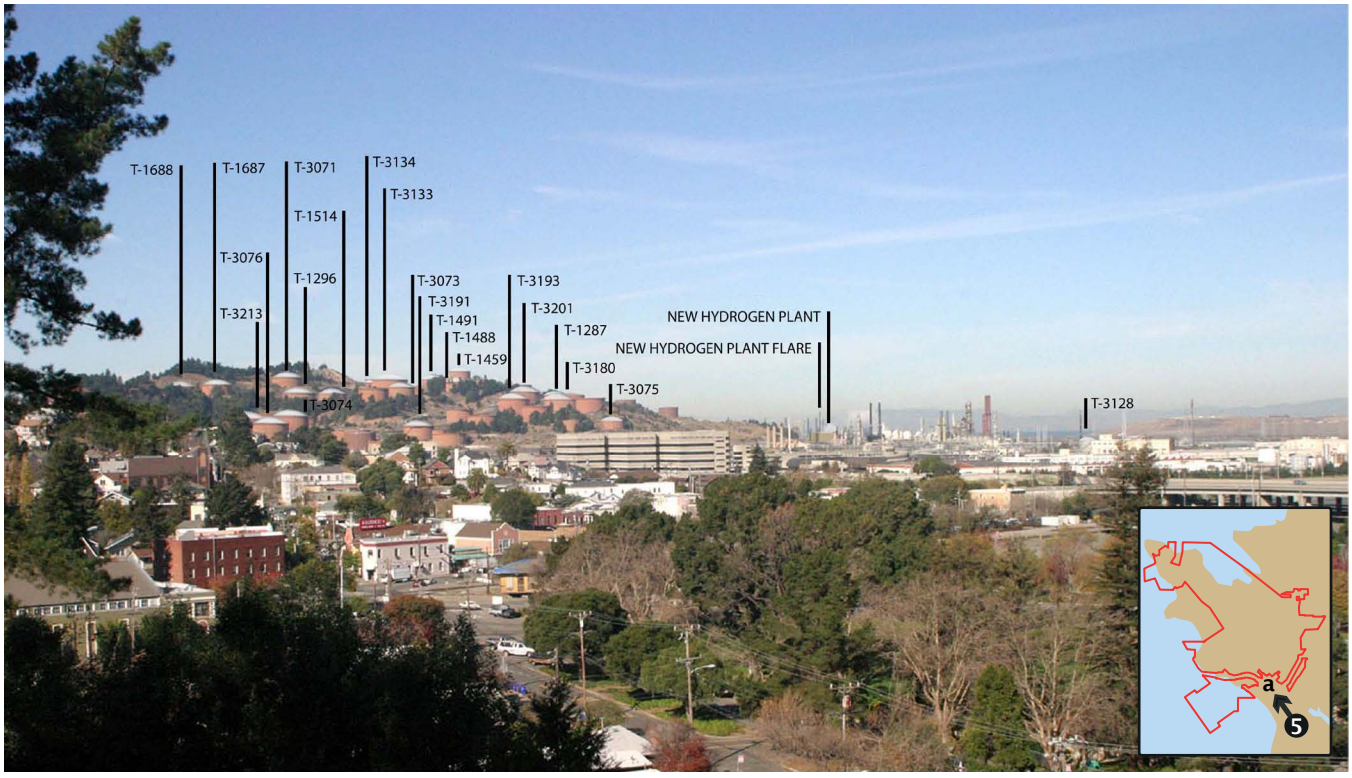


Photo 2: Simulation illustrates the maximum construction under the 100% Utilization Scenario

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-8b
Chevron Refinery Modernization Project EIR
Viewpoint 5a - Simulated View of Facility,
Looking West-Northwest from Buena Vista Avenue (93% and 100%)



Photo 1: Existing view of Facility



Photo 2: LED simulated view of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48B)

Figure 4.1-8c
Chevron Refinery Modernization Project EIR
Viewpoint 5a - Night-Time View of Facility,
Looking West-Northwest from Buena Vista Avenue



Photo 1: Existing view of Facility



Photo 2: LED simulated view of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48B)

Figure 4.1-9
Chevron Refinery Modernization Project EIR
Viewpoint 5b - Night-Time View of Facility,
Looking Northwest from Buena Vista Avenue



Photo 1: Photo taken in 2008, prior to construction of 2008 Project



Photo 2: Photo taken in 2014, prior to construction of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-10a
Chevron Refinery Modernization Project EIR
Viewpoint 6 - Pre-Modernization Project View of Facility,
Looking South from Wildcat Creek (2008 & 2014)



Photo 1: Simulation illustrates the maximum construction under the 93% Utilization Scenario



Photo 2: Simulation illustrates the maximum construction under the 100% Utilization Scenario

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-10b
Chevron Refinery Modernization Project EIR
Viewpoint 6 - Pre-Modernization Project View of Facility,
Looking South from Wildcat Creek (93% and 100%)



Photo 1: Existing view of Facility



Photo 2: LED simulated view of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48B)

Figure 4.1-10c
Chevron Refinery Modernization Project EIR
Viewpoint 6 - Night-Time View of Facility,
Looking South from Wildcat Creek

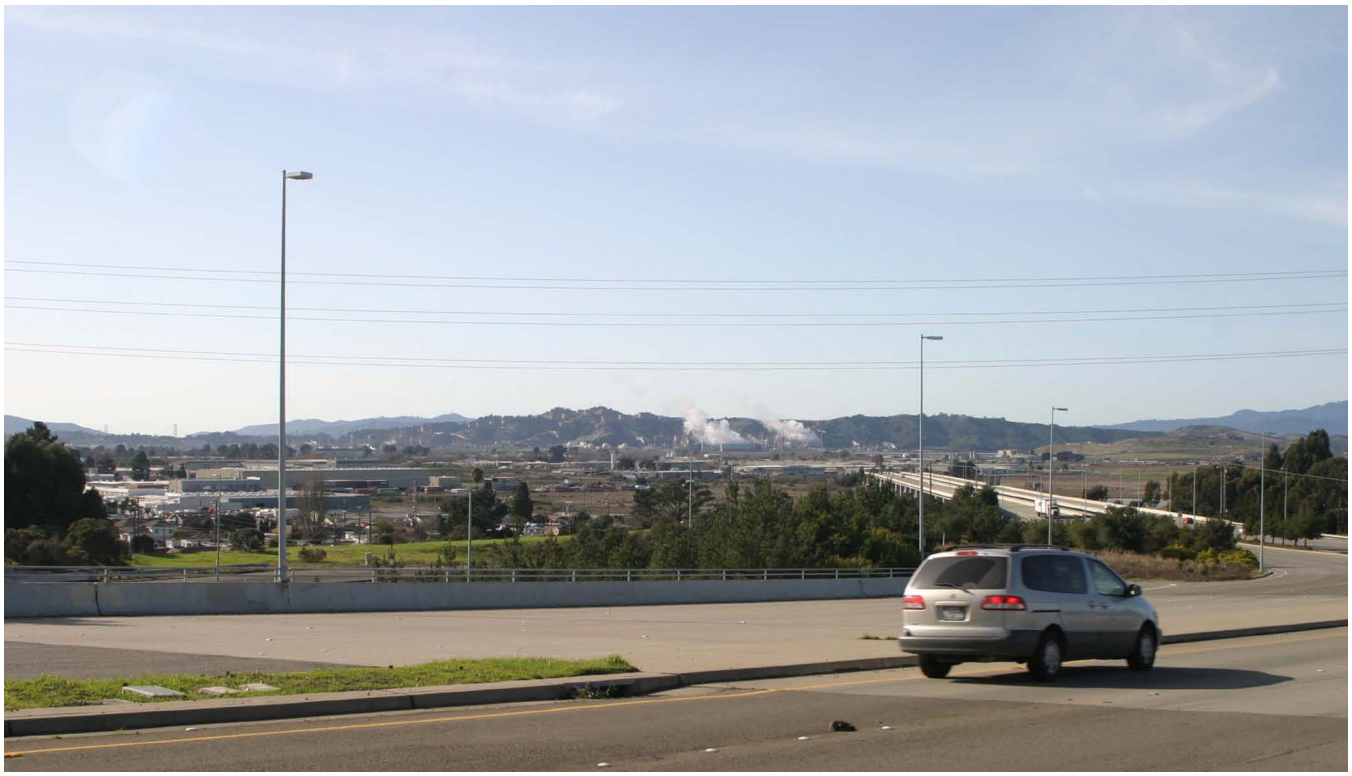


Photo 1: Photo taken in 2008, prior to construction of 2008 Project

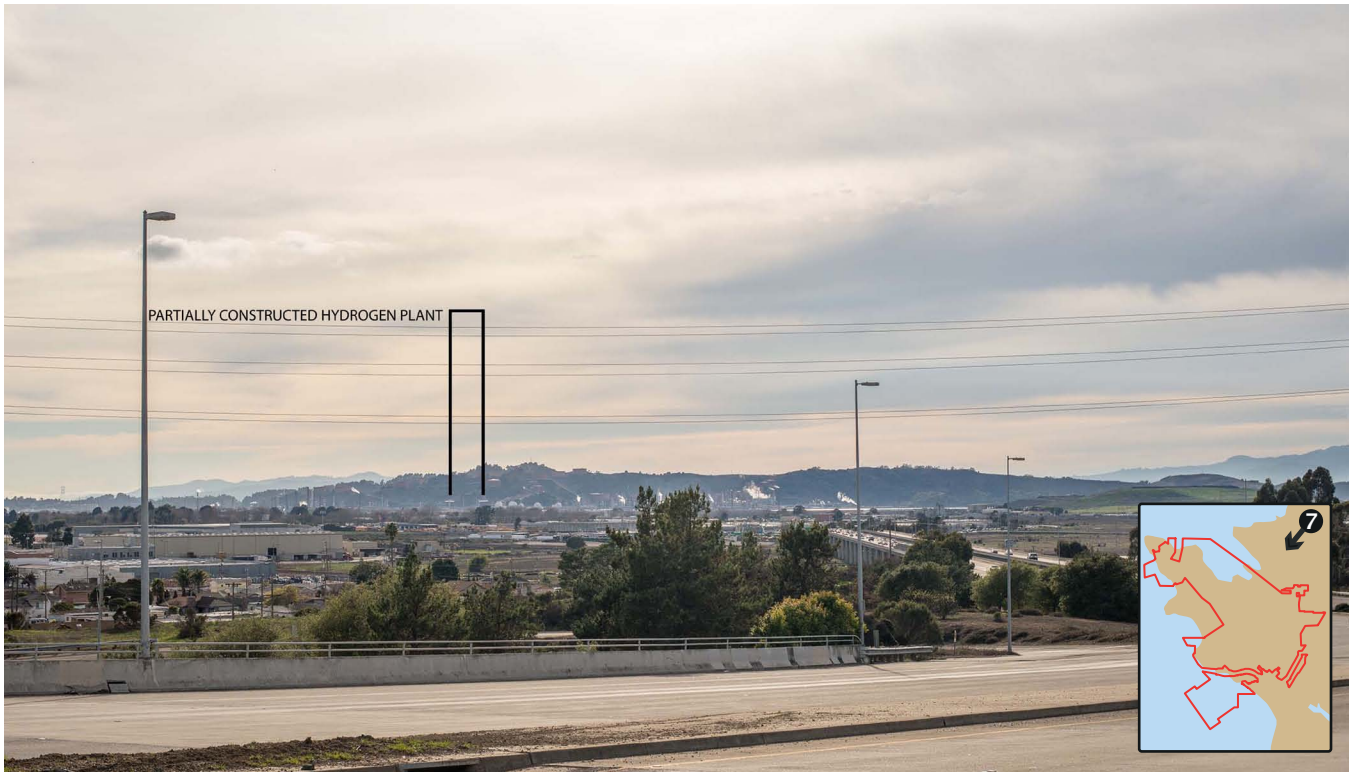


Photo 2: Photo taken in 2014, prior to construction of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-11a
Chevron Refinery Modernization Project EIR
Viewpoint 7 - Pre-Modernization Project View of Facility,
Looking Southwest from Richmond Parkway (2008 & 2014)



Photo 1: Simulation illustrates the maximum construction under the 93% Utilization Scenario

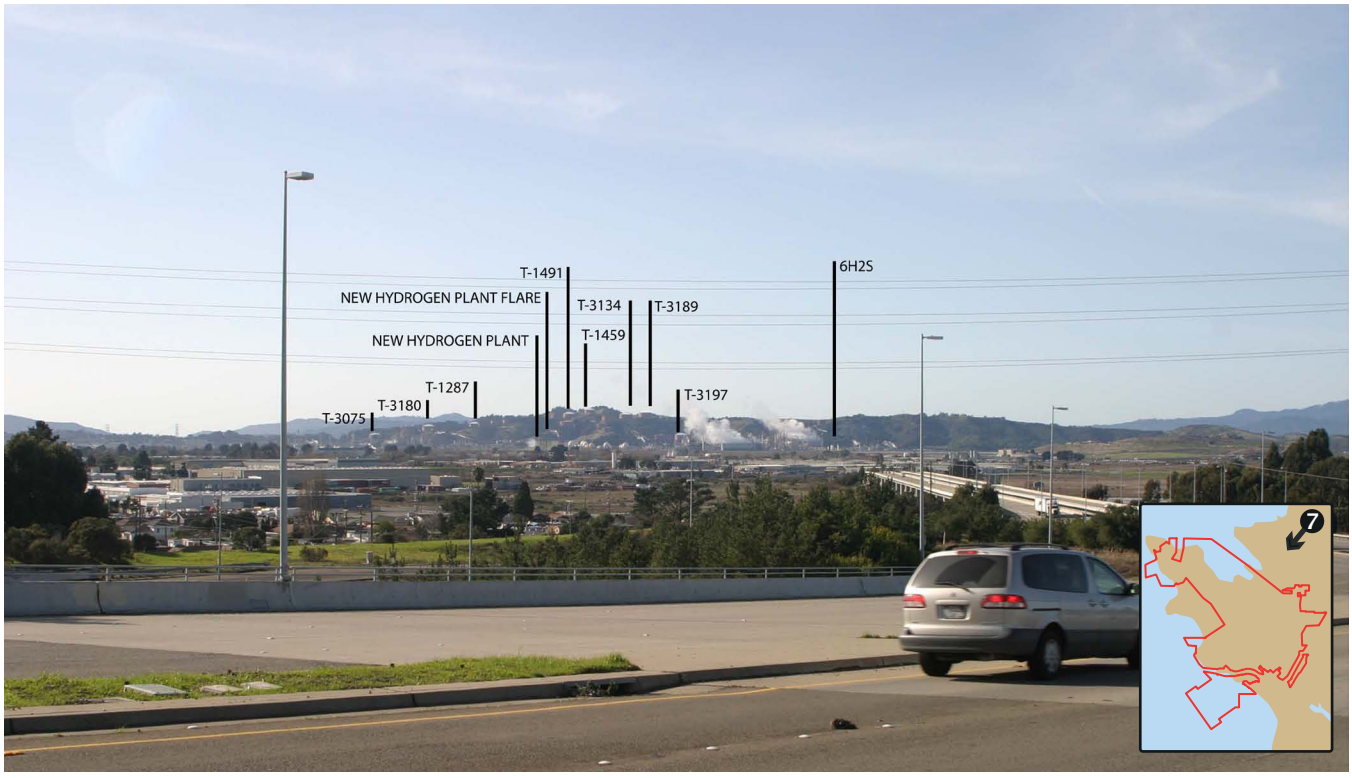


Photo 2: Simulation illustrates the maximum construction under the 100% Utilization Scenario

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-11b
Chevron Refinery Modernization Project EIR
Viewpoint 7 - Pre-Modernization Project View of Facility,
Looking Southwest from Richmond Parkway (93% and 100%)



Photo 1: Existing view of Facility



Photo 2: LED simulated view of Modernization Project

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48B)

Figure 4.1-11c
Chevron Refinery Modernization Project EIR
Viewpoint 7 - Night-Time View of Facility,
Looking Southwest from Richmond Parkway



Photo 1: Photo taken in 2008, prior to construction of 2008 Project

A photo of current conditions (2014) is not included because conditions have not changed since 2008.

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-12a
Chevron Refinery Modernization Project EIR
Viewpoint 8 - Pre-Modernization Project View of Facility,
Looking East from Richmond-San Rafael Bridge (2008)

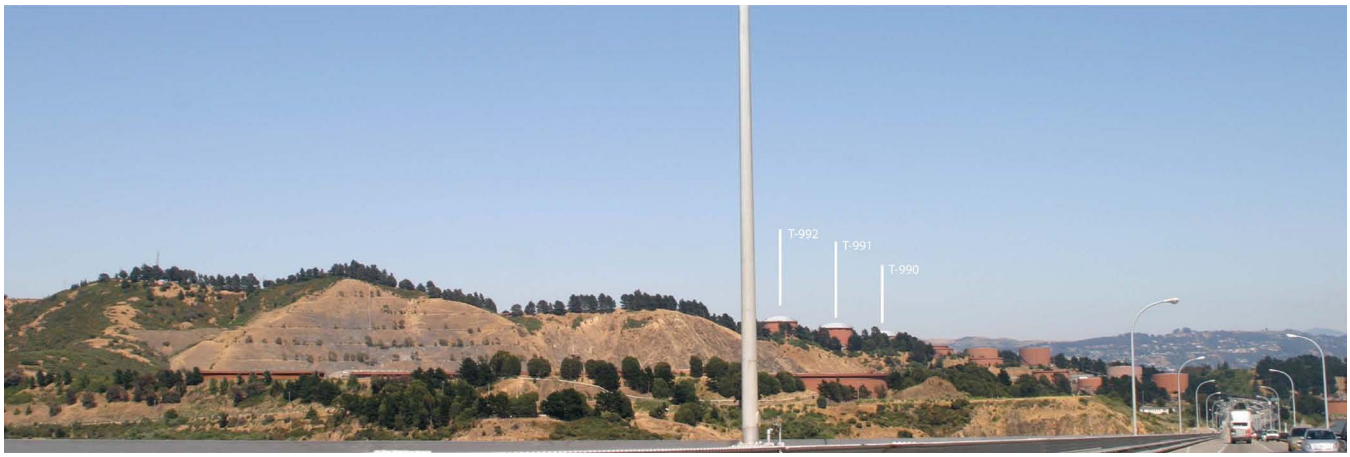


Photo 1: Simulation illustrates the maximum construction under the 93% Utilization Scenario

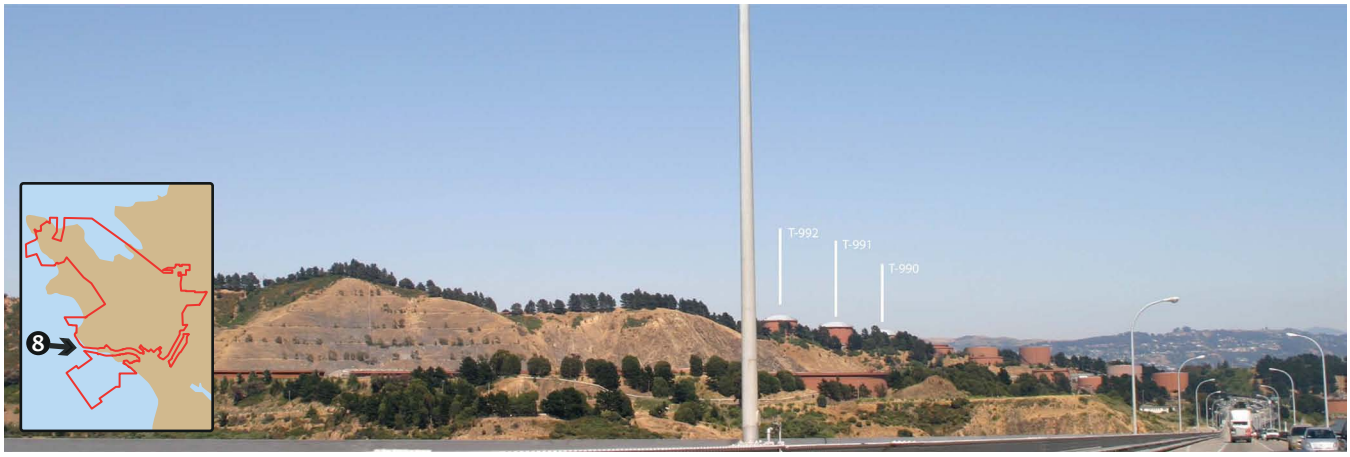


Photo 2: Simulation illustrates the maximum construction under the 100% Utilization Scenario

02.24.2014 P:\11-005 CVRN\PRODUCTS\DEIR\Figures\4.1 Aesthetics\Drafts\Figures 8a-12b.indd

Source: Vallier Design Associates, Inc.; Chevron (T48Ar2)

Figure 4.1-12b
Chevron Refinery Modernization Project EIR
Viewpoint 8 - Pre-Modernization Project View of Facility,
Looking East from Richmond-San Rafael Bridge (93% and 100%)

4.1.6 References—Aesthetics, Visual Quality, Light, and Glare

Chevron. 2011. Flare Minimization Plan. Accessed February 13, 2014. http://www.baaqmd.gov/~/media/Files/Compliance%20and%20Enforcement/Flares/2011%20-%20FMP%20Update%20-%20Clean%20Version_Final%20submittal.ashx?la=en.

Chevron Data Transmittal #22 (Rev #2): Project Locations, 2014.

Chevron Data Transmittal #36M (Rev #2): Flares, 2014.

Chevron Data Transmittal #38 (Rev #1): APNs, 2013.

Chevron Data Transmittal #47A (Rev #6): Project Design Feature Descriptions: Domes, LED, 2014.

Chevron Data Transmittal #48A (Rev #2): Tank Dome and Project Visualizations, 2014.

Chevron Data Transmittal #48A (Rev #2) Addendum: Tank Dome and Project Visualizations, 2014.

Chevron Data Transmittal #48B: LED Lighting Visualizations, 2013.

Chevron Data Transmittal #48D: Tank Dome and Project Visualizations, 2014.

City of Richmond. 2012. *Richmond General Plan (2030).*

City of Richmond. 2006. Municipal Code – Chapter 15.04 ZONING. Accessed April 27, 2007. http://bpc.iserver.net/codes/richmond/index.htm.

4.2 AGRICULTURAL RESOURCES

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) revisions to applicable law on this topic area, including (a) adoption of a new Richmond General Plan, and (b) revisions to the CEQA Guidelines adopted in 2010 that add consideration of forestry-related issues to the agricultural issues to be considered in an EIR. These revisions do not change the 2008 EIR's conclusions that there are no significant agricultural impacts for the Modernization Project, nor would the Project result in any significant adverse forestry-related impacts.

IMPACT SUMMARY

Construction and operation of the Modernization Project would result in no impacts to agricultural or forestry resources. No mitigation would be required.

4.2.1 Introduction

This section establishes the existing conditions and identifies and evaluates potential impacts related to agricultural and forestry resources that could result from construction and operation of the Modernization Project.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities. For example, as described in *Chapter 3, Project Description, Section 3.3*, construction of the new hydrogen plant is approximately 48% complete. Most

major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

4.2.2 Setting

4.2.2.1 Regional and Project Setting

Richmond's agriculture primarily consists of commercial nurseries where the products are grown above ground in planters and are not directly dependent on prime agricultural soils (City of Richmond, 2012). According to the California Department of Conservation's Farmland Mapping and Monitoring Program (FMMP), the Project site is not located on Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (California Department of Conservation, 2010). There are no active agricultural operations within the vicinity of the Project site except for greenhouse nurseries and indoor plants located approximately 1 mile away near the Richmond Parkway. No land within the vicinity of the Project site is designated as forestry land or timberland.

4.2.2.2 Regulatory Setting

4.2.2.2.1 *Farmland Mapping and Monitoring Program*

The California Department of Conservation, under the Division of Land Resource Protection, has set up the FMMP, which monitors the conversion of the state's farmland to and from agricultural use. The map series identifies eight classifications and uses a minimum mapping unit size of 10 acres. The program also produces a biannual report on the amount of land converted from agricultural to non-agricultural use. The program maintains an inventory of state agricultural land and updates its Important Farmland Series Maps every 2 years. The FMMP is an informational service only and does not constitute state regulation of local land use decisions (California Department of Conservation, 2013). The FMMP designates land as one of the following eight categories: (1) Prime Farmland; (2) Farmland of Statewide Importance; (3) Unique Farmland; (4) Farmland of Local Importance; (5) Grazing Land; (6) Urban and Built-up Land; (7) Other; and (8) Water. The first four categories are considered valuable farmland and any conversion of land within these categories is typically considered to be an adverse impact. As indicated on the 2010 FMMP map, the Project site is designated as Urban and Built-Up Land (California Department of Conservation, 2010).

4.2.2.2.2 *City of Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan 2030), including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions.* There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.2.2.2.3 *City of Richmond Zoning Ordinance*

The majority of the Project site is zoned M-3 (Heavy Industrial) (see Figure 4.10-3 in *Section 4.10, Land Use, Plans, and Policies*). Other zoning designations within the Project site include M-2 (Light Industrial), M-4 (Marine Industrial), and CRR (Community and Regional Recreation District) (see Figure 4.10-3 in *Section 4.10, Land Use, Plans, and Policies*).

4.2.3 Significance Criteria and Methodology

4.2.3.1 Significance Criteria

Consistent with Appendix G of the CEQA Guidelines, a significant adverse agricultural resource- or forestry resource-related impact would occur if the Modernization Project would do any of the following:

(A) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (farmland) as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use;

(B) Conflict with existing zoning for agricultural use, or a Williamson Act contract;

(C) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g));

(D) Result in the loss of forest land or conversion of forest land to non-forest use; or

(E) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of farmland to non-agricultural use, or conversion of forest land to non-forest use.

4.2.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of agricultural- and forestry-related impacts is explained in the context of each impact, as discussed further below.

4.2.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

Review and comparison of the Modernization Project to the environmental setting shows that the Project would create no impacts related to the following environmental topics listed in CEQA Guidelines Appendix G.

(A) Potential of the Project to convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to non-agricultural use

There is no Prime Farmland, Unique Farmland, or Farmland of Statewide Importance within the Project site or adjacent lands. Thus, the Modernization Project does not have the potential to convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to non-agricultural use. The Modernization Project would have no impact.

(B) Potential of the Project to conflict with existing agricultural zoning, or a Williamson Act contract

As discussed above, the majority of the Project site is zoned M-3 (Heavy Industrial); other zoning designations include M-2 (Light Industrial), M-4 (Marine Industrial), and CRR (Community and Regional Recreation District). None of the Project site or any adjacent properties are covered by a Williamson Act contract or zoned for agricultural uses. No zoning revisions are proposed as part of the Modernization Project. Thus, construction and operation of the Modernization Project would not interact with or conflict with existing agricultural zoning or a Williamson Act contract. The Modernization Project would have no impact.

(C) Potential of the Project to conflict with existing zoning for, or cause rezoning of, forest land, timberland, or timberland zoned Timberland Production

As described above, the existing zoning for the Project site does not involve forest land or timberland. No zoning revisions are proposed as part of the Modernization Project. Thus, the Modernization Project would not conflict with existing zoning for, or cause rezoning of, forest land, timberland, or timberland zoned Timberland Production.

(D) Potential of the Project to result in the loss of forest land or conversion of forest land to non-forest use.

There is no existing forest land within the Project site or its vicinity. Thus, the Modernization Project would have no impact on forest land.

(E) Potential of the Project to involve other changes in the existing environment, which due to their location or nature, could result in conversion of farmland to non-agricultural use, or conversion of forest land to non-forest use.

There are no agricultural areas under cultivation (or land classified as valuable agricultural land) within or adjacent to the Project site, nor are there any forestry resources within or adjacent to the Project site. Additionally, the Project site is not adjacent to any land identified for agricultural use in the General Plan 2030 or the City of Richmond Zoning Ordinance.

As a result, any changes to the existing environment would not, due to the nature and location of the Modernization Project, have impacts on agricultural land by creating a use incompatible to agricultural operations, and would not result in conversion of farmland to non-agricultural use or conversion of forest land to non-forest use. The Modernization Project would have no impact.

4.2.4 Impacts and Mitigation Measures

The Modernization Project would be developed and implemented within the boundaries of the Project site with the exception of certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section, 4.3 Air Quality,* and some of the greenhouse gas reduction measures, such as the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*, none of which would involve any new physical development on or affecting existing or planned agricultural activities, or on priority agricultural resource lands. The Facility has been in operation since 1902, and does not contain any agricultural or forestry timber resources. Thus, any development on the Project site would not result in the conversion of existing agricultural land to non-agricultural use or conversion of forest land to non-forest use.

Although there are some greenhouse nurseries located within 1 mile of the Project site boundaries, these agricultural operations occur indoors within greenhouses, are not dependent on prime agricultural soils, are not designated as agricultural lands by the General Plan 2030 or State farmland maps. These

nursery operations have been operating in areas zoned for light industrial uses, and their ability to operate would not be affected by the Modernization Project. Therefore, the Modernization Project would result in no significant adverse impacts to agriculture or forestry under the Appendix G CEQA thresholds for these resources.

4.2.5 Cumulative Impacts

The geographic area considered for agricultural and forestry resource cumulative impacts analysis is the City of Richmond and the North Richmond Area, which is immediately northeast of the Project site in unincorporated Contra Costa County.

Development of the Modernization Project would not result in the conversion of existing agricultural land to non-agricultural use or conversion of forest land to non-forest use. A small portion of the City of Richmond is designated Agriculture in the General Plan 2030. This area is along the eastern edge of Wildcat Canyon Regional Park, west of San Pablo Dam Road, approximately 5 miles from the Project site. Table 3.5 of the General Plan 2030 states that the Agriculture land use designation includes agricultural uses such as grazing, crop production, farming, community gardens, and ancillary residential uses. The area with the Agriculture General Plan 2030 land use designation is designated as Grazing Land and Other by the FMMP, which are not considered valuable farmland nor included in the state farmland resource map.

There are no areas within the City designated for forestry resources by the General Plan 2030. Given the Modernization Project would have no adverse impacts to agriculture or forestry under the Appendix G CEQA thresholds for these resources, the Project would have no cumulatively considerable impact on such resources. Accordingly, the Modernization Project, together with past, present existing, pending, and reasonably foreseeable future projects, would not result in significant cumulative impacts on agriculture and forestry resources.

See *Section 4.0, Introduction to Chapter and Methodology* for a detailed discussion of the approach and methods of the cumulative analysis.

4.2.6 References—Agricultural Resources

California Department of Conservation. 2010. *Contra Costa County Important Farmland 2010*. Accessed May 30, 2013. Website: ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/pdf/2010/con10.pdf.

California Department of Conservation. 2013. Farmland Mapping and Monitoring Program (FMMP), Accessed May 22, 2013. Website: http://www.conservation.ca.gov/dlrp/fmmp/Pages/index.aspx.

City of Richmond. 2012. *Richmond General Plan (2030).*

4.3 AIR QUALITY

The Air Quality section of the 2008 EIR was challenged in Court and is a subject of the peremptory writ issued on March 14, 2011. This section consists of new analysis and text, and replaces the entirety of the Air Quality section included in the 2008 EIR. Because a portion of the Modernization Project was constructed prior to issuance of the writ, this section evaluates construction-related emissions for the Modernization Project as a whole as well as the portion of the Modernization Project that has not yet been constructed. This section is formatted differently from other sections of the EIR due to the complexity of this subject matter.

IMPACT SUMMARY

Construction Impacts:

- Construction of the Modernization Project would result in potentially significant, localized adverse construction dust-related air quality impacts. Potential dust generated from construction activities would be mitigated to less-than-significant levels by implementing Bay Area Air Quality Management District-recommended dust control measures.
- Construction activities associated with the Modernization Project would generate short-term emissions of ozone precursors (i.e., oxides of nitrogen [NO_x] and reactive organic gases [ROGs]) that would be significant. Implementation of mitigation measures to reduce NO_x and ROG emissions would reduce the impact to a less-than-significant level. Construction-related emissions of other criteria air pollutants for the overall Modernization Project would be less than significant.
- Construction activities associated with the Modernization Project would generate short-term emissions of particulate matter less than 10 microns (PM_{10}) and particulate matter less than 2.5 microns ($PM_{2.5}$) that could increase risks to public health. However, this impact would be less than significant.
- Construction activities associated with the Modernization Project would expose sensitive receptors to emissions of toxic air contaminants (TACs) that would result in risks below the significance threshold; thus this impact would be less than significant and no mitigation would be necessary.

Operational Impacts:

- Operation of the Modernization Project would result in NO_x emissions below Baseline levels (which are also well below applicable CEQA significance criteria) for the 93% Utilization Scenario. NO_x emissions would also be reduced to Baseline levels for Facility utilization levels up to 100% through recommended mitigation measures, thereby reducing NO_x emissions to less-than-significant levels.

- Operation of the Modernization Project would result in an increase in ROG emissions that would be significant; however, ROG emissions would be reduced to Baseline levels (and well below the CEQA significance criteria) through implementation of recommended mitigation measures for the 93% utilization levels with 100% hydrogen utilization. ROG emissions would also be reduced to Baseline levels for Facility utilization levels up to 100% through recommended mitigation measures, thereby reducing ROG emissions to less-than-significant levels.
- Operation of the Modernization Project would result in $PM_{2.5}$ and PM_{10} emissions below Baseline levels (which are also well below applicable CEQA significance criteria) for the 93% Utilization Scenario with 100% hydrogen plant utilization. $PM_{2.5}$ and PM_{10} emissions would also be reduced to Baseline levels for Facility utilization levels up to 100% through recommended mitigation measures, thereby reducing $PM_{2.5}$ and PM_{10} emissions to less-than-significant levels.
- Operation of the Modernization Project would result in an increase in localized carbon monoxide (CO) concentrations above Baseline levels (which are well below applicable CEQA significance criteria) for all scenarios. CO emissions would also be reduced to Baseline levels for Facility utilization levels up to 100% through recommended mitigation measures, thereby reducing CO emissions to less-than-significant levels.
- Operational activities associated with the Modernization Project would expose sensitive receptors to increases in emissions of TACs that result in health risks above Baseline levels (which are well below applicable CEQA significance criteria) for the 93% Utilization Scenario with 100% hydrogen plant utilization. Health risks from TAC emissions would also be reduced to Baseline levels for Facility utilization levels of up to 93% and 100% through recommended mitigation measures, thereby reducing health risks from toxic air contaminants to less-than-significant levels.
- Operational activities associated with the Modernization Project could lead to increases in odorous emissions from new or modified Facility components, and from existing Facility components processing feedstocks (crude and gas oils) with higher concentrations of sulfur. This would be a less-than-significant impact with mitigation.
- The Modernization Project would not conflict with or obstruct implementation of the 2010 Bay Area Clean Air Plan; thus, this impact would be less than significant and no mitigation would be necessary.
- The Modernization Project would not contribute to cumulative regional air emissions of criteria pollutants or health risks from TACs.

- The Modernization Project would be located in an area with relatively high ambient levels of risks from TACs compared to other Bay Area communities; TAC sources include regional freeways, the Port of Richmond, rail, and other industrial facilities. Because the Modernization Project would not result in a net increase above Baseline levels in criteria air pollutants or health risks from TACs, the Project would not contribute to an adverse cumulative impact requiring mitigation, or cause a disparate significant adverse health impact in an already-burdened community.

4.3.1 Introduction

This section evaluates the potential impacts of the Modernization Project on regional and local air quality from operations at the Facility. The impacts of Modernization Project construction are also analyzed. This section discusses criteria air pollutant (CAP) and TAC emissions associated with the Modernization Project, while greenhouse gas emissions are discussed in *Section 4.8, Greenhouse Gases*.

This section provides a description of existing air quality conditions, an overview of air quality regulations, and an analysis of the potential impacts on regional and local air quality from air emissions associated with the Modernization Project. The methods of emissions analysis for short-term construction and long-term operations were developed based on methodologies established by expert air quality agencies including the Bay Area Air Quality Management District (BAAQMD), California Air Resources Board (CARB), and United States Environmental Protection Agency (EPA). Chevron also obtained air quality permits from BAAQMD as part of the Chevron Hydrogen and Energy Renewal Project (2008 Project), and as part of the permit process BAAQMD staff developed engineering evaluations for the key refinery processing components of the Modernization Project. The EIR team also included experts in air quality and refinery operations, and the EIR preparation process included extensive consultation with BAAQMD staff regarding the methodologies, calculations, and conclusions presented in this section.

As discussed in *Chapter 3, Project Description*, the Modernization Project includes Facility components that would result in lower emissions compared to existing Facility components (e.g., lower-NO_x [oxides of nitrogen]) burners will replace several existing burners). Chevron has also proposed to add several new features (Project Design Features) to the Project that were not part of the 2008 Project, and were developed by Chevron to reduce net air emissions from the Facility. Finally, this EIR identifies mitigation measures to reduce emissions of

CAPs and TACs causing adverse health risks to below applicable CEQA significance criteria (discussed in *Section 4.3.5*). The Project Design Features, mitigation measures requiring implementation of Project Design Features, and additional mitigation measures would also achieve Chevron's objective of ensuring that the Modernization Project would result in NNI in localized emissions of criteria pollutants or health risks from localized TACs.

4.3.2 Physical Setting

This physical setting description provides the air quality context for the Modernization Project in both the local and regional context.

Air quality depends upon both the rate and location of pollutant emissions. Atmospheric conditions such as wind speed, wind direction, and air temperatures interact with features of the landscape to determine the movement and dispersal of air pollutants and consequently affect air quality. Geography, topography, meteorology, and proximity to populated areas are all relevant to understanding the physical setting against which Project impacts will be evaluated.

Air quality conditions have also been measured and evaluated over time, and this physical setting description also provides information about existing local and regional air quality conditions.

Finally, the legal framework for regulating air emissions is divided into two general categories of pollutants, and then further divided based on the nature of the activity or “source” of air pollution. The first category of pollutants are CAPs, for which ambient air quality standards based on the protection of public health have been established under State and federal law. These criteria pollutant standards, the types of sources that emit criteria pollutants, and the region's status in complying with these standards, are described in *Section 4.3.2.2.1* below.

The second category of pollutants are TACs, which comprise a wide variety of compounds determined to pose an actual or potential risk to public health, either by increasing cancer risks or increasing other health risks such as respiratory diseases like asthma. TACs have been of particular concern in Richmond, and have been evaluated in a variety of studies and are being addressed with various programs, as described below.

There is also a complex and overlapping set of laws, regulations, and permit mandates that apply to various Refinery Operations. Refinery Operations are those operations, excluding transportation, that are associated with the refining

of feedstocks into petroleum and includes the stationary sources of emissions at the facility. These are summarized in the *Section 4.3.3* and in *Appendix 4.3-REG*.

4.3.2.1 Local Setting

An understanding of the local physical conditions in and around the Facility, including the City of Richmond and nearby unincorporated county areas north of Richmond, is critical to understanding the localized impacts, including potential for adverse health impacts, for the Modernization Project.

Figure 4.3-1 shows the City of Richmond, including North Richmond (unincorporated Richmond) along with the location of the Modernization Project.

As shown in Figure 4.3-1, the 2,153-acre Facility is located along the western boundary of the City of Richmond. The main portion of the Facility is bounded by the Chevron Richmond Marketing Fuels Terminal to the southeast and Chevron Energy Technology Company to the south. The marine terminal and wharf (Long Wharf) are located on the southern boundary of the Facility on the San Francisco Bay. The Long Wharf is over 1 mile long and receives and unloads crude oil and other raw materials shipped from worldwide locations, as well as loading refined products produced at the Facility for shipment elsewhere.

As shown in Figure 4.3-2, a number of neighborhoods surround the Facility. The residential communities of Atchison Village, Santa Fe and Iron Triangle are located southeast of the Facility, across Castro Street and Garrard Boulevard. The Shields-Reid community lies toward the northeast. Parchester Village is located northeast of the Facility and Point Richmond is located to the southwest. Point San Pablo Peninsula and the San Francisco Bay form the western border of the Facility and San Pablo Bay forms the northern boundary of the Facility property. Point San Pablo Yacht Harbor, where some residents may live in houseboats, is located north of the Project site and is part of the larger Point Richmond neighborhood.

4.3.2.1.1 *Sensitive Receptors within Facility Vicinity Neighborhoods*

For the purposes of air quality, public health, and noise analyses, sensitive receptors are generally defined as land uses with population concentrations that would be particularly susceptible to disturbance from dust, noise, vibration, air pollutant concentrations, or other disruptions associated with the Modernization Project construction and/or operation.

Sensitive receptors include residences, schools, day care centers, libraries, hospitals, residential care centers, parks, and churches. Some receptors are considered more sensitive than others to air pollutants. The reasons for greater

than average sensitivity include pre-existing health problems, or duration of exposure to air pollutants. Schools, hospitals, and convalescent homes are considered to be relatively more sensitive to poor air quality because children, elderly people, and the infirm are more susceptible to respiratory distress and other air quality-related health problems than is the general public. Residential areas are considered sensitive to poor air quality because people usually stay home for extended periods of time, with associated greater exposure to ambient air. Recreational uses are also considered sensitive due to the greater exposure to ambient air because vigorous exercise associated with recreation places a high demand on the human respiratory system.

Since the 1970s, Chevron has been relocating petroleum processing units northward, away from the community located near the southern and eastern boundaries of the Facility. This has created vacant land areas at the Facility's southern and eastern perimeter that serves as a physical separation (or buffer) between Facility processing activities and adjacent off-site uses.

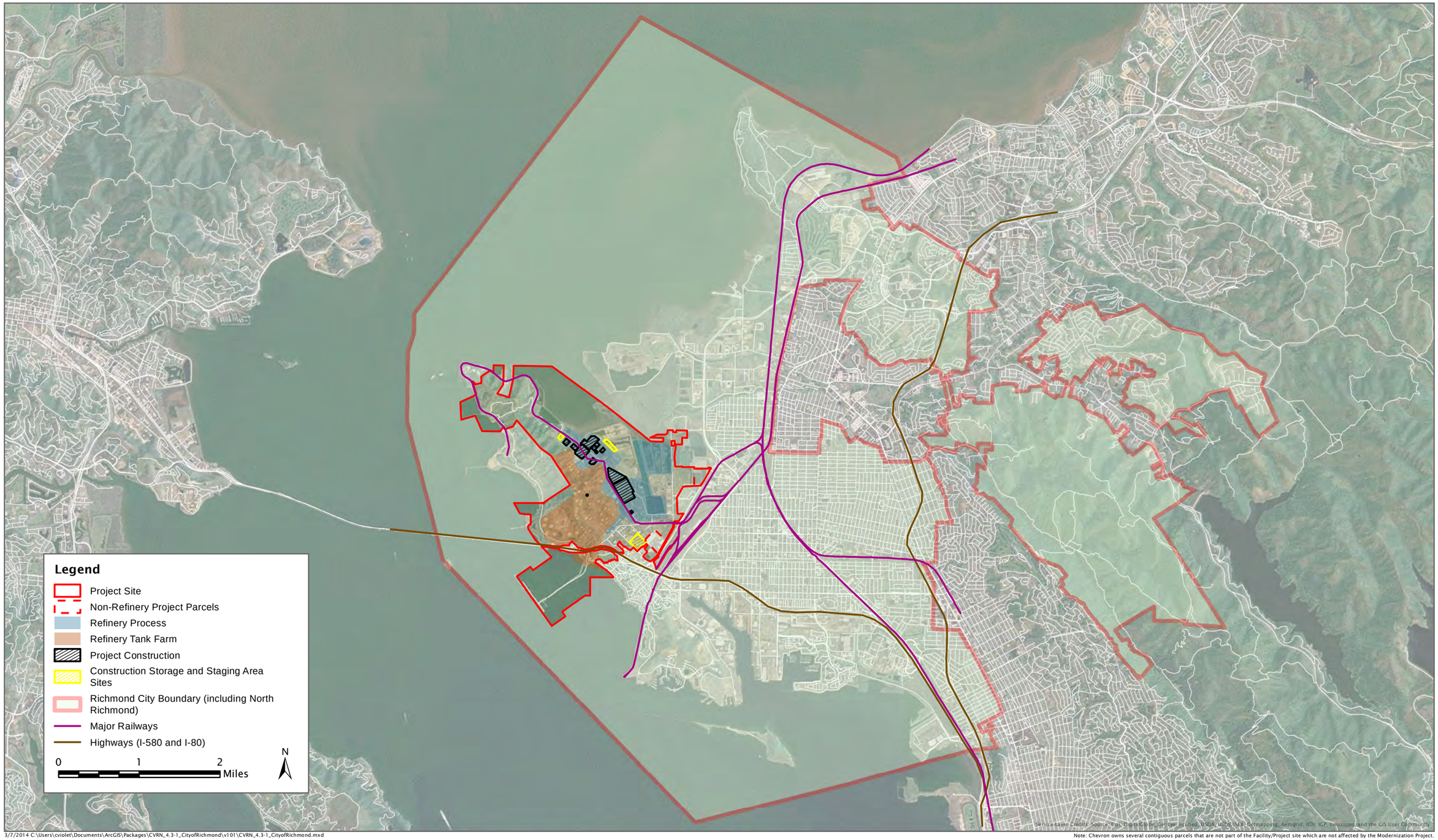
The six neighborhoods that have portions of the neighborhood within a 1-mile radius of the Facility are Shields-Reid, Iron Triangle, Atchison Village, Santa Fe, Point San Pablo, and Point Richmond as shown in Figure 4.3-3. The following is a listing of sensitive land uses located within approximately 1 mile of the Modernization Project's physical components (e.g., the Hydrogen Plant Replacement) as shown in Figure 4.3-4:

- Atchison Village and Park, a residential community that is the closest sensitive land use to the Modernization Project site, is approximately 5,200 feet or 1 mile from the closest physical modification proposed as part of the Modernization Project;
- Washington Park and Washington Elementary School are approximately 5,700 feet or 1.1 miles away;
- Richmond Municipal Natatorium is approximately 5,000 feet or 0.9-mile away; and
- Peres Elementary School is approximately 6,000 feet or 1.1 miles away.

Additional land use information is presented and discussed in more detail in *Section 4.10, Land Use, Plans, and Policies*.

4.3.2.1.2 *Localized Climate, Meteorological and Topological Data*

Meteorological and topological data, particularly information about topographic features and wind patterns that influence how pollution is dispersed locally, are the first elements of the relevant localized physical setting.



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T22r2, T38r1, T47Ar5, and T47Br3); City of Richmond, 2005; Google, 2013

Figure 4.3-1
Chevron Refinery Modernization Project EIR
City of Richmond Map Including North Richmond



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T38r1 and T54)

Figure 4.3-2
Chevron Refinery Modernization Project EIR
Location of the Project Site and Adjacent Land Use



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T38 r1); City of Richmond, 2010

Figure 4.3-3
Chevron Refinery Modernization Project EIR
Neighborhoods in the Project Site's Vicinity

POINT RICHMOND (PT. SAN PABLO)
POINT RICHMOND (YACHT HARBOR)
Richmond Parkway
Rumrill Blvd
NORTH RICHMOND
Gertrude Ave
SHIELDS-REID
Peres Elementary School
23rd St
Portola Ave
Castro St
IRON TRIANGLE
Barrett Ave
Atchison Park
ATCHISON VILLAGE
Ohio Ave
Garrard Blvd
Calrson Blvd
SANTA FE
Hwy 580
POINT RICHMOND
Washington Park and Elementary School
Cutting Blvd
MARINA BAY
Richmond Municipal Natatorium
Richmond-San Rafael Bridge
Hwy 580

Legend

- Project Site
- Non-Refinery Project Parcels
- Richmond City Limit
- Hospital
- School
- Child Care
- Other Sensitive Receptors

0 2,000 4,000 Feet

N

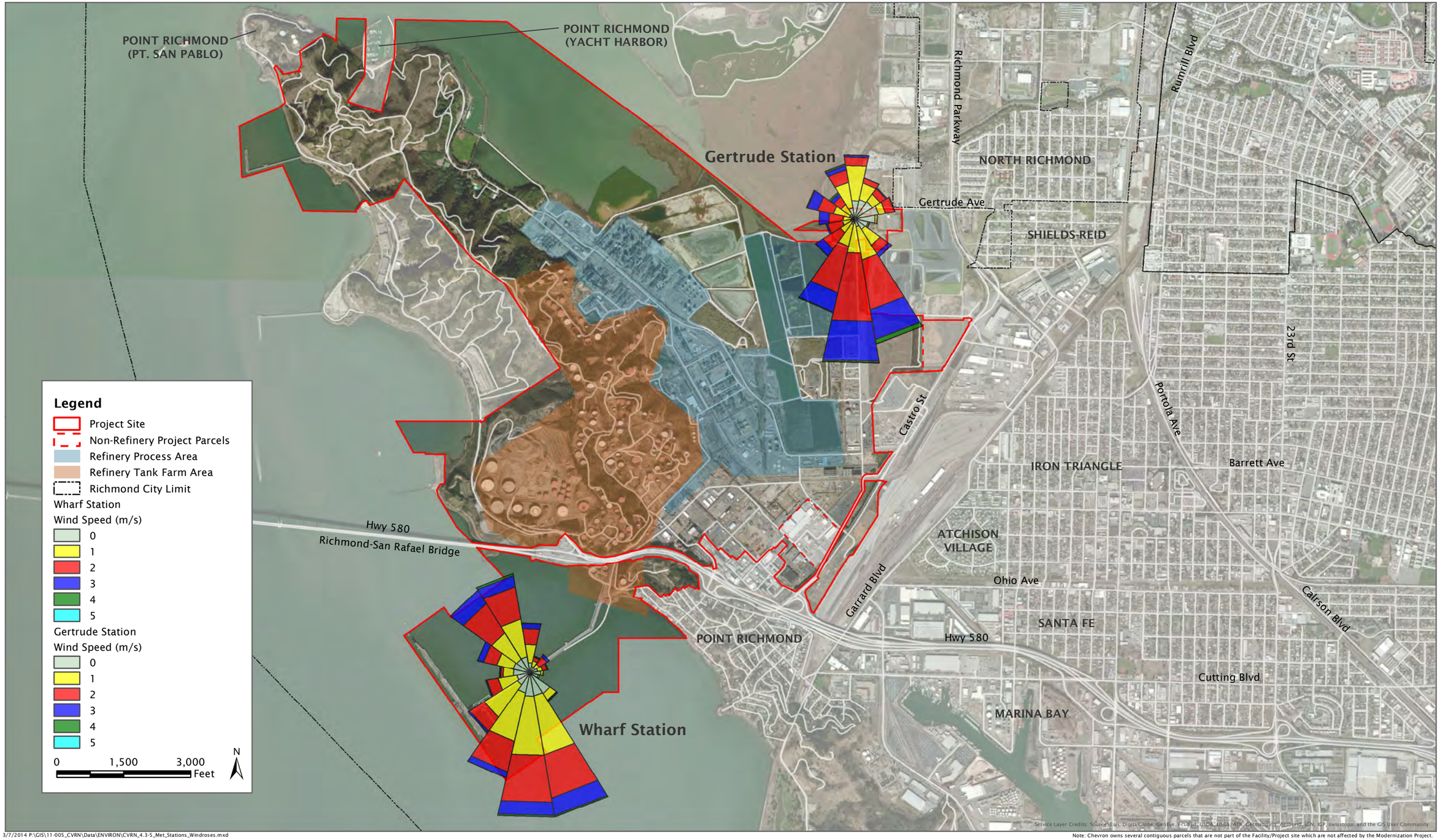
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: CDE, 2013;CCLD, 2012; OSHPD, 2013; Chevron (T38r1); Google, 2013

Figure 4.3-4
Chevron Refinery Modernization Project EIR
Sensitive Land Uses within a Mile of the Project Site Boundary



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T9r1 and T38r1); NCDC, 2007

Figure 4.3-5
Chevron Refinery Modernization Project EIR
Gertrude and Pier Meteorological Station and Windroses (Indicating “Blowing From” Distribution)

The Facility is located on land immediately adjacent to the bay, and Facility shipping facilities (Long Wharf) are in the bay. Proximity to the bay helps moderate localized temperatures. The Facility is also bisected by a ridge. As shown in Figure 4.3-5, two surface meteorological stations are located in the vicinity of the Facility: one is the station maintained by Chevron located just south of the western end of the West Gertrude Avenue (Gertrude station) north of the ridge, on Facility property; the other station is a National Climate Data Center station (Automatic Weather Station ID 994036) located on the Long Wharf south of Interstate 580 (I-580) (Wharf station).

Figure 4.3-5 shows that prevailing winds are most often northerly (and to a lesser extent southerly), along the shoreline.

4.3.2.1.3 *Air Quality Within the City of Richmond*

In addition to understanding population and sensitive use distributions near the Facility, and topographic and wind pattern data that influence the distribution of air pollutants, this EIR also examined air quality data that have been collected in and near the Facility.

4.3.2.1.3.1 BAAQMD Monitoring Data for Richmond

Table 4.3-1 summarizes the monitored concentrations of certain TACs associated with increased cancer health risks at BAAQMD's Richmond 7th Street monitoring station and the nearby San Pablo-Rumrill monitoring station in 2010, the most recent year for which data are available.

To understand the health consequences of these monitored concentrations of TACs, a health risk assessment (HRA) must be completed. An HRA combines information about ambient air quality concentrations of TACs with information about the toxicity of each TAC and possible exposure "pathways" by which people may come into contact with these ambient air concentrations (e.g., by inhaling the air, or by having deposited airborne dust particles come in contact with skin, or by having airborne dust particles deposited in soil where fruit trees or other food is grown). This HRA methodology is normally used to assess the significance of air pollution from particular kinds of activities (e.g., industrial, highways, rail, shipping, etc.), and was used to assess impacts from the Modernization Project, as discussed in Impact 4.3-6, below.

4.3.2.1.3.2 Chevron Air Monitoring

Chevron also operates air monitors within or in close proximity to the Facility, including monitors required by BAAQMD and monitors voluntarily installed by Chevron to monitor operational and other conditions.

TABLE 4.3-1 AMBIENT CONCENTRATIONS OF TACS AND OTHER CHEMICALS (RICHMOND-7TH STREET AND SAN PABLO-RUMRILL BAAQMD MONITORING STATIONS)

	Concentration[a,b]			
	Richmond 7th		San Pablo Rumrill	
Compound	ppb	µg/m³	ppb	µg/m³
Acetone[c]	1.404	3.334	4.533	10.768
1-3-Butadiene[d]	0.030	0.067	0.030	0.067
Benzene	0.186	0.594	0.198	0.632
Carbon Tetrachloride	0.107	0.676	0.106	0.665
Chloroform	0.018	0.089	0.022	0.106
Ethylbenzene	0.080	0.349	0.110	0.476
Ethylene Dibromide[d]	0.005	0.038	0.005	0.038
Ethylene Dichloride[d]	0.050	0.202	0.050	0.202
Freon 113[c]	0.070	0.335	0.066	0.314
Methyl Chloroform (1,1,1-Trichloroethane)[d]	0.016	0.086	0.015	0.081
Methylene Chloride (Dichloromethane)	0.183	0.636	0.322	1.119
Methyl Ethyl Ketone	0.171	0.503	0.573	1.689
Tetrachloroethylene (Perchloroethylene)	0.012	0.081	0.012	0.085
Toluene	0.690	2.602	0.838	3.158
Trichloroethylene	0.069	0.374	0.006	0.032
Trichlorofluoromethane[c]	0.183	1.026	0.169	0.947
Vinyl Chloride[d]	0.050	0.128	0.050	0.128
M/P Xylene	0.330	1.433	0.534	2.318
O-Xylene	0.120	0.523	0.347	1.506

Notes: ppb = parts per billion; µg/m³ = micrograms per cubic meter.

[a] Data are taken from the BAAQMD Richmond-7th Street and San Pablo-Rumrill monitoring stations for 2010.

[b] Average of 27 samples at Richmond-7th Street and 20 samples at San Pablo-Rumrill. Samples with concentrations below the method detection limit were assigned a value equal to one-half of the detection limit.

[c] Acetone, Freon 113, and trichlorofluoromethane are not TACs.

[d] Ethylene dibromide, ethylene dichloride, 1,3-butadiene, and vinyl chloride were not detected above the method detection limit in any of the samples at either station. In addition, at San Pablo–Rumrill only, methyl chloroform was not detected above the method detection limit in any of the samples.

Source: BAAQMD, 2010b.

TABLE 4.3-2 SO_2 AMBIENT MONITORING DATA SUMMARY (2008-2012) FROM FACILITY

Pollutant	Standard	Value Federal Std.	Value State Std.	Site	2008	2009	2010	2011	2012
Sulfur Dioxide	Highest 1-Hour Average (ppb)[d]	--	250[a]	Castro Street	86	54	N/A	N/A	N/A
				Gertrude St.	78	43	N/A	N/A	N/A
				Golden Gate	40	49	N/A	N/A	N/A
	Highest 1-Hour Average (ppb)[e]	75[b,c]	250[a]	Castro Street	N/A	N/A	55	**763**	**370**
				Gertrude St.	N/A	N/A	**276**	**429**	**312**
				Golden Gate	N/A	N/A	12	**342**	**568**
	Highest 24-Hour Average (ppb)	140[b]	40[a]	Castro Street	20	23	21	39	**68**
				Gertrude St.	17	15	20	25	20
				Golden Gate	8	9	7	19	32
	Annual Average (ppb)[e]	30[b]	--	Castro Street	5	4	4	3	3
				Gertrude St.	6	5	6	2	4
				Golden Gate	1	1	1	4	3

Note: ppb = parts per billion. Values in **bold and underlined** are in excess of applicable standard

[a] State standard. Generally, State standards are not to be exceeded.

[b] Federal standard. Generally, national standards are not to be exceeded more than once per year. In August 2010, EPA revoked the annual average SO_2 standard of 0.030 ppm and the 24-hour SO_2 standard of 0.14 ppm. In June 2010, EPA established a new 1-hour SO_2 standard of 0.075 parts per million (ppm) and thus, during the period above, the 250 ppb California Ambient Air Quality Standard would apply.

[c] 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

[d] Limit applicable before 2010

[e] Limit applicable since 2010

Source: Ambient Monitoring Data for 2008-2012 (Chevron Data Transmittal #9 (Rev #1), 2013).

For example, sulfur dioxide (SO_2) concentrations are monitored by Chevron at a number of stations at and around the Facility. Table 4.3-2 summarizes these data from the Castro Street, Golden Gate, and Gertrude Street monitoring sites, for 2008 through 2012. The data show several episodes where the hourly SO_2 concentration equals or exceeds the applicable ambient air quality standard. The Facility received a notice of violation (NOV A51291A) for exceeding BAAQMD's Regulation 9 Rule 1 SO_2 concentration limit on December 21, 2010. Although SO_2 concentrations measured at the Facility monitors exceeded BAAQMD's

Regulation 9 Rule 1 SO_2 concentration limit during 2011 and 2012, there is no record of NOVs for elevated SO_2 concentration during these years.

A chemical compound associated with odor, hydrogen sulfide (H_2S), is monitored by Chevron at a number of stations in and around the Facility. Table 4.3-3 summarizes these data from Castro Street, Golden Gate, and Gertrude Street monitoring sites, for 2008 through 2010. The data show two episodes where the hourly H_2S concentration exceeded the Ambient Air Quality Standards.

TABLE 4.3-3 AIR QUALITY DATA SUMMARY (2008-2010) FROM FACILITY

Pollutant	Standard	Value	Site	2008	2009	2010
Hydrogen Sulfide	Highest 1-hour Avg (ppb)	30[a]	Castro Street	10	8	5
			Gertrude Street	**66**	10	**111**
			Golden Gate	7	6	5

Notes: ppb = parts per billion. Values in **bold and underlined** are in excess of applicable standard.
[a] State Standard. Generally, State standards are not to be exceeded.
Source: Ambient Monitoring Data for 2008-2010 (Chevron Data Transmittal #9 (Rev #1), 2013).

4.3.2.1.3.3 Richmond Community Air Quality Monitoring Program

As part of a prior agreement with the City of Richmond, Chevron funded a new community air quality monitoring program operated by an independent organization, Argos Scientific. Air quality monitors were installed in three nearby neighborhoods (Atchison Village, North Richmond and Point Richmond), and fenceline monitors at the Facility boundary closest to those neighborhoods, as shown in Figure 4.3-6. The monitors provide a combination of continuous (in some cases) and discrete (in other cases) data of several TACs, including fine particulates ($PM_{2.5}$), ozone, SO_2, black carbon, H_2S, ammonia (NH_3), several types of metals including those generally associated with refineries such as vanadium, polycyclic aromatic hydrocarbons (PAHs), and several other compounds that tend to evaporate in air (volatile organic compounds [VOCs]). Both the fenceline and community monitors are installed, and real-time data for all three neighborhoods are available to the public via a website (www.fenceline.org/richmond). Quarterly reports will also be compiled and made available on the website (Chevron, 2012).

Maximum detected concentrations measured since April 2013 by the fenceline monitoring equipment located adjacent to Point Richmond, Atchison Village, and North Richmond are summarized in Table 4.3-4. As stated in the monthly reports available on the website, the concentrations of these compounds were lower than the toxicity standards established by the State of California. Note that the



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T-22r2, T38r1, T-47Ar4, T-47Br2, and T-56r2); City of Richmond, 2012

Figure 4.3-6
Chevron Refinery Modernization Project EIR
Map of Fenceline and Community Air Monitoring Stations

TABLE 4.3-4 MAXIMUM DETECTED CONCENTRATIONS (PPB) MEASURED BY THE FENCE LINE MONITORING EQUIPMENT LOCATED ADJACENT TO POINT RICHMOND, ATCHISON VILLAGE, AND NORTH RICHMOND

	Compound	April '13	May '13	June '13	July '13	Aug '13	Sept '13	Oct '13	Nov '13	Dec '13
Point Richmond	Benzene	7	11	ND	ND	ND	24	ND	ND	ND
	Sulfur Dioxide	27	16	11	7	14	124	226	89	113
	Toluene	23	13	6	5	8	35	5	8	5
	p-Xylene	10	16	14	ND	ND	10	ND	ND	ND
	Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Hydrogen Sulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Ozone	45	72	NR	NR	NR	NR	NR	NR	NR
Atchison Village	Benzene	8	8	6	ND	12	10	ND	ND	6
	Sulfur Dioxide	51	24	ND	ND	ND	257	240	169	100
	Toluene	23	15	19	ND	ND	72	24	19	170
	p-Xylene	8	9	6	7	8	7	ND	ND	10
	Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Hydrogen Sulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Ozone	50	45	NR	NR	NR	NR	NR	NR	NR
North Richmond	Benzene	ND	6	ND	ND	ND	ND	ND	ND	ND
	Sulfur Dioxide	20	15	14	23	22	41	49	47	104
	Toluene	9	23	8	13	11	16	52	22	126
	p-Xylene	ND	ND	6	ND	9	5	50	ND	26
	Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Hydrogen Sulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Ozone	45	60	NR	NR	NR	NR	NR	NR	NR

Note: ppb = parts per billion; ND = not detected; NR = not reported
Source: Argos Scientific, 2013.

concentration of SO_2 at Atchison Village on September 7, 2013, and October 16, 2013, was above the 1-hour short-term/acute exposure limit of 230 ppb used for the monitoring program for 5 minutes; therefore, the 1-hour short-term/acute exposure limit of 230 ppb was not exceeded, and the wind direction during these episodes was from the south or southeast, suggesting that the SO_2 concentrations are not attributable to the Facility (Argos Scientific, 2013). In addition, the SO_2 concentrations measured since April 2013 by the fenceline monitoring equipment did not exceed the State or federal ambient air quality standards.

Community monitoring data for Point Richmond, Atchison Village, and North Richmond are summarized in Table 4.3-5. For all compounds except $PM_{2.5}$, the maximum detected concentrations for the month of available data (January 2014) are summarized in the table. For those compounds with exposure limits established for the community monitoring program, these maximum concentrations are all below the exposure limits. Note that this is a conservative comparison because the data is based on 5-minute averages but the exposure limits have averaging times of 1-hour or longer. For $PM_{2.5}$, the table includes a summary of the maximum daily and monthly average concentrations. As indicated in the table, the maximum 24-hour average $PM_{2.5}$ concentration on January 24, 2014, is above the 24-hour National Ambient Air Quality Standard (NAAQS) of 35 µg/m^3 at the Atchison Village and North Richmond stations (36 and 38 µg/m^3, respectively). However, this is not considered an exceedance of the NAAQS because the form of the 24-hour standard is the 98th percentile averaged over 3 years. While there are not enough data to make a direct comparison to the NAAQS, the 98th percentile of the data collected, which corresponds to the second highest 24-hour concentration at each station, is below the NAAQS of 35 µg/m^3. Furthermore, a significant portion of the higher readings from January 24, 2014, occurred when the wind was blowing from the south or southeast, suggesting that they are not attributable to the Facility. The form of the $PM_{2.5}$ annual primary (12 µg/m^3) and secondary (15 µg/m^3) standards is the annual mean, averaged over three years. Thus, a direct comparison to these annual standards is also not possible since only a single month of data has been reported. However, the monthly average concentrations at the Point Richmond and North Richmond stations are 12.04 and 14.78 µg/m^3, respectively, which is slightly above the primary $PM_{2.5}$ standard concentration.

4.3.2.1.3.4 Other Emissions Monitoring and Reporting in Richmond

Air emissions of CAPs and TACs from the Facility and other industrial or regulated air pollution sources in Richmond are monitored, recorded, and reported to federal, State, and local regulatory authorities as part of a number of different regulatory programs, which are described in greater detail in *Appendix*

TABLE 4.3-5 SUMMARY OF CONCENTRATIONS (PPB) MEASURED BY THE COMMUNITY MONITORING EQUIPMENT LOCATED AT POINT RICHMOND, ATCHISON VILLAGE, AND NORTH RICHMOND

	Maximum 5-Minute Average Concentration																Max. 24-Hour Conc.	Max. Monthly Conc.
	Ammonia	Benzene	Black Carbon	Ethyl-benzene	Hydrogen Sulfide	3-Methylpentane	MP-Xylene	N-Hexane	N-Heptane	N-Octane	O-Xylene	Toluene	1,2,3-Trimeth-benzene	1,2,4-Trimeth-benzene	1,3,5-Trimeth-benzene	2,2,4-Trimethyl-pentane	$PM_{2.5}$	$PM_{2.5}$
	ppb	ppb	µg/m³	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	µg/m³	µg/m³
Atchison Village	92.9	4.3	12.0	7.8	5.3	5.6	30.4	14.7	3.1	1.1	10.7	9.9	0.50	1.4	0.30	6.5	35.5	11.9
Point Richmond	41.4	2.3	8.8	0.86	4.8	3.0	1.4	3.9	6.5	0.90	0.78	5.3	0.32	8.8	0.20	6.9	31.8	12.0
North Richmond	54.7	1.0	31.1	0.72	3.7	3.6	2.3	18.7	0.82	1.6	0.41	3.2	0.21	0.33	0.13	5.7	38.1	14.8
Exposure Criteria[a]																		
Acute (1-Hour) Exposure Criteria	4,800						6,285				6,285	8,600						
Acute (6-Hour) Exposure Criteria		433																
24-Hour Exposure Criteria																	35[b]	
Chronic Exposure Criteria	300	20		8		200				200	70							12[c]

Notes: ppb = parts per billion; Conc. = concentration.

The time period of data summarized in this table includes a single month (January 2014).

For all compounds except $PM_{2.5}$, the maximum 5-minute average concentration is summarized in the top part of the table. For $PM_{2.5}$, the maximum daily and monthly average concentrations are summarized in the top part of the table.

[a] Exposure criteria used for community monitoring program (http://www.fenceline.org/richmond/chems.htm)

[b] The form of the 24-hour $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) of 35 micrograms per cubic meter (µg/m³) is the 98th percentile averaged over 3 years.

[c] The form of the annual $PM_{2.5}$ NAAQS of 12 µg/m³ is the 98th percentile averaged over 3 years.

Sources: Chevron Data Transmittal #93, 2014. City of Richmond, 2013.

4.3-REG. These include reporting requirements established by BAAQMD rules and procedures (e.g., BAAQMD Emissions Inventory [EI], Regulation 9 Rule 10 Reporting), BAAQMD permits (e.g., Richmond lube oil plant permit reporting), federal reporting requirements implemented by EPA (e.g., Clean Air Act and Toxic Release Inventory reporting requirements), and State reporting requirements implemented by the CARB (e.g., Air Toxics Hot Spots reporting requirements). The measurement and reporting frequency of emissions monitoring data depends on the specific program, and summaries of emissions monitoring data are typically available for public review as hourly-average values or as annual totals by pollutant. The purpose of many of these programs is to provide regulators, as well as the general public, a way of monitoring overall air emissions for a facility, or in a locality or region. These air emissions monitoring and reporting programs also provide specific information regarding the sources contributing to air pollution on a local and regional basis, and assist in informing policy decisions to improve or maintain air quality.

As discussed further in *Section 4.3.4*, below, both the Chevron Hydrogen and Energy Renewal Project EIR Consolidated Volume (2008 EIR) and this EIR use the BAAQMD Annual Emission Inventory as the most comprehensive source of emissions related to Refinery Operations.

4.3.2.1.4 *Evaluations of Richmond Air Quality*

Air quality has been a longstanding concern in Richmond. There have been several studies of Richmond's air quality. Major studies and study methodologies are described below.

4.3.2.1.4.1 TAC Study Comparing Richmond and Bolinas

A community-based participatory research collaboration involving the Silent Spring Institute, Communities for a Better Environment (CBE), and faculty from Brown University and the University of California at Berkeley, completed a 2009 exposure study comparing indoor and outdoor air samples from 40 homes in communities adjacent to the Facility to samples from ten homes in the rural, coastal community of Bolinas, California in Marin County (Green-Brody et al., 2009). These 24-hour integrated samples were analyzed for pollutants including particulates, metals, PAHs, polychlorinated biphenyls (PCBs), ammonia, sulfates, pesticides, flame retardants, phthalates, and phenols. Unlike Richmond, Bolinas has no industrial facilities, has no freeways, has no Port, is not adjacent to urbanized areas with industrial facilities or freeways, and has an isolated population base of approximately 1,620, relative to Richmond's population of approximately 105,000, located adjacent to populated communities. The study also used other available data from the California Environmental Protection

Agency (Cal/EPA) State ambient air quality monitors. The following results were reported in the study:

- More air pollutants and higher outdoor concentrations of air emissions were detected in urbanized Richmond than in rural Bolinas.
- Nickel and vanadium, which are generally associated with refineries, other industrialized operations, and shipping were detected in Richmond at some of the highest concentrations when compared to a distribution of monitoring data from Cal/EPA State ambient air quality monitors.
- Despite high traffic in Richmond, outdoor concentrations of certain particulates and traffic-related pollutants were in the lower half of the distribution of Cal/EPA's statewide monitoring data.
- There is a correlation between outdoor and indoor concentrations that suggests that outdoor pollutants likely penetrate into homes.

As noted in this Green-Brody journal article, limitations of the study include the small sample size in Bolinas, and the lack of multi-season samples or direct Refinery Operational emissions samples to compare to household contaminant profiles.

4.3.2.1.4.2 Community Air Risk Evaluation (CARE) Program

BAAQMD initiated the Community Air Risk Evaluation (CARE) program in 2004 to evaluate and reduce health risks associated with exposures to outdoor TACs in the Bay Area. The program examines TAC emissions from point sources such as refineries and power plants, area sources typically including relatively small sources within a single geographic area (e.g., dry cleaners, gas stations and auto body paint shops in an urban area), and mobile sources such as cars, trucks, ships and locomotives. The CARE program focused on these types of emissions near sensitive populations to help prioritize air quality mitigation strategies. The main objectives of the CARE program are to:

- Characterize and evaluate potential cancer and non-cancer health risks associated with exposure to TACs from both stationary and mobile sources throughout the Bay Area.
- Assess potential exposures to sensitive receptors including children, senior citizens, and people with respiratory illnesses.
- Identify significant sources of TAC emissions and prioritize use of resources to reduce TACs in the most highly impacted areas (i.e., priority communities).

- Develop and implement mitigation measures—such as grants, guidelines, or regulations—to achieve cleaner air for the public and the environment, focusing initially on priority communities.

The BAAQMD methodology for assessing cancer risks from TAC emissions focused on the pollutants that BAAQMD determined to be the primary drivers or causes of such health risks, including particulate matter from diesel exhaust, and four chemicals (1,3-butadiene, benzene, formaldehyde, and acetaldehyde).

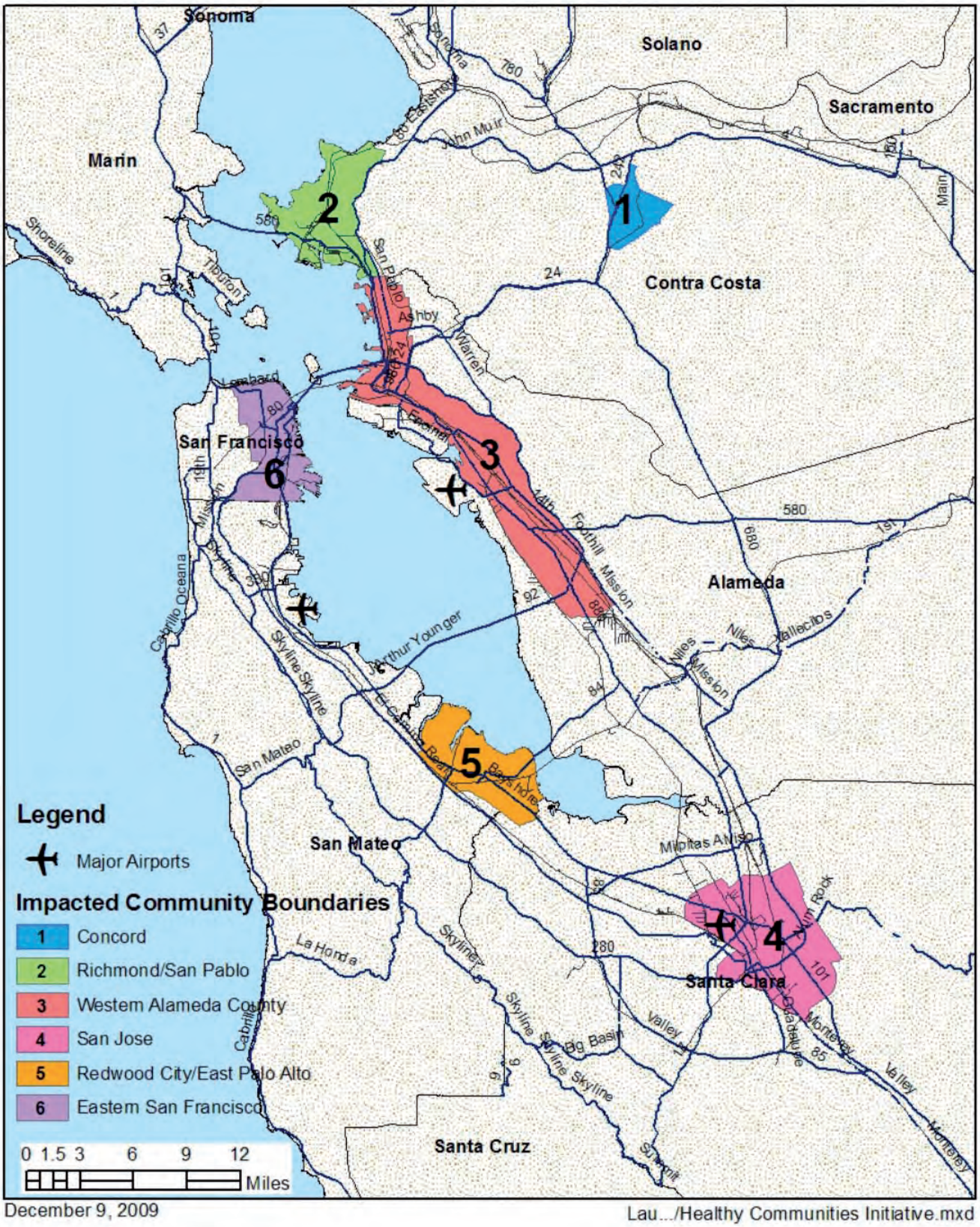
BAAQMD used the information gathered during the initial CARE process to designate communities with higher relative TAC exposure levels within the nine-county San Francisco air basin (CARE communities). These communities are shown in Figure 4.3-7. Richmond, together with San Pablo, was one of six Bay Area communities determined by BAAQMD to have higher relative TAC exposure, and accordingly was designated a CARE community.

The CARE program methodology also evaluated risk reductions that were anticipated to occur in the near term based on the implementation of air quality improvement mandates already required and in the process of being implemented, such as cleaner fuels for cars and trucks, and more stringent emission standards designed to reduce diesel particulates present in diesel exhaust and other pollutants. As shown in Figure 4.3-8, the estimated cancer risk in 2015 for receptors in the vicinity of the Modernization Project ranges from 100 to 600 in a million (BAAQMD, 2012b).

The CARE community assessment is a planning tool designed to help prioritize policy and funding actions, and not a formal HRA. For example, in the CARE program calculations, risks are presented in broad ranges (i.e., increments of 100 in a million), and the actual risks will fall within this broad range. In contrast, a project-level HRA of the type done for the Modernization Project produces an estimated health risk outcome that is far more precise (e.g., 4 excess cancer cases per million). Second, the CARE program planning methodology estimated risk differentials comparing relatively large areas (one square kilometer) even though risks within each area may vary considerably. In contrast, for a project-level HRA of the type done for the Modernization Project, risks were calculated for thousands of much smaller areas (squares 200 meters on a side) in the populated areas within 12 kilometers of the Facility.

4.3.2.2 Regional Setting

The City of Richmond is located in west Contra Costa County. It is located within the nine-county San Francisco Bay Area Air Basin (SFBAAB), and falls under the jurisdiction of the BAAQMD, which has the regulatory lead in assuring attainment



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Source: BAAQMD, 2009a

Figure 4.3-7
Chevron Refinery Modernization Project EIR
BAAQMD CARE Communities

of federal and State regional air quality goals, and has the lead air permitting and enforcement activities for the Facility. As discussed further below, the region is in compliance with most federal ambient air quality standards, with the exception of ozone (for which the region is considered a marginal non-attainment area) and $PM_{2.5}$, (for which the region is not in attainment). California has also established State ambient air quality standards. The region has not met California standards for ozone, respirable particulates (PM_{10}), or $PM_{2.5}$, and is otherwise in attainment or unclassified for other California standards.

For purposes of this EIR, regional setting information is most relevant to understanding the extent to which the Modernization Project may cause or contribute to any exceedance of federal or State ambient air quality standards.

As described in the *Section 4.3.6*, the Modernization Project would result in no net increase in any criteria air pollutant, or health risk from toxic air contaminants, and thus would not cause or contribute to any exceedance of federal or State ambient air quality standards.

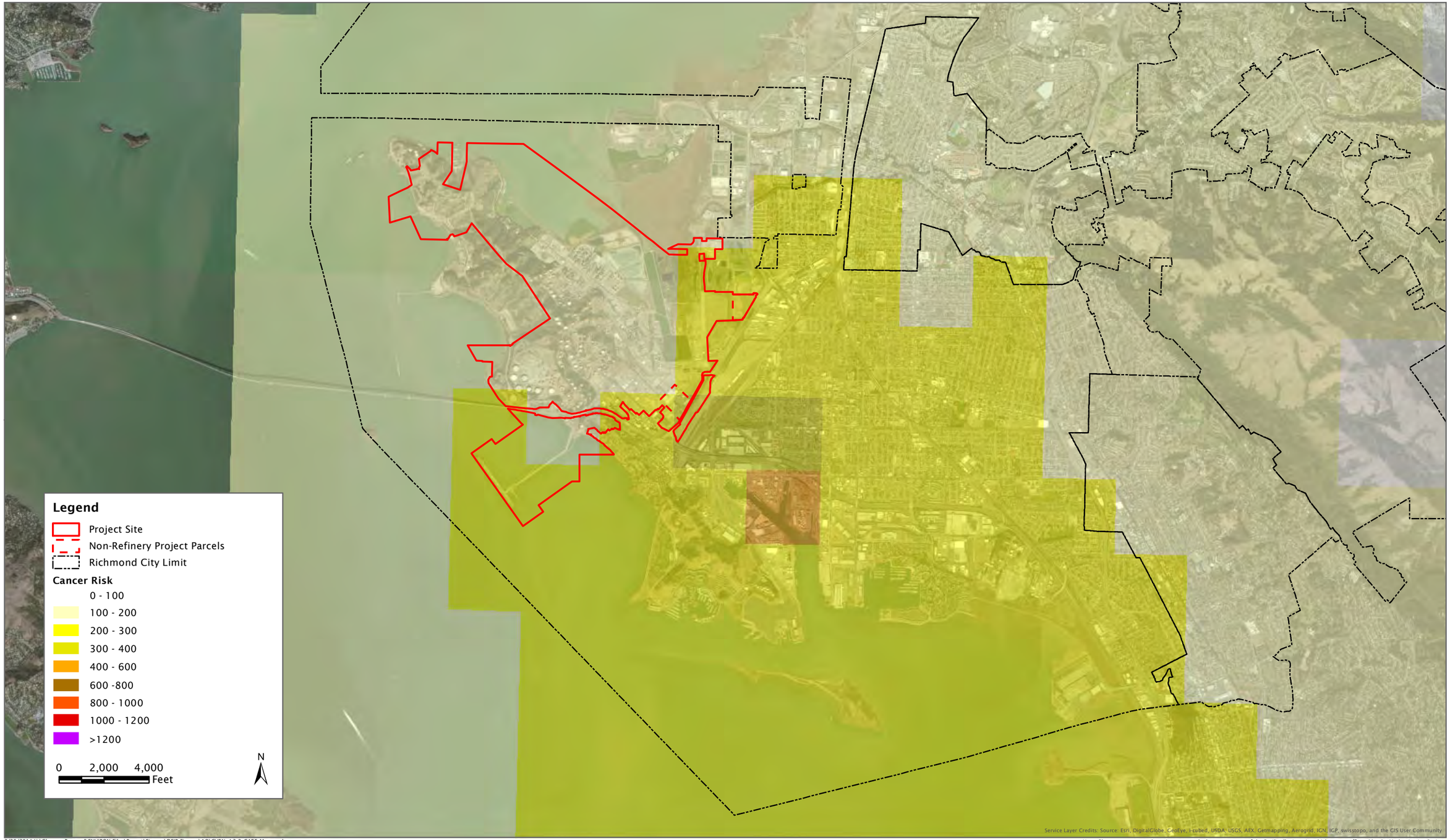
4.3.2.2.1 *Criteria Air Pollutants*

Federal and State air quality laws identify CAPs, including particulate matter (PM_{10} and $PM_{2.5}$), ground-level ozone (O_3), carbon monoxide (CO), SO_2, nitrogen dioxide (NO_2), and lead. Additional details regarding the federal and State regulations pertaining to criteria air pollutants is in *Section 4.3.3, Regulatory Setting*.

Attainment of ambient air quality standards, discussed in the following section, is demonstrated with mandatory monitoring of regional air quality. BAAQMD operates a regional monitoring network that measures the ambient concentrations of six criteria pollutants. The major pollutants of concern in the San Francisco Bay Area are O_3, PM_{10}, $PM_{2.5}$, CO, NO_2, and SO_2. Within Contra Costa County, the BAAQMD operates or receives criteria pollutant data from six monitoring stations in the local area. The monitoring stations along with the pollutants measured are described in Table 4.3-6 below.

Based on this monitoring data, the San Francisco Bay Area Air Quality Basin (SFBAAB) is currently designated as an air quality attainment area under NAAQS for all pollutants except for O_3 (for which the region is designated as a marginal nonattainment area) and $PM_{2.5}$ (EPA, 2013b).[1] Under the California State standards, the region is a nonattainment area for O_3, PM_{10}, and $PM_{2.5}$, and is an attainment or unclassified area for all other pollutants.

[1] SFBAAB is in non-attainment of the 24-hour $PM_{2.5}$ NAAQS; its status under the recently revised annual $PM_{2.5}$ standard is currently under review.



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: BAAQMD, 2012b; Chevron (T38 r1)

Figure 4.3-8
Chevron Refinery Modernization Project EIR
CARE Program Cancer Risk Ranking Estimate in 2015 in the Vicinity of the Project Site

TABLE 4.3-6 BAAQMD CRITERIA POLLUTANT MONITORING STATIONS OPERATING IN CONTRA COSTA COUNTY

Contra Costa County Monitoring Station	Criteria Pollutants Monitored	Operation Schedule
Bethel Island	O_3, PM_{10}, CO, NO_x, SO_2	PM: 1 in 6 days; other pollutants continuous
Concord	O_3, PM_{10}, $PM_{2.5}$, CO, NO_x, SO_2	PM: 1 in 6 days; $PM_{2.5}$: daily (October – March), 1 in 3 days (April – September); other pollutants continuous
Crockett	SO_2	Continuous
Martinez	SO_2	Continuous
Richmond: 7th St	SO_2	Continuous
San Pablo: Rumrill	O_3, PM_{10}, $PM_{2.5}$, CO, NO_x, and SO_2	PM_{10}: 1 in 6 days; other pollutants continuous

Note: Operating schedule based on 2012.
Source: BAAQMD, 2013.

Of the six CAPs, ozone is the only one that is not emitted directly to the air from emission sources. Instead, ground-level ozone is formed from a chemical reaction between NO_x and VOCs, often referred to as precursors, in the presence of sunlight (EPA, 2013a). NO_x collectively refers to two oxides of nitrogen, namely NO and NO_2. VOCs refer to a general class of carbon-containing compounds that exhibit photochemical reactivity (i.e., can undergo a chemical reaction in air in the presence of sunlight). Different regulatory agencies (i.e., EPA, CARB, and BAAQMD) have established different nomenclature and definitions of photochemically reactive organic compounds (i.e., VOCs, reactive organic compounds, reactive organic gases [ROGs], and precursor organic compounds [POCs]). However, these definitions are very similar and generally include the same organic compounds, with only minor differences in specific chemicals that are excluded (i.e., exhibit negligible photoreactivity, as determined by the specific regulatory agency). Although not defined by photoreactivity, total hydrocarbons (THC) is another term that is used by EPA to encompass airborne organic compounds. Because THC, VOCs, ROGs, and POCs generally include the same organic compounds, in consultation with BAAQMD, it was determined that these were equivalent for the purposes of estimating and evaluating emissions for the purposes of this EIR. The definition of each of these terms and lists of specific organic compounds excluded from each category can be found on agency websites or in publicly available documents (CARB, 2009a; Code of Federal Regulations, 40; BAAQMD, 1994). Ambient concentrations of

pollutants are determined by regional pollutant emissions, pollutant emissions in a given area, and wind patterns and meteorological conditions for that area. As a result, ambient concentrations can vary among different locations within an area. The closest and most representative monitoring station locations to the Modernization Project site are Richmond and San Pablo. On January 1, 2013, the San Pablo-Rumrill station began monitoring $PM_{2.5}$. Prior to this date, the nearest monitoring station in Contra Costa County that monitored $PM_{2.5}$ was located in Concord (2975 Treat Boulevard). Table 4.3-7 shows a 5-year (2008-2012) summary of maximum concentration monitoring data collected from the Richmond (SO_2), San Pablo (O_3, SO_2, PM_{10}, $PM_{2.5}$, CO, and NO_2), and Concord ($PM_{2.5}$, CO, O_3, and NO_2) stations, compared with the NAAQS and CAAQS. The monitoring data show that the O_3, PM_{10}, and $PM_{2.5}$ periodically exceeded the NAAQS and CAAQS during this period.

4.3.2.2.2 *Toxic Air Contaminants*

This section presents ambient air toxics monitoring data for the Modernization Project site and vicinity, as well as regional, local, and Facility emission inventories during the Baseline period. Baseline period air toxics emissions inventories for the Facility are discussed in greater detail in *Section 4.3.4*.

4.3.2.2.2.1 TAC Chemicals and Their Sources

Table 4.3-8 presents source and health impact information for the ten TACs posing the greatest known health risks in California, based on ambient air quality data.

4.3.2.2.2.2 Local TAC Emission Sources: Richmond and Surrounding Area

Major local TAC sources include industrial activity in the vicinity of the Modernization Project site, shipping and other maritime activities from the Port of Richmond and its tenants, and emissions from cars, trucks, and trains using the area's highway, parkway, and rail transportation network. Like CAP emissions, TAC emissions result from the operation of factories and other stationary facilities, and from mobile sources such as passenger automobiles and light-duty trucks, other mobile equipment such as portable diesel generators, ships and harbor craft such as tugboats, cargo handling equipment, heavy duty trucks and construction equipment, and rail locomotives. More information on local CAP emissions sources can be found in *Appendix 4.3-PHYS*.

Different TACs are emitted from different types of sources. For example, a major TAC emitted by mobile sources is diesel particulate matter (DPM), including very small particles (referred to as PM_{10}) and even smaller particles (referred to as $PM_{2.5}$). By comparison, a typical human hair is about 100 microns thick.

TABLE 4.3-7 2008-2012 CRITERIA POLLUTANT AMBIENT AIR MONITORING DATA COLLECTED NEAR THE MODERNIZATION PROJECT

Pollutant	Standard	Value NAAQS	Value CAAQS	2008	2009	2010	2011	2012
Ozone[a] (San Pablo; Concord for 2009)	Highest 1-Hour Average (ppm)	--	0.09	0.08	0.11	0.10	0.08	0.09
	Days Over State Standard	--	--	0	2	1	0	0
	Highest 8-Hour Average (ppm)	0.075[h]	0.07	0.063	0.088	0.081	0.058	0.059
	Days Over State Standard	--	--	0	2	1	0	0
	Days Over National Standard	--	--	0	5	1	0	0
Carbon Monoxide[b] (San Pablo; Concord for 2009, 2010)	Highest 1-Hour Average (ppm)	35[f]	20	2.5	1.8	1.2	1.9	1.6
	Highest 8-Hour Average (ppm)	9[f]	9.0	1.3	1.1	1.0	1.0	0.9
Nitrogen Dioxide[a,b] (San Pablo; Concord for 2009, 2010)	Highest 1-Hour Avg. (ppm)	0.1[d]	0.18	0.067	0.040	0.042	0.051	0.055
	Annual Average (ppm)	--	0.03	0.012	0.009	0.008	0.010	0.009
Sulfur Dioxide[c] (Richmond)	Highest 1-Hour Average (ppm)	--	0.25	--	--	N/A	N/A	N/A
	Highest 24-Hour Average (ppm)	0.14	0.04	0.008	0.006	N/A	N/A	N/A
	Annual Average (ppm)	0.03	--	0.002	0.001	N/A	N/A	N/A
	Highest 1-Hour Average (ppm)	0.075[e]	0.25	N/A	N/A	0.026	0.021	0.013
	Highest 24-Hour Average (ppm)	--	0.04	N/A	N/A	0.007	0.003	0.002
	Annual Average (ppm)	--	--	N/A	N/A	--	--	--
PM_{10}[b] (San Pablo; Concord for 2009, 2010)	Highest 24-Hour Average (µg/m^3)	150[g]	50	44	33	41	73	47
	Days Over State Standard	--	--	0	0	0	1	0
	Annual Average (µg/m^3)	--	20	20.9	14.7	13.7	19.7	15.6

TABLE 4.3-7 2008-2012 CRITERIA POLLUTANT AMBIENT AIR MONITORING DATA COLLECTED NEAR THE MODERNIZATION PROJECT

Pollutant	Standard	Value NAAQS	Value CAAQS	2008	2009	2010	2011	2012
$PM_{2.5}$[a] (Concord)	Highest 24-Hour Average (µg/m³)	35[i]	--	60.3	39	36.4	47.5	32.2
	Days Over National Standard	--	--	3	1	1	2	0
	Annual Average (µg/m³)	12[j] (primary)	12	9.3	8.4	7.1	7.8	6.5
		15[j] (secondary)						

Notes: -- = indicates there was insufficient (or no) data available; ppm = parts per million; µg/m³ = microgram per cubic meter.
[a] CARB-approved a new State 8-hour O_3 standard of 0.070 ppm on May 17, 2008, and approved new State 1-hour and annual NO_2 standards of 0.18 ppm and 0.03 ppm, respectively on February 22, 2007. EPA approved a new federal 24-hour $PM_{2.5}$ standard of 35 µg/m³ on September 21, 2006.
[b] The San Pablo site was temporarily closed in March 2009 due to heavy damage from a building fire. No statistics are available for 2009 and therefore, data from the Concord site are reported here.
[c] On June 2, 2010, EPA established a new 1-hour SO_2 standard, effective August 23, 2010, and revoked both the existing 24-hr SO_2 standard and the annual primary SO_2 standard. Data shown are from the Richmond monitoring station.
[d] 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
[e] 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
[f] Not to be exceeded more than once per year.
[g] Not to be exceeded more than once per year on average over 3 years.
[h] Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.
[i] 98th percentile, averaged over 3 years.
[j] Annual mean, averaged over 3 years.
Sources: BAAQMD, 2013d.

TABLE 4.3-8 SUMMARY OF SOURCES AND HEALTH EFFECTS OF TOP 10 CARCINOGENIC TACS IN CALIFORNIA

TAC	Sources	Example Non-Cancer Chronic and Acute Impacts
Acetaldehyde	Mobile engine exhaust Stationary source fuel combustion	Eye, skin, respiratory system irritation
Benzene	Fugitive emissions from gasoline Gasoline engine exhaust Crude oil and natural gas mining Petroleum refining Electricity generation Residential fuel combustion Natural petroleum seeps	Central nervous system impacts
1,3-Butadiene	Mobile engine exhaust (incomplete combustion) Agricultural waste burning Residential wood burning Wildfires Oil/gas extraction Petroleum refining, synthetic material manufacturing	Neurological impacts Eye, mucous membrane irritation
Carbon Tetrachloride	Chemical product manufacturing Petroleum refining	Respiratory tract irritation Central nervous system impacts
Hexavalent Chromium	Industrial uses: chrome plating, chromic acid anodizing; glass furnace firebrick lining Gasoline motor vehicles	Renal toxicity Gastrointestinal hemorrhaging
p-Dichlorobenzene	Consumer products (insect repellants, air fresheners)	Eye, nose, throat irritation Liver, skin, central nervous system impacts
Formaldehyde	Motor vehicle exhaust (complete combustion) Residential wood burning	Respiratory symptoms Eye, nose, throat irritation
Methylene Chloride	Plastic product and synthetics manufacturing Aircraft and parts manufacturing Paint stripping operations	Bone marrow, liver, Kidney impacts
Perchloroethylene	Dry cleaning operations Aircraft part manufacturing Fabricated metal product manufacturing Consumer products (e.g. brake cleaners, tire sealants)	Liver toxicity Kidney dysfunction Neurological impacts
Diesel particulate matter	Diesel fuel combustion	Reduced lung function

Note: All compounds in this list have been identified as carcinogens by the State of California.
Source: CARB, 2009b; CARB, 1998.

4.3.2.2.3 *Odors*

Land uses in Richmond that constitute odor sources include industrial facilities such as the Facility, wastewater treatment facilities, solid waste transfer facilities, and under some conditions naturally occurring sources, such as the decomposition of natural organic matter in bayland marsh and pond areas. Other examples of minor sources of odors include restaurants and auto body painting establishments. In general, odor dispersal occurs relatively quickly, with noticeable impacts diminishing substantially with increasing distance from the source.

4.3.3 Regulatory Setting

4.3.3.1 Federal, State, and Regional Regulatory Agencies

Air quality within the SFBAAB is regulated by several federal, State, regional, and local government agencies. These agencies work individually and jointly to improve air quality through legislation, regulations, planning, policymaking, education, and programs. As discussed below, some State programs are administered at the regional level, and some federal programs are implemented at the State or regional levels.

EPA is responsible for implementing the programs established under the federal Clean Air Act, which was enacted in 1963 and most recently amended in 1990. Under the federal Clean Air Act, EPA is responsible for setting and enforcing the NAAQS, judging the adequacy of State Implementation Plans (SIPs), which will be discussed in further detail later in this section, and regulating emission sources that are under the exclusive authority of the federal government (e.g., aircraft, ships, sources outside of State waters (outer continental shelf), vehicles sold in states other than California, and certain locomotives). EPA has delegated the authority to implement many of the federal programs to California or the BAAQMD, while retaining an oversight role to ensure that the programs continue to be implemented.

CARB is the State regulatory agency with authority to enforce regulations to achieve and maintain the NAAQS. CARB also has the authority to adopt California Ambient Air Quality Standards (CAAQS), which in many cases are more stringent than the NAAQS, and enforce them through the California Clean Air Act of 1988, which requires that all air districts in the state endeavor to achieve and maintain the CAAQS by the earliest practicable date. CARB is responsible for developing the SIP. CARB reviews operations and programs of the regional air districts, and requires each air district with jurisdiction over a nonattainment area to develop its own strategy for achieving the NAAQS and CAAQS. Other CARB duties include determining and updating area designations and maps, setting emissions

standards for new mobile sources, consumer products, small utility engines, and off-road vehicles, and monitoring air quality, in conjunction with air monitoring networks maintained by air pollution control and air quality management districts.

BAAQMD is the regional air district with jurisdiction over the nine-county region located in the San Francisco Bay Area Air Basin. It is responsible for preparing the air quality plans that are required under the federal Clean Air Act and California Clean Air Act (which are compiled to form the SIP), and for implementing attainment strategies to ensure that future emissions will be within federal and State standards. BAAQMD regulates and issues permits for stationary sources at industrial and commercial facilities. Both federal and State O_3 plans rely heavily upon stationary source control measures set forth in BAAQMD's Rules and Regulations. BAAQMD also inspects stationary sources of air pollution, responds to citizen complaints, and monitors ambient air quality and meteorological conditions.

BAAQMD develops guidance for assessing air quality impacts for projects subject to CEQA. It recommends thresholds for determining whether projects would have significant adverse environmental impacts, identifies methodologies for predicting project emissions and impacts, and identifies measures that can be used to avoid or reduce air quality impacts.

In addition to EPA, CARB, and BAAQMD, other organizations join in the efforts to improve air quality such as the Association of Bay Area Governments (ABAG), Metropolitan Transportation Commission (MTC), county transportation agencies, cities and counties, and various non-governmental organizations. These organizations participate in the adoption of regulations and policies, as well as implementation of extensive education and public outreach programs.

Air quality within the SFBAAB is addressed through the efforts of various federal, State, regional, and local government agencies. These agencies work individually and jointly to improve air quality through legislation, regulations, planning, policymaking, education, and programs.

As further discussed in *Appendix 4.3-REG*, the primary regulations governing air quality cover CAPs, TACs, and odors. Air quality policies, regulations, and statutes also address a wide variety of other topics, including environmental justice. CAPs—which include O_3, CO, NO_2, SO_2, PM (including respirable PM_{10} and $PM_{2.5}$), and lead—are regulated at the federal and State level for stationary sources as well as mobile and marine sources. In addition, BAAQMD has number of regulations pertaining to CAPs, many of which expand upon federal and State regulations.

Similar to CAPs, TACs are also regulated at the federal, State, and local levels. At the federal level, TACs—referred to as hazardous air pollutants—are regulated through a variety of approaches, such as EPA's National Emissions Standards for Hazardous Air Pollutants; EPA's Emergency Planning and Community Right-to-Know Act, which has a reporting component for air toxics; and a chemical accident prevention program.

In California, TACs are defined by CARB as those air pollutants that "may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential hazard to human health" (CARB, 2013). There are currently over 200 substances that have been identified by the CARB as TACs (CARB, 2011b). While most TACs originate from human sources such as fossil fuel combustion or dry cleaning facilities, natural sources such as forest fires and volcanic eruptions also contribute TACs to ambient air.

In California, TACs are subject to a variety of laws and regulations, such as the Tanner Air Toxics Act (Assembly Bill 1807) and the Air Toxics Hot Spots Information and Assessment Act of 1987 (Assembly Bill 2588, or the Hot Spots Act); California Accidental Release Prevention program; Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65); and a diesel risk reduction plan with corresponding regulations designed to reduce diesel emissions. CARB also regulates TACs by promulgating State regulations to reduce TAC emissions from mobile sources, and providing guidance to local air districts on the regulation of TACs from stationary sources, such as refineries. Other laws and regulations address accident and other risks from TACs. A more detailed description of applicable TAC laws and regulations is presented in in *Appendix 4.3-REG*.

In the Bay Area, BAAQMD has developed rules and regulations that limit emissions from various TAC sources, such as solvent cleaning operations, aerosol paint products, and flares at petroleum refineries. Similar to the accidental release programs at the federal and State levels, BAAQMD also has a work plan to address accidental releases from industrial facilities.

Further information on federal, State and local air quality laws and regulations setting can be found in *Appendix 4.3-REG*.

4.3.3.2 City of Richmond

4.3.3.2.1 *Richmond General Plan 2030*

Adopted in April 2012, the Richmond General Plan 2030 (General Plan 2030) establishes the policy framework that serves as the City's basis for both public and private decision-making, and guides the community's long-range development. The goals and policies of the plan reflect the City's philosophy on

public and private development and provide guidance for making decisions on related issues.

Consistency with the General Plan 2030, including plan elements relevant to this section, is addressed in *Section 4.10, Land Use, Plans, and Policies*, and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.3.3.2.2 *City of Richmond Ordinances*

Richmond Municipal Code Section 15.04.840.030 establishes visibility-based particulate matter and air contaminant standards that prohibit emissions of dust or particulate matter that is detectable at the property boundary by a reasonable person who is not using instruments. "Toxic fumes" must also be addressed as part of the Conditional Use Permit review and approval process (Richmond Zoning Code, Section 15.04.820.025).

4.3.3.3 Regulation of Odors

Odors are generally not regulated due to impacts on human health, but are regulated as a nuisance. However, manifestations of a person's reaction to strong odors can range from psychological (e.g., irritation, anger, anxiety) to physiological (e.g., circulatory and respiratory impacts, nausea, vomiting, headache).

The ability to detect odors varies considerably among the population and overall is quite subjective. Some individuals are able to smell very minute quantities of specific substances; others may not have the same sensitivity but may have sensitivities to odors of other substances. In addition, people may have different reactions to the same odor; an odor that is offensive to one person may be acceptable to another (e.g., fast food restaurant). It is important to also note that an unfamiliar odor is more easily detected, and a transient odor is more likely to result in complaints than a constant one. This is caused by a phenomenon known as odor fatigue, in which a person can become desensitized to almost any odor and recognition only occurs with an alteration in the intensity.

The occurrence and severity of odor problems depends on numerous factors, including the nature, frequency, duration and intensity of the source, wind speed and direction, and the sensitivity of the receptor(s). Substances present in refinery air emissions, such as H_2S, SO_2, methyl mercaptan, other reduced sulfur compounds, ammonia, benzene compounds, naphthalene, and toluene, among others, are known to cause unpleasant odors.

Odors are typically considered a local air quality problem. EPA has not established regulations that deal with the generation of odors.

California Health and Safety Code Section 41700 states that no person can discharge air contaminants or other material that cause injury, detriment, nuisance, or annoyance to any considerable number of persons or the public, or discharge air contaminants that endanger the comfort, health, or safety of such persons.

Odors caused by air pollutants are regulated by BAAQMD. These regulations place general limitations on odorous substances and specific emission limitations on certain odorous compounds, such as ammonia and H_2S. BAAQMD may issue a Notice Of Violation if a business or individual violates a requirement of BAAQMD's odor rules, which generally prohibit the creation of an objectionable odor beyond the facility's boundaries that remains objectionable after dilution with four parts of odor-free air.

Finally, the City of Richmond addresses odors in its General Plan 2030 and Zoning Code. Consistency with the General Plan 2030, including plan elements relevant to this section, is addressed in *Section 4.10, Land Use, Plans, and Policies,* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030. Zoning Code Section 15.04.840.030 prohibits “continuous, frequent or repetitive odors that are perceptible beyond property boundaries” and notes that an odor that is detected for no more than 15 minutes per day is not a “continuous” odor. Odor must also be addressed as part of the Conditional Use Permit review and approval process (Richmond Zoning Code, Section 15.04.820.025).

4.3.3.4 Environmental Justice

Federal, State, regional and local agencies have increasingly recognized and responded to the potential for disparate impacts to occur in communities with lower income levels, or larger minority populations, that already host industrial or transportation-related land uses that generate CAPs and TACs. This concern is generally referred to as environmental justice. Increasing pollution levels in these communities, even increases allowed by existing federal, State, and local air quality permit laws, may result in more significant health impacts than allowing such pollution increases in other higher income or less diverse communities with fewer existing pollution sources.

At the federal level, an executive order (i.e., Executive Order 12898) directs federal agencies to consider environmental justice during the regulatory process.

At the State level, environmental justice is being addressed through several California statutory programs (e.g., Senate Bill 115, Senate Bill 828). In addition, screening tools, such as the California Communities Environmental Health Screening Tool (EnviroScreen Tool), are available to help determine which portions of the State have higher pollution burdens and vulnerabilities than other areas, so that assistance can be prioritized to those communities with higher pollution burdens. The BAAQMD CARE program, discussed above, also considers environmental justice, and BAAQMD has adopted environmental justice policies.

Finally, the City of Richmond addresses environmental justice in its General Plan 2030. Consistency with the General Plan 2030, including plan elements relevant to this section, is addressed in *Section 4.10, Land Use, Plans, and Policies*, and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.3.3.5 Facility Compliance with Applicable Air Quality Laws, Regulations, and Permit Conditions

According to a summary of NOVs provided by BAAQMD and Chevron (Chevron Data Transmittal #66, 2014), BAAQMD has issued 51 notices of violation against the Facility during 2008-2010. Of the 51 NOVs, 45 are listed as resolved and six are listed as pending. The violations are associated with BAAQMD Regulation 9 (inorganic gaseous pollutants), due to exceedances in SO_2, CO, and H_2S; Regulation 12 (specifically rules related to flares), due to missed flare samples; Regulation 8 (organic compounds), due to leaks, spills, inspections, monitoring, and maintenance violations; Regulation 10 (new stationary sources), due to H_2S exceedances and performance tests and benzene waste violations; Regulation 1, due to maintenance of monitor and late reporting; and Regulation 2 (permits), due to operations without permits.

From January 2011 through November 2013, Chevron has reported receiving 118 NOVs. Nine relate to the August 2012 fire, discussed further in *Section 4.13.2.4.3.2.1.5 of Section 4.13, Public Safety*; and the remaining relate to Regulation 2, due to failure to meet permit conditions and operation without permits; Regulation 8, due to deviations related to leaks, spills, inspections, and monitoring and maintenance violations; Regulation 10, due to deviations from the regulation including flaring due to operator error; Regulation 9, due to H_2S and NO_x exceedances; Regulation 1, due to late reporting and monitor maintenance; Regulation 12, due to missed flare samples; and Regulation 6, due to opacity excesses.

4.3.4 Facility Setting and Baseline

The major sources of emissions of CAPs and TACs from Refinery Operations are stationary sources, such as furnaces and process units used to heat, chemically modify, and separate crude oil and purchased gas oils feedstock into marketable products such as gasoline, diesel, jet fuel, and lubricants. Refinery Operations also generate fugitive emissions from tanks and fugitive components, such as valves and flanges on pipelines. Emissions are also generated from combustion sources involved in the transportation of feedstocks brought into and marketable products transported from the Facility. Transportation-related combustion air emissions sources include vessels associated with marine shipping, locomotives associated with rail transport and trucks.

In consultation with the BAAQMD, the BAAQMD Emissions Inventory (EI) was determined to provide the most comprehensive ongoing framework for understanding emissions from Refinery Operations for purposes of this EIR. A detailed discussion of the use of BAAQMD EI data to estimate Refinery Operations emissions is included in *Appendix 4.3-OP*. The BAAQMD EI was also used in the setting section of the 2008 EIR. As discussed below, and in more detail in *Appendix 4.3-OP*, when continuous emissions monitoring data, more detailed Engineering Evaluations were available (as prepared by BAAQMD engineers responsible for processing air permit applications, including permit applications for Modernization Project components that were included in the 2008 EIR), or updated emissions factors for specific Facility equipment sources were provided by BAAQMD, they were used to estimate Facility emissions.

This EIR also includes emission estimates, again developed in collaboration with BAAQMD staff and relevant regulatory guidance, for Facility transportation related to marine shipping, trucking, and rail activities. Emissions for shipping, locomotives from rail activities, and trucking, were not included or analyzed in the 2008 EIR because the project (either for the 2008 Project or the current Modernization Project) did not include any changes to the Facility's shipping, trucking, or rail transport conveyance capabilities.

Because the Appellate Court Decision required an assessment of the emission consequences of potential changes to Facility throughput and variations in potential crude oil blends, this EIR includes a comprehensive analysis of transportation-related air emissions that could vary with Facility utilization levels. In general, higher Facility utilization levels generate a higher level of shipping, trucking, and rail activity and associated air emissions (i.e., more transportation, and hence more transportation emissions, occur with 100% Facility utilization than 93% Facility utilization). Certain transportation levels, particularly related to shipping, also vary in accordance with the types of vessels serving the Long

Wharf, which itself varies with the amount of crude blend and purchased gas oil shipped to and processed in the Facility (see the discussion of the Unit Rate Model in *Appendix 4.3-URM*).

As discussed below, air emissions from Refinery Operations, marine shipping, and truck and rail activity are estimated using different data sources and analysis methods. Emissions from Refinery Operations include emissions from process unit furnaces and units, catalytic reforming, the fluid catalytic cracker, cooling water towers, product loading racks, storage tanks, component fugitives, electricity and steam generation, flares, light ends product loading, maintenance shops, portable storage containers, and wastewater treatment. The data sources and estimation methods used for estimating Refinery Operations emissions are summarized in more detail in *Appendix 4.3-OP*. Shipping emissions include emissions from combustion sources (e.g., marine and wharf equipment engines) required to deliver crude oil, gas oil and other feedstocks to and to convey products from the Facility by sea. The data sources and estimation methods used for estimating shipping emissions are summarized in more detail in *Appendix 4.3-SHP*. Rail and truck emissions are relatively minor in scope and include emissions from combustion sources (e.g., truck and locomotive engines) required to deliver materials to and to convey products from the Facility by train and surface roads. The data sources and estimation methods used for estimating rail and truck emissions are summarized in more detail in *Appendix 4.3-TRANS*. Baseline and future case emission levels, and, in certain instances, the potential air quality impacts associated with each of these emissions sources, are separately calculated and analyzed in this EIR. The Facility's total emissions, however, consist of the sum of all emissions from Refinery Operations, shipping, and truck and rail activity.

4.3.4.1 Baseline Methodology Overview

The Facility filed a revised application for the Modernization Project early in 2011, and the City filed its Notice of Preparation for this EIR in May of 2011.

The City selected the 3 years preceding the Notice of Preparation (2008-2010) as the Baseline period, rather than a single year, based on a variety of considerations. A 3-year baseline period provides a more representative sample of Facility operational levels and resulting emissions compared to a single year of data, which may be based on atypical operations. The City selected the years 2008-2010 as the Baseline years because they were the 3 years immediately preceding publication of the Notice of Preparation for which complete operational and emissions data were available, and because 2008-2010, on average, generally represent typical Refinery Operations and emissions levels. Emissions for 2011 were also evaluated, and remained consistent with the 2008-

2010 Baseline period (see *Appendix 4.3-URM*). Because 2011 emissions were consistent with Baseline emissions, the Baseline was not modified to include 2011 emissions data.

In August 2012, a major fire resulted in the shutdown of the Facility's crude unit, as described in greater detail in *Section 4.13, Public Safety*. The Facility continued to process gas oils and other blendstocks while the crude unit was inoperable, and the crude unit was repaired and placed back into service in the second quarter of 2013. The inactive status of the crude unit during an extended period from 2012 to 2013 resulted in these years not being representative of normal Refinery Operations, and these years were therefore excluded from the average annual Baseline period Facility emissions.

The average annual emissions during 2008-2010 were further evaluated with respect to several factors. First, as authorized by the California Supreme Court in *Neighbors for Smart Rail v. Exposition Metro Line Construction Authority*, (2013) 57 Cal.4th 439 (*Smart Rail*), when adopted air pollution reduction legal mandates and scheduled and funded facility improvements will result in lower facility emissions in the foreseeable future, it is appropriate for an EIR to compare project impacts against the reduced emissions that will occur in the future for the facility, and not simply compare a project with what would soon become unrepresentative existing levels. As discussed in *Appendices 4.3-OP*, *4.3-SHP*, and *4.3-TRANS*, there are some regulatory mandates and equipment changes that will occur by the anticipated Modernization Project start date in 2016 that will reduce emissions. As of 2016, regulatory changes will result in certain emission reductions from some marine shipping-related combustion activity, and from rail and truck use, but not for Refinery Operations.

Second, as directed by the BAAQMD, updated emissions factors developed by the BAAQMD for certain Facility emission sources in the BAAQMD's EI were used in place of older factors that were in use during 2008-2010. These updated factors result in changes to the emissions calculated for the applicable sources and more accurately reflect Facility Baseline conditions than data from 2008-2010. The updated EI factors are summarized in *Section 1.6 of Appendix 4.3-OP*.

Third, Facility emissions data are produced from Continuous Emissions Monitoring System (CEMS) equipment installed on certain Facility emissions sources. At the direction of the BAAQMD, CEMS data for applicable sources was used in place of other 2008-2010 estimation factors to more accurately reflect Facility Baseline conditions. The Baseline factors derived from CEMS data are summarized in *Section 1.4.4 of Appendix 4.3-OP*. Finally, In September 2008, the BAAQMD conducted an Engineering Evaluation (EE) of the 2008 Project that

developed emissions factors for the proposed sulfur recovery unit, hydrogen plant, and certain other proposed Facility improvements. At the direction of the BAAQMD, emissions factors developed in the BAAQMD EE for applicable sources was used in place of other 2008-2010 estimation factors to more accurately reflect Facility emissions. The factors derived from EE data are summarized in *Section 1.5 of Appendix 4.3-OP*.

The emissions Baseline for the Modernization Project reflects applicable Facility physical modifications, EI factors for Facility sources updated by BAAQMD from the 2008-2010 inventory, emissions factors developed for Facility sources by BAAQMD in the 2008 EE, CEMS data for Facility sources, and regulatory mandates that will affect emissions in the near future. These factors are described in more detail below and in *Appendix 4.3-OP* for Refinery Operations, which include Facility stationary sources. Baseline emissions for shipping are discussed below and in more detail in *Appendix 4.3-SHP* and in *Appendix 4.3-TRANS* for rail and trucking.

The following sections explain the development of Baseline CAP and TAC emissions in more detail.

4.3.4.2 CAP and TAC Emissions During 2008-2010

This section describes Facility emissions during 2008-2010 from Refinery Operations, shipping, rail, and trucking activities.

4.3.4.2.1 *Stationary Emission Sources at the Facility*

Table 4.3-9 summarizes the types of emissions from the main types of stationary process units and other stationary equipment, such as pipelines, pumps, and storage tanks, at the Facility. Additional details regarding each process unit used in the refining process referenced in Table 4.3-9 are provided in *Appendix 3, Overview of Oil Refining Process.*

Most of the process equipment is fueled by refinery fuel gas, which is a collection of light gases created within the Facility in various processing units blended with natural gas. These light gases are first collected and processed in a gas-processing unit to recover any heavier components that can be refined into marketable products, and then processed to remove most sulfur compounds such as H_2S to reduce sulfur emissions from combustion. The treated light gases are blended with purchased natural gas and vaporized LPG in the fuel gas drums to form refinery fuel gas, which is used as fuel for the heaters and boilers that run the process units. Consumption of refinery fuel gas in the process units results in both CAP and TAC emissions. Table 4.3-10 lists the TAC emissions associated with refinery fuel gas.

TABLE 4.3-9 TYPES OF EMISSIONS FROM FACILITY STATIONARY SOURCES

Emission Source	CAPs	TACs
RFG/NG Combustion (including flares)	NO_x, CO, PM, VOCs, and SO_2	Fuel combustion TACs[a]
Fluid Catalytic Cracker Process	NO_x, CO, PM, VOCs, and SO_2	Fluid catalytic cracker process TACs
Rheniformer Process	NO_x, SO_2, CO, and VOCs	
Cooling Towers	VOCs, PM	Chlorine, bromine, NH_3, and metals
Loading Terminals (Wharf, Marketing)	VOCs	Wharf: motor gas/aviation gas fugitive TACs Marketing: motor gas/aviation gas TACs
Sulfur Recovery Claus Units (Process and Combustion)	NO_x, CO, PM, VOCs, and SO_2	Fuel combustion TACs carbon disulfide, H_2S, sulfuric acid
Process Component Fugitives	VOCs	Hydrogen Plant: NH_3, hydrocarbons FCC FHT: diethanolamine, H_2S, hydrocarbons Sulfur Recovery Unit, H_2S Plant: DEA, H_2S, NH_3 Tanks: hydrocarbons
Storage Tanks	VOCs	Perchloroethylene, Crude/Gas Oil/Motor Gas/Aviation Gas fugitive TACs
Wastewater-related Units	VOCs	Hydrocarbons, H_2S and NH_3
Hydrogen Plant Process	CO, VOCs	Methanol

[a] Fuel combustion TACs are listed in Table 4.3-10.
Note: RFG = refinery fuel gas; NG = natural gas; FCC FHT – fluid catalytic cracker feed hydrotreater
Source: BAAQMD EI (See *Appendix 4.3-EI*) and BAAQMD EE (see *Appendix 4.3-EE*)

TABLE 4.3-10 TYPES OF TOXIC AIR POLLUTANTS FROM FUEL GAS COMBUSTION IN REFINERY FUEL GAS

Acetaldehyde	Formaldehyde
Antimony[a]	Indeno(1,2,3-cd)pyrene[a]
Arsenic	Lead[a]
Benzene	Manganese
Benzo(a)anthracene[a]	Mercury
Benzo(a)pyrene	Naphthalene[a]
Benzo(b)fluoranthene[a]	Nickel
Benzo(k)fluoranthene[a]	Phenol
Cadmium	Selenium[a]

TABLE 4.3-10 TYPES OF TOXIC AIR POLLUTANTS FROM FUEL GAS COMBUSTION IN REFINERY FUEL GAS

Chrysene[a]	Toluene
Copper	Xylenes[a]
Ethylbenzene[a]	Zinc

[a] This TAC was listed as a refinery fuel gas TAC in the EE, but a specific quantity is not reported in annual emissions inventories

Source: BAAQMD Emissions Inventory (see *Appendix 4.3-EI*) and BAAQMD Engineering Evaluation (see *Appendix 4.3-EE*).

4.3.4.2.1.1 The BAAQMD Emissions Inventory

The BAAQMD tracks emissions of CAPs and TACs annually in an emissions inventory (the BAAQMD EI). An emissions inventory is an itemized list of emissions estimates for specific sources of air pollution over a specified time period. The BAAQMD EI is derived from annual updates submitted to the BAAQMD summarizing throughput or firing rates, for stationary air pollution sources. Annual updates are submitted to the BAAQMD for each applicable source within the Facility. The BAAQMD uses the submitted information to calculate emissions, and prepare an annual emissions inventory of CAPs and TACs from each source. The results of this analysis are used to assess fees based on the estimated emissions from the applicable sources.

The BAAQMD EI includes annual CAPs and TACs emission estimates for sources in the Facility. Other CAPs and TACs emissions reports are also prepared by Chevron for the Facility, including monthly CEMS data, and a compliance report for the Richmond lube oil plant permit. During consultations, the BAAQMD confirmed that the EI, which was used in the 2008 EIR and is the most complete emissions data source for the Facility, represents the best available data for estimating 2008-2010 emissions levels from the Facility.

4.3.4.2.1.2 Estimation of 2008-2010 CAP Emissions from Facility Stationary Sources

Consistent with the 2008 EIR methodology, 2008-2010 CAP emissions were obtained from the BAAQMD EI compiled by the BAAQMD[2] for 2008, 2009, and 2010.[3] The BAAQMD EI reports contain annual-average daily emissions of five

[2] BAAQMD Emission Inventories are included as *Appendix 4.3-EI*.

[3] This is consistent with the 2008 EIR in the reliance on BAAQMD's EI, though the 2008 EIR used a 1-year period (2005), instead of a 3-year averaging period (2008-2010), as the Baseline.

CAPs (CO, NO_x, PM_{10}, SO_2, and VOCs) for every stationary source permitted by BAAQMD in the Facility. $PM_{2.5}$ emissions were conservatively assumed to equal PM_{10} emissions. The BAAQMD EI for 2008-2010, and also for 2011, is summarized in *Appendix 4.3-EI*. The BAAQMD EI CAPs emissions for 2011 are consistent with emissions as reported in the BAAQMD EI for the 2008-2010 period. As a result, annual average daily emissions from 2008-2010 are representative of normal operating conditions.

4.3.4.2.1.3 Estimation of 2008-2010 TAC Emissions from Refinery Operations

TAC emissions during 2008-2010 were also prepared from the BAAQMD EI. There are potential overlaps between the CAPs and TACs data in the BAAQMD EI. The CAPs category of ROGs, for example, can include individual chemicals, such as benzene and toluene, that are also reported separately in the TACs data. Similarly, the particulate matter CAPs category contains individual chemicals, such as lead and arsenic, that are listed in the TACs data. In order to characterize the individual chemical constituents of groups of chemicals, speciation profiles are used. Speciation profiles provide estimates of the chemical composition of emissions, and are used in preparing emission inventories and air quality models. Regulatory agencies, such as CARB and the BAAQMD, maintain and update estimates of the chemical composition and size fractions of particulate matter and the chemical composition of ROGs, for a variety of emission source categories.

4.3.4.2.2 *2008-2010 Shipping Emissions*

The Facility imports crude oil, gas oil and smaller amounts of additional blendstocks, and exports a portion of manufactured transportation fuels and blendstocks, via ships and barges. Other exports from the Facility are conveyed via rail, truck, or pipeline, as described in *Section 4.0.3.3.4 of Section 4.0, Introduction to Chapter and Methodology.* Waterborne transport includes self-propelled ocean-going vessels or tanker ships and vessels that are not self-propelled (i.e., barges) that dock at Chevron's Long Wharf and unload and/or load liquid materials over the dock. Both the ships and barges require assistance from smaller ships called tugs (also called harbor craft). The ships, barges, and tugs utilize engines fueled by fossil fuels and emit CAP and TAC airborne emissions in conjunction with Facility shipping.

Shipping emissions are not subject to CEMS monitoring, are not included in the 2008 BAAQMD EE for certain Modernization Project facilities, and are not included in the BAAQMD EI. In consultation with BAAQMD, standardized methods for estimating shipping-related emissions were used to develop an emission inventory for shipping activities related to Chevron's Long Wharf in 2008-2010. The methodology used to develop the shipping emissions inventory is described

in detail in *Appendix 4.3-SHP* and in a report prepared by Chevron's contractor, ICF (Chevron Data Transmittal #26F, 2014). The methods used in the shipping-related emissions inventory are consistent with other San Francisco Bay shipping emission inventories (ENVIRON, 2008; Moffitt & Nichols and ENVIRON, 2010a-d), subject to factors specific to Modernization Project, and CEQA and Department of Homeland Security considerations. The City's experts (ENVIRON) and the BAAQMD have peer reviewed the ICF report, and agree it is appropriate to use information from that report in estimating shipping emissions in this EIR.

4.3.4.2.2.1 Estimation of 2008-2010 CAP Shipping Emissions

The shipping emissions estimates for 2008-2010 developed for this EIR are consistent with current CARB, EPA, and/or other Port inventory practices with respect to emissions sharing for vessels with multiple calls at different refineries; types of sources included; definition of vessel activities (cruise, high speed transit, low speed transit, maneuvering, at-berth, anchorage); load factors, data sources for vessel movement, vessel characteristics, and emission factors; fundamental emission equations; and incorporation of applicable regulations (ENVIRON, 2008; Moffitt & Nichols and ENVIRON, 2010a-d; Starcrest, 2008, 2012, 2013a-b; ICF International, 2009; CARB, 2005, 2010, 2011a; and EPA, 2008). The methods used to derive the 2008-2010 emission estimates are summarized below, and in more detail in *Appendix 4.3-SHP*.

4.3.4.2.2.2 Estimation of 2008-2010 TAC Shipping Emissions

TACs are associated with fossil fuel combustion in internal combustion engines (main and/or auxiliary) on ships and barges and in the boilers on ships. TAC emissions from ship internal combustion engines are characterized using the same method used for diesel internal combustion engines, regardless of the type of liquid fuel burned (diesel, bunker, etc.). The primary TAC from diesel internal combustion engines is DPM, which, to be conservative, is assumed to be equal to PM_{10} emissions from ship-related engines. TACs associated with ship-related boiler combustion are evaluated by separately evaluating the ROGs TAC emissions. The estimation of 2008-2010 TAC shipping emissions is described in more detail in *Appendix 4.3-SHP*.

4.3.4.2.3 *Estimation of 2008-2010 Rail and Truck Emissions*

Rail and truck emissions sources comprise a small fraction of Facility emissions relative to Refinery Operations and shipping. For example, trucking contributes approximately 5% of total 2008-2010 NO_x emissions and rail contributes approximately 2% of total 2008-2010 NO_x emissions. In general, baseline rail and truck emissions were estimated on the basis of the number of truck trips and trains to the Facility during 2008-2010. This information was used to estimate

the combustion sources and emissions from locomotives and trucks based on engine and fuel types used in 2008-2010. The estimation of baseline rail and trucking CAP and TAC emissions are further discussed in *Appendix 4.3-TRANS*. To provide a conservative assessment, $PM_{2.5}$ emissions for rail were assumed to equal PM_{10} emissions from rail.

4.3.4.3 Emission Estimate Adjustments as of Modernization Project Anticipated Operational Start in 2016

As discussed above, in consultation with BAAQMD, 2008-2010 emissions based on 2008-2010 EI data for Refinery Operations, and estimated from shipping, trucking, and rail activity during 2008-2010, were adjusted to reflect (1) new regulations and equipment changes scheduled to be implemented before the January 2016 anticipated start date for the Modernization Project consistent with the Supreme Court decision in *Smart Rail*, (2) BAAQMD updates of emissions factors used for certain Facility sources in the 2008-2010 EI, (3) emission factors developed for certain Facility sources in the 2008 BAAQMD EE, and (4) CEMS monitoring data for applicable Facility sources. As discussed in *Appendix 4.3-OP*, the updated EI factors, factors derived from the 2008 EE, and CEMS data were used in the Baseline emissions estimates for Refinery Operations.

As discussed in *Appendix 4.3-SHP* and *Appendix 4.3-TRANS*, new regulations and equipment changes scheduled to be implemented before the January 2016 anticipated start date for the Modernization Project affect emissions from ship, truck, and rail combustion activities. For shipping, these factors include (1) the scheduled implementation of new legal mandates designed to reduce emissions from shipping, and (2) Chevron's confirmed upgrades to certain ships used by the Facility. These factors reduce Baseline NO_x, PM_{10} and $PM_{2.5}$, and TAC DPM emissions from shipping (see *Appendix 4.3-SHP*). For rail, the Baseline reflects the long-haul emission factors for long-distance locomotives approved by EPA and locomotive fleet turnover attributable to new regulations and equipment changes. Baseline trucking emission estimates reflect EPA's 2016 fleet year mix (the mix of older and newer trucks assumed to be on the road in 2016) and corresponding emission factors. These factors are further described in *Appendix 4.3-TRANS*. The factors described above ensure that emissions data for 2008-2010 accurately reflect the level of Facility Baseline emissions against which Modernization Project air quality impacts are assessed.

Baseline CAP emissions for Refinery Operations, shipping, rail, and truck activities and the entire Facility are shown in Table 4.3-11.

TABLE 4.3-11 BASELINE CRITERIA AIR POLLUTANT EMISSIONS

	Annual Average Emissions (Tons/Year)				
	CO	NO_x	$PM_{10}/PM_{2.5}$	SO_2	VOCs
Refinery Operations	406	756	487	353	937
Shipping	108	491	15	20	34
Trucking	7.4	36	0.99	0.093	1.6
Rail	3.1	21	0.51	0.013	1.3
Total	525	1,303	502	373	973

Source: See *Appendices 4.3-OP, 4.3-TRANS,* and *4.3-SHP*.

TAC emissions for Refinery Operations during 2008-2010, for shipping, rail, and truck activities, as well as the entire Facility, are shown in Table 4.3-12.

4.3.4.4 Baseline Odors at the Refinery

The Refinery Operations generate hydrogen sulfide emissions, which are regulated by BAAQMD as an odorous compound, as well as other odorous compounds. According to a review of odor complaint records, there were 237 total odor complaints filed against Chevron with BAAQMD between 2008 and 2010, of which 26 were confirmed based on BAAQMD verification protocols.

More specifically, there were five confirmed out of 99 total complaints in 2008, 12 confirmed out of 78 total complaints filed in 2009, and nine confirmed out of 60 filed in 2010. The most frequent odor descriptions for confirmed complaints include "petroleum/diesel/gasoline/oily," "burning/burnt," and "acrid/noxious/ chemical."

From January 1, 2011 through February 18, 2014, there were 228 total odor complaints filed against Chevron with BAAQMD, of which 36 were confirmed based on BAAQMD verification protocols. There were 19 confirmed out of 99 total odor complaints in 2011, 11 confirmed out of 70 total odor complaints in 2012, three confirmed and one pending out of 33 total odor complaints in 2013, and three confirmed and two pending out of 26 total odor complaints in 2014. The most frequent odor descriptions for confirmed complaints include "petroleum/diesel/gasoline/oily," "acrid/noxious/chemical," and "strong/bad/ horrible" or another nonspecific descriptor.

TABLE 4.3-12 BASELINE DETAILED POLLUTANT EMISSION INVENTORY

TAC	Emissions (lbs/year)
Acetaldehyde	201.0
Ammonia	228,220.5
Antimony	0.3
Arsenic	2.2
Benzene	18,279.7
Benzo(a)anthracene	0.0
Benzo(a)pyrene	240.2
Benzo(b)fluoranthene	0.0
Benzo(k)fluoranthene	0.0
Beryllium	0.0
Bromine & Compounds	–
1,3Butadiene	65.7
Biphenyl	–
Butane	–
Methyl Ethyl Ketone	91.6
Butyl Acetate	3.8
Cadmium	0.9
Carbon Disulfide	2,909.2
Chlorine	1.9
Chlorobenzene	1.3
Chloroform	–
Chromium	0.4
Chromium (Hexavalent)	0.8
Chrysene	-
Copper Compounds	9.1
Cumene	125.9
Cyclohexane	537.5
1,2-Dibromoethane	1.1
DPM	19,056.1
Diethanolamine	38.3
Ethane	–

TABLE 4.3-12 BASELINE DETAILED POLLUTANT EMISSION INVENTORY

TAC	Emissions (lbs/year)
Ethanol	620.3
Ethanolamine	40.9
Ethylene	2,445.0
Ethylbenzene	1,340.8
Formaldehyde	1,345.7
N-Hexane	10,259.5
Cyanide Compounds	–
Hydrogen Sulfide	1,013.3
Indeno(1,2,3-cd)pyrene	0.0
Lead Compounds	3.0
Tetra-Ethyl Lead	35.7
Manganese Compounds	120.4
Mercury Compounds	3.0
Methanol	2,892.9
2-heptanone	2.6
Cresols	0.4
Naphthalene	4.5
Nickel Compounds	33.1
Polycyclic Aromatic Compounds	645.4
Phenol	53.0
Propane	–
Propylene Glycol Monomethyl	1.3
Propylene	1,563.0
Selenium	3.7
Silicon	30.7
Sulfate	1,522.6
Sulfuric Acid Mist	52,873.1
Perchloroethylene	26.4
Toluene	24,649.9

TABLE 4.3-12 BASELINE DETAILED POLLUTANT EMISSION INVENTORY

TAC	Emissions (lbs/year)
1,2,4-trimethylbenzene	884.5
Vanadium	63.1
Xylene	16,194.1
2,2,4-trimethylpentane	3,230.6
Zinc compounds	135.8
Amine – other	6.3
Avgas	810.3
Bunker C fuel oil	0.8
Cycloparaffins – other	608.4
Diesel Oil	3,544.2
Fuel – jet 'A'	7,675.2
Gas oil	3,533.2
Glycols	7.6
Ketone – other/not spec	12.6
LPG	13,273.8
Mineral spirits	17.9
Oil – non-fuel, other	4,343.5
Oil/water mixture	12,405.9
Organic liquid – other	9,206.7
PAHs (non-carcinogenic)	1,601.1
Paraffins – C3+	4,534.7
Petroleum Products – other	1,387.0
Facility Feedstock – other	6,593.7
Reformate	10.5
Stoddard solvent	5.2
Sulfur or sulfur compounds	1,501.5
Waste water – refin, other	2,284.9
Water/organics mixture	559.1

People sometimes experience adverse health impacts that are attributed to odors in ambient air. Often these health impacts are non-specific symptoms (headaches, nausea, reflex nausea, gastro-intestinal distress, fatigue, eye irritation, throat irritation, shortness of breath, runny nose, sleep disturbance, inability to concentrate, etc.) which cannot be directly linked to a specific chemical (McGinley and McGinley, 1999). There is little scientific research surrounding long term, low level exposure to chemicals or short term exposures with the olfactory area as a key route of exposure.

4.3.5 Significance Criteria and Methodology

This section discusses the criteria and general methods used to evaluate the Modernization Project's significance with respect to air quality impacts under CEQA. It also discusses the BAAQMD 2010 thresholds of significance, which are used to evaluate the Modernization Project. Methodology is discussed in more detail in *Section 4.3.6* below.

4.3.5.1 CEQA Guidelines Appendix G Thresholds

Appendix G of the State CEQA Guidelines requires evaluating whether the project under consideration would:

(A) Conflict with or obstruct implementation of an applicable air quality plan;

(B) Violate any air quality standard, or contribute substantially to an existing or projected air quality violation;

(C) Result in a cumulatively considerable net increase of any CAP for which the project region is non-attainment under an applicable federal or State ambient air quality standard (including increasing emissions which exceed quantitative thresholds for ozone precursors);

(D) Expose sensitive receptors to substantial pollutant concentrations; or

(E) Create objectionable odors affecting a substantial number of people.

Appendix G of the State CEQA Guidelines advises lead agencies to rely on the CEQA significance criteria established by the local air pollution control agency (for the Bay Area, BAAQMD) to determine the significance of a project's air emissions under the Appendix G thresholds.

4.3.5.2 BAAQMD Significance Thresholds

Consistent with Appendix G, this EIR uses the thresholds of significance adopted in the 2010 BAAQMD CEQA Guidelines (BAAQMD significance thresholds) for

evaluating the significance of CAP and TAC emissions impacts. The BAAQMD significance thresholds are summarized in Table 4.3-13. The BAAQMD significance thresholds are divided between CAPs and TACs, and are set for evaluating a project's short-term construction emissions, long-term operational emissions, and cumulatively considerable impacts. Generally, the BAAQMD significance thresholds for CAPs address the first three Appendix G air quality CEQA thresholds and the TAC thresholds address the fourth Appendix G threshold. Finally, BAAQMD has established a threshold for odors, consistent with the fifth Appendix G threshold.

The 2010 BAAQMD CEQA Guidelines explain that criteria pollutant thresholds based on emission rates (e.g., NO_x, ROGs, PM_{10} exhaust, $PM_{2.5}$ exhaust) or ambient air concentrations (e.g., CO) are designed to maintain concentrations below State and federal standards, or to prevent a "cumulatively considerable contribution" to regional nonattainment with ambient air quality standards.

To assist the lead agency in evaluating air quality impacts at the community scale, thresholds of significance have been established for local community risks and hazards associated with TACs and $PM_{2.5}$ with respect to siting a new source and/or receptor, as well as for assessing both individual source and cumulative multiple source impacts. These thresholds of significance focus on $PM_{2.5}$ and TACs because these more so than other emission types may pose significant adverse health impacts at the local level as discussed separately below.

The emissions of TACs and $PM_{2.5}$ are evaluated based on the health impacts that may result from the emissions of TACs and $PM_{2.5}$. The health impacts associated with TACs are quite diverse and generally are assessed locally, rather than regionally. TACs (and $PM_{2.5}$) can cause long-term health impacts such as cancer, birth defects, neurological damage, asthma, bronchitis, or genetic damage; or short-term acute affects such as eye watering, respiratory irritation (a cough), running nose, throat pain, and headaches.

For evaluation purposes, TACs are separated into carcinogens and non-carcinogens based on the nature of the physiological impacts associated with exposure to the pollutant. Carcinogens are assumed to have no safe threshold below which health impacts would not occur, and cancer risk is expressed as excess cancer cases per one million exposed individuals, typically over a lifetime of exposure. Non-carcinogenic substances differ in that there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis. Acute and chronic exposure to non-carcinogens is expressed as a hazard index

TABLE 4.3-13 BAAQMD CEQA AIR QUALITY THRESHOLDS OF SIGNIFICANCE[A]

Air Pollutants (and Precursors)	Construction-Related Average Daily Emissions (lbs/day)	Operations-Related	
		Average Daily Emissions (lbs/day)	Maximum Annual Emissions (tons/year)
ROGs	54	54	10
NO_x	54	54	10
PM_{10} (equipment exhaust)	82	82	15
$PM_{2.5}$ (equipment exhaust)	54	54	10
$PM_{10}/PM_{2.5}$ (fugitive dust)	BMP	Best management practice compliance required to be less than significant	
CO (local concentration)	None	9.0 ppm (8-hour average) 20.0 ppm (1-hour average)	
Greenhouse Gases – Projects Other than Stationary Sources	None	Compliance with Qualified Greenhouse Gas Reduction Strategy OR 1,100 MT of CO_2e/yr OR 4.6 MT CO_2e/SP/yr (residents + employees)	
Greenhouse Gases – Stationary Sources	None	10,000 MT of CO_2e/yr	
Risks and Hazards for New Sources and Receptors (Individual Modernization Project)	Same as Operational Thresholds	Compliance with Qualified Community Risk Reduction Plan or Increased cancer risk of >10.0 in a million Increased non-cancer risk of > 1.0 HI (chronic or acute) Ambient $PM_{2.5}$ increase: > 0.3 µg/m^3 annual average, a concentration that would not result in significant health impacts. Zone of Influence: 1,000-foot radius from fence line of source or receptor	
Risks and Hazards for New Sources and Receptors (Cumulative Threshold)	Same as Operational Thresholds	Compliance with Qualified Community Risk Reduction Plan or Increased cancer risk of >100 in a million (from all local sources) Increased non-cancer risk of >10 HI (from all local sources) (chronic) Ambient $PM_{2.5}$ increase: > 0.8 µg/m^3 annual average (from all local sources) Zone of Influence: 1,000-foot radius from fence line of source or receptor	

TABLE 4.3-13 BAAQMD CEQA AIR QUALITY THRESHOLDS OF SIGNIFICANCE[A]

Air Pollutants (and Precursors)	Construction-Related Average Daily Emissions (lbs/day)	Operations-Related	
		Average Daily Emissions (lbs/day)	Maximum Annual Emissions (tons/year)
Accidental Release of Acutely Hazardous Air Pollutants	None	Storage or use of acutely hazardous materials locating near receptors or new receptors locating near stored or used acutely hazardous materials considered significant[a]	
Odors	None	Complaint History – five confirmed complaints per year averaged over 3 years	

Note: BMP = best management practices; MT of CO_2e/yr = metric tons of carbon dioxide equivalent per year; MT CO_2e/SP/yr = metric tons carbon dioxide equivalent per service population per year; HI = hazard index; µg/m^3 = micrograms per cubic meter.

[a] A threshold related to storage and use of acutely hazardous air pollutants has been vacated; this threshold is discussed in *Section 4.13, Public Safety.*

Source: BAAQMD, 2011.

(HI), which is the ratio of expected exposure levels to an acceptable reference exposure levels.

The thresholds of significance for local community risk and hazard impacts are identified below. Local community risk and hazard impacts are associated with TACs and $PM_{2.5}$ because emissions of these pollutants can have significant adverse health impacts at the local level. If Modernization Project-related emissions of TACs or $PM_{2.5}$ exceed any of the following thresholds, the Project would result in a significant adverse impact:

- Non-compliance with a qualified Community Risk Reduction Plan;
- An excess cancer risk level of more than 10 in 1 million, or a non-cancer (i.e., chronic or acute) hazard index greater than 1.0 would be a significant cumulatively considerable contribution;
- An incremental increase of greater than 0.3 microgram per cubic meter (µg/m^3) annual average $PM_{2.5}$ from a single source would be a significant cumulatively considerable contribution.

Cancer risks, and acute and chronic hazard indices, are calculated from the estimated concentrations of pollutants in the air and the potential for exposure of people to these pollutants. That process is known as risk assessment.

Concentrations in the air are calculated from TAC emissions using air dispersion modeling. Air dispersion modeling is the mathematical estimation of pollutant impacts from emissions sources within a study area. Information on factors that affect the fate and transport of pollutants in the atmosphere, including meteorological conditions, site configuration, emission release characteristics, and surrounding terrain, is used in the dispersion model. Once concentrations are calculated using air dispersion modeling, the risks are calculated using information on how much air people breathe and the toxicity of the chemical considered. The resulting cancer risks and chronic and acute hazard index, as described above, are compared to the BAAQMD significance thresholds to assess significance.

With respect to odors, the significance threshold used is the odor nuisance complaint approach in BAAQMD Regulation 7. The 2010 BAAQMD CEQA Guidelines also provide guidance in the form of screening distances, to help evaluate potential odor impacts. The screening distance from a new petroleum refinery is 2 miles. Since the Facility is located within 2 miles of residential receptors, existing odor complaints and the potential for increased odors resulting from the Modernization Project is evaluated in this EIR.

4.3.5.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

All of the CEQA Guidelines Appendix G topics are discussed further in the sections that follow.

4.3.6 Impacts and Mitigation Measures

4.3.6.1 Modernization Project Construction Impacts

A description of the Modernization Project's construction phases is presented in *Chapter 3, Project Description.* To varying degrees, these construction phases would generate emissions from four main types of sources: (1) off-road construction equipment; (2) on-road mobile sources like delivery trucks, soil hauling trucks, flatbeds, worker commuting vehicles, and worker transport vehicles; (3) paving and coating activities; and 4) soil movement (fugitive dust).

Construction of several components of the Modernization Project was well underway in the period between the City's approval of the Chevron Hydrogen and Energy Renewal Project (2008 Project) and the court decision invalidating the EIR, vacating the City's Project approvals, and halting further construction. As described in *Chapter 3, Project Description*, the Modernization Project now under consideration has evolved to exclude several components of the 2008 Project (e.g., a new cogeneration plant has been dropped) and include more emission reduction Project Design Features, such as installation of a new dome on an

existing storage tank to reduce ROG emissions. This EIR includes a comprehensive emission estimate for all Modernization Project construction emissions, including (1) an emission estimate for partially completed Modernization Project components, and (2) an emission estimate for remaining Modernization Project components (including Project Design Features that were not included in the 2008 Project).

Because newer construction equipment is subject to more stringent emission controls than older construction equipment, and because BAAQMD models for estimating construction emissions assume the construction work will be completed using an evolving combination of older and newer construction equipment, *Sections 4.3, Air Quality,* and *4.8, Greenhouse Gases,* of the EIR conservatively assume that construction would begin in 2014. If a construction start date of 2016 is used, consistent with other EIR sections (e.g., *Section 4.16, Transportation and Traffic*), then Modernization Project construction emission estimates would be lower—and less mitigation would be required to reduce impacts to less-than-significant levels—due to improvements in construction equipment emission controls and cleaner fuels.

Modernization Project construction impacts are evaluated by determining the emissions associated with Modernization Project construction, and the health impacts that may result from Modernization Project construction, and comparing these to applicable BAAQMD CEQA significance thresholds. Construction-phase emissions were calculated using standard BAAQMD methodologies, as described in greater detail in *Appendices 4.3-CST* and *4.3-CHRA*, as summarized below.

Impact 4.3-1: Construction of the Modernization Project could result in potentially significant, localized construction dust-related air quality impacts. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Modernization Project-related demolition, excavation, soil stockpiling and handling, and other construction activities may generate wind-blown dust (including PM_{10} and $PM_{2.5}$). Construction-related dust emissions would vary from day to day, depending on the level and type of activity, silt content of the soil, and the weather. In the absence of mitigation, dust generated from construction activities may result in significant adverse impacts on a temporary and intermittent basis during the construction period.

According to BAAQMD significance thresholds, a project would not have a significant adverse air quality impact if applicable BAAQMD-recommended

construction best management practices are required as mitigation measures and implemented during construction activities.

The 2010 BAAQMD CEQA Guidelines note that individual best management practices have been shown to reduce fugitive dust by anywhere from 30% to more than 90%, and conclude that projects that implement construction best management practices will reduce fugitive dust emissions to a less-than-significant level.

The Modernization Project would implement Mitigation Measure 4.3-1 to ensure that fugitive dust for Modernization Project construction would result in less-than-significant impacts. This mitigation also contains measures that would reduce emissions of $PM_{2.5}$ and PM_{10} and emissions from construction equipment engine exhaust.

> Mitigation Measure 4.3-1: All remaining construction activities for the Modernization Project shall comply with the following Bay Area Air Quality Management District (BAAQMD) construction mitigation measures:
>
> 1a: All exposed surfaces shall be watered at a frequency adequate to maintain minimum soil moisture of 12%. Moisture content can be verified by lab samples or moisture probe.
>
> 1b: All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 miles per hour.
>
> 1c: Wind breaks (e.g., trees, fences) shall be installed on the windward side(s) of actively disturbed areas of construction. Wind breaks should have at maximum 50% air porosity.
>
> 1d: Vegetative ground cover (e.g., fast-germinating native grass seed) shall be planted in disturbed areas as soon as possible and watered appropriately until vegetation is established.
>
> 1e: The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities on the same area at any one time shall be limited. Activities shall be phased to reduce the amount of disturbed surfaces at any one time.
>
> 1f: All trucks and equipment, including their tires, shall be washed off prior to leaving the site.

1g: Site accesses to a distance of 100 feet from the paved road shall be treated with a 6- to 12-inch compacted layer of wood chips, mulch, or gravel.

1h: Sandbags or other erosion control measures shall be installed to prevent silt runoff to public roadways from sites with a slope greater than 1%.

1i: All haul trucks transporting soil, sand, or other loose material off-site shall be covered.

1j: All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping shall be prohibited.

1k: All vehicle speeds on unpaved roads shall be limited to 15 miles per hour.

1l: All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.

1m: Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure, Title 13, Section 2485 of California Code of Regulations). Clear signage shall be provided for construction workers at all access points.

1n: All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.

1o: A publicly visible sign shall be posted providing the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The BAAQMD's phone number shall also be visible to ensure compliance with applicable regulations.

Implementation of Mitigation Measures 4.3-1a through 4.3-1o above would reduce the impact to a less-than-significant level.

Impact 4.3-2: Future construction activities associated with the Modernization Project would generate short-term emissions of ozone precursors (i.e., oxides of nitrogen [NO_x] and reactive organic gases [ROGs]) that would exceed Bay Area Air Quality District (BAAQMD) significance

thresholds. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Emission levels for construction activities could vary day-to-day depending on the number and types of equipment, duration of use, operation schedules, and the number of construction workers. When considered in the context of long-term Modernization Project operations, construction-related emissions would be temporary, but these activities still could cause potentially significant adverse impacts on local air quality.

Table 4.3-14 summarizes average daily construction period emissions for which there are BAAQMD significance thresholds (NO_x, ROGs, $PM_{10,}$ and $PM_{2.5}$).

Table 4.3-14 shows that construction-period ROG and NO_x emissions would be above the daily and construction-phase operational BAAQMD thresholds, and thus warrant mitigation.

Mitigation Measure 4.3-2a: Chevron shall reduce construction-related NO_x emissions to less-than-significant levels by implementing one or more of the following feasible mitigation measures, all of which have been found to result in emissions reduction for construction projects:

- Using lower emitting construction equipment, increasing carpooling or otherwise reducing construction-worker automobile use in daily commutes, extending the duration of construction by 1 year by delaying the modifications required to increase the throughput capacity of the FCC FHT until after construction of the hydrogen plant and amine contactor, or reducing the hours of use of construction equipment;
- Reducing operations and/or emissions from portable generators at the Facility during the construction period, and thereby reducing NO_x emissions;
- Installing the low-NO_x burners included in the Modernization Project in the first 6 months of the construction period, thereby reducing net NO_x emissions from the Facility while construction of the Modernization Project continues;
- Retiring permanent NO_x emission reduction credits to offset this temporary NO_x construction increase, in an amount sufficient to offset construction period NO_x emissions; or
- Implementing a combination of two or more of the above measures, in an amount sufficient to offset construction-period NO_x emissions to less-than-significant levels.

TABLE 4.3-14 MODERNIZATION PROJECT CONSTRUCTION TOTALS AND DAILY AVERAGE EMISSIONS (LBS/DAY)

Pollutant	ROGs	NO_x	PM_{10} (Exhaust Only)	$PM_{2.5}$ (Exhaust Only)
Total Emissions [lbs]	170,962	686,920	39,653	38,317
Emissions from Completed Construction [lbs]	107,118	362,553	24,046	23,411
Emissions from Future Construction [lbs]	63,844	324,368	15,606	14,905
Average Daily Emissions from Completed Construction [lbs/day]	**351**	**1,189**	**79**	**77**
Average Daily Emissions from Future Construction [lbs/day]	**82**	**414**	20	19
BAAQMD Significance Threshold [lb/day]	**54**	**54**	**82**	**54**

Source: BAAQMD, 2011. (see *Appendix 4.3-CST*, Table A4.3-CST-12). Nominal levels of SO_2 and CO would also be emitted during these activities. The quantities of SO_2 generated during construction activities would be minimal and not require mitigation to be less than significant, because construction equipment would use ultra-low sulfur diesel fuel (15 ppm sulfur content by weight). Emissions of SO_2 and CO have been calculated and are presented in *Appendix 4.3-CST*.

Mitigation Measure 4.3-2b: Chevron shall reduce construction-related ROG emissions to less-than-significant levels by implementing one or more of the following feasible mitigation measures, all of which have been found to result in emissions reduction for construction projects:

- Installing the tank dome Project Design Feature, and installing one additional tank dome, in the first 6 months of Project construction, thereby reducing net ROG emissions from the Facility before completing construction of the hydrogen plant or sulfur removal components of the Modernization Project;
- Using lower emitting construction equipment, increasing carpooling or otherwise reducing construction-worker automobile use in daily commutes, extending the duration of construction by 1 year by delaying the modifications required to increase the throughput capacity of the FCC FHT until after construction of the hydrogen plant and amine contactor, or reducing the hours of use of construction equipment;
- Retiring permanent ROG emission reduction credits to offset this temporary ROG construction increase, in an amount sufficient to offset construction-period ROG emissions; or

- Implementing a combination of the above measures, in an amount sufficient to offset construction-period ROG emissions to less-than-significant levels.

Implementation of Mitigation Measures 4.3-2a and 4.3-2b above would reduce this impact to a less-than-significant level.

Impact 4.3-3: Future construction activities associated with the Modernization Project would generate short-term emissions of particulate matter less than 10 microns (PM_{10}) and particulate matter less than 2.5 microns ($PM_{2.5}$) that could increase risks to public health. This impact would be less than significant and no mitigation is necessary. (LTS)

Small airborne particles produced by construction activities can cause significant adverse health risks. Larger particles (dust) are effectively controlled to levels that avoid adverse public health risks based on the dust control management mandates included in Mitigation Measure 4.3-1. Smaller particles, including PM_{10} and $PM_{2.5}$, are more easily inhaled deeper into lungs, and pose an enhanced health risk.

During construction activities, PM_{10} and $PM_{2.5}$ are associated with diesel equipment exhaust from construction equipment. BAAQMD has adopted thresholds for PM_{10} and $PM_{2.5}$ emissions from construction equipment, and Table 4.3-14 shows that remaining Modernization Project exhaust-related construction emissions are below the BAAQMD significance thresholds.

PM_{10} and $PM_{2.5}$ are also produced from other types of construction activities that generate fugitive dust, including, for example, material movement during construction grading, and truck loading activities. These additional construction-related PM_{10} and $PM_{2.5}$ Modernization Project emissions are presented in Table 4.3-15.

TABLE 4.3-15 MODERNIZATION PROJECT CONSTRUCTION FUGITIVE PM EMISSIONS (LBS/YR)

Pollutant	PM_{10} (Fugitive-Dust Only)	$PM_{2.5}$ (Fugitive-Dust Only)
Completed Construction	35,850	5,432
Remaining Construction	159	28

Source: *Appendix 4.3-CST*, Table A4.3-CST-12.

The completed construction activities include the vast majority of these non-exhaust PM_{10} and $PM_{2.5}$ emissions, such as site grading and excavation, and foundation and subsurface work. Remaining construction-related fugitive dust sources would be nominal, and would be further reduced by implementing Mitigation Measures 4.3-1, 4.3-2a, and 4.3-2b. While not required by CEQA, Chevron has agreed to implement the following improvement measure to further reduce this already less-than-significant impact.

> Improvement Measure 4.3-3: The Modernization Project shall implement reasonable and prudent practices to reduce PM_{10} and $PM_{2.5}$ emissions from construction equipment to further reduce this less-than-significant impact. Such practices may include, but are not limited to, the following:
>
> 3a: Idling time of diesel-powered construction equipment shall be minimized.
>
> 3b: Off-road equipment (more than 50 horsepower) to be used in the construction project (i.e., owned, leased, and subcontractor vehicles) shall be newer, since newer equipment may achieve a Project-wide fleet-average 20% NO_x reduction, and 45% PM reduction compared to the most recent CARB fleet average. Acceptable options for reducing emissions include the use of late-model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available.
>
> 3c: All construction equipment, diesel trucks, and generators shall be equipped with Best Available Control Technology for emission reductions of NO_x and PM.
>
> 3d: Contractors should use equipment that meets CARB's most recent certification standard for off-road heavy duty diesel engines.

Impact 4.3-4: Construction activities associated with the Modernization Project would result in toxic air contaminant (TAC) emissions that are below the level of significance. This impact would be less than significant and no mitigation is necessary. (LTS)

According to BAAQMD significance thresholds, Project construction would have a significant adverse air quality impact if it would cause an excess cancer risk level exceeding 10 in 1 million, or an acute or chronic HI greater than 1.0, as measured by an HRA model that takes into consideration topography, wind patterns, and other facts in identifying the maximum exposed individual. For the Modernization Project HRA, this maximum exposed individual model was also focused on neighboring uses that are at greater risk of adverse health impacts

from air emissions, including residences, schools, hospitals and convalescent facilities, parks, and churches. These are considered sensitive receptors for HRA purposes, and the maximum exposed individual data were focused on maximum exposed individual sensitive receptors (MEISR).

Additionally, BAAQMD has a concentration-based threshold for annual $PM_{2.5}$ concentrations that exceed 0.3 $\mu g/m^3$.

Table 4.3-16 summarizes the cancer risk, non-cancer hazards, and $PM_{2.5}$ concentrations associated with unmitigated construction for the MEISRs for both completed and future construction.

The total Project construction values included in Table 4.3-16 are likely conservative because they do not include a quantitative estimate of emission reductions achieved by construction-related mitigation measures imposed in the 2008 EIR. Remaining Modernization Project construction activities would be less than significant, likewise without including a quantitative assessment of the emission and risk reduction benefits of Mitigation Measures 4.3-1, 4.3-2a, and 4.3-2b, and Improvement Measure 4.3-3, in this EIR. No further mitigation is warranted for this construction-related impact.

Mitigation Measure 4.3-4: None required.

TABLE 4.3-16 PUBLIC HEALTH IMPACTS FROM CONSTRUCTION

MEISR Category	BAAQMD Significance Threshold	Total Project Construction	Remaining Project Construction
MEISR for Cancer Risk [# in a million]	10.0	10.6	5.2
MEISR for Chronic HI [unit-less]	1.0	0.02	0.01
MEISR for Acute HI [unit-less]	1.0	0.09	0.05
MEISR for $PM_{2.5}$ [$\mu g/m^3$]	0.3	0.09	0.05

Source: BAAQMD, 2011 (see *Appendix 4.3-CHRA*, Table A4.3--CHRA-9a).

4.3.6.2 Modernization Project Operational Impacts

This section summarizes the calculation methodologies used to quantify and evaluate air quality impacts associated with the operation of the Modernization Project, following construction of the Project components and Project Design Features. This section presents the general calculation methods and summarizes

key assumptions and data sources. The section then identifies operational impacts of the Modernization Project.

The BAAQMD CEQA Guidelines contain instructions on how to evaluate, measure, and mitigate air quality impacts generated from projects. The guidelines include an evaluation of CAPs, TACs, and odor emissions generated from plans or projects. The guidelines provide BAAQMD-recommended procedures for evaluating potential air quality impacts during the environmental review process consistent with CEQA requirements. The methods used in this impacts analysis follow BAAQMD CEQA Guidelines and the direction provided by the BAAQMD during the EIR preparation process.

4.3.6.2.1 *Overview of Operational Air Quality Impact Assessment*

Potential air quality impacts associated with Modernization Project operations were evaluated by comparing CAP and TAC emissions for a range of future scenarios with Baseline emission levels. Modernization Project CAP and TAC emissions were calculated by using an analysis tool called a unit rate model (URM)[4] developed by independent petroleum refinery experts retained by the City. The URM estimates how Facility operations change when the Facility refines heavier or lighter crude oil blends, crude and purchased gas oil with higher and lower sulfur content, and operates at higher or lower utilization levels than during 2008-2010. In consultations with the BAAQMD, the URM results were then used to scale Baseline Refinery Operations, shipping, and truck and rail emission levels to generate CAP and TAC emissions for each future scenario evaluated in this EIR. If the throughput for a certain Facility processing unit increased from Baseline utilization levels by 20% in a scenario, for example, Baseline CAP and TAC emissions for that unit were generally increased by 20% using this scaling methodology. As discussed below, emissions from all Facility sources (except sources unaffected by changes in Facility utilization) were calculated by scaling URM results against the Baseline in each scenario.

[4] The URM also responds to the Appellate Court Decision, which directed the City to evaluate whether the project would enable the Facility to refine different types and volumes of crude oil, and to evaluate potential emission consequences that might be associated with any such changed feedstocks. As discussed below, and in more detail in *Appendix 4.3-URM*, the URM was used to evaluate Facility operations, and operational limitations related to physical and permit constraints, for a range of very heavy, very light, high sulfur and utilization rates ranging from 93% (higher than the 2008-2010 utilization rate of approximately 89%) up to 100% (the theoretical maximum level that, in practice, cannot feasibly be sustained). To create bookends that illustrate the consequences of refining these very heavy, very light, and very sour crude blends, the URM considers both crude oils that can feasibly be shipped to and refined by Facility, and crude oils that are essentially hypothetical due to transportation and/or Facility design constraints.

Several Facility operational scenarios are analyzed in this EIR to evaluate potential Modernization Project air quality impacts. A Project Crude Blend consisting of a higher sulfur content (2.5% versus Baseline period sulfur of 1.58% by weight) and slightly lower American Petroleum Institute gravity (API gravity) (31.6 versus 33.7), along with a higher gas oil sulfur content (2.25% versus 1.5%) was developed based on a combination of crude and gas oil blends that would optimize Facility utilization under the 93% Utilization Scenarios. This Project Crude Blend did not consume all available capacity of the hydrogen plant, but since a planned but separate cumulative project is to export available hydrogen from the hydrogen plant to other Bay Area refineries and customers, the hydrogen plant was conservatively assumed to operate at 100% capacity to estimate maximum hydrogen plant emissions.

The URM also evaluates a 100% Facility Utilization Scenario assuming the hydrogen plant operates at 100% of capacity (Project Crude Blend, Maximum Hydrogen Plant, 100% Utilization Scenario). Finally, changes from Baseline emissions are estimated for 17 other crude oil blend, crude oil sulfur content, and Facility utilization scenarios. These additional scenarios consider varying sulfur content in crude and gas oils, varying API gravity in crude and gas oils, and operating at 93% and maximum operations up to the 100% scenario.

For CAPs, the impact analysis first evaluates changes from Baseline levels under the CEQA significance criteria and the NNI Modernization Project objective for CAPs (no net increase in CAP emissions above Baseline levels) for the 93% Project Crude Blend Utilization and Maximum Hydrogen Plant Production Scenario. Mitigation measures are identified to reduce potential CAPs impacts to less-than-significant levels and to achieve the CAPs NNI objective. Changes from Baseline CAP emissions are also evaluated for the 100% Project Crude Blend Utilization with Maximum Hydrogen Plant Production Scenario. Additional mitigation measures are identified that would be implemented to reduce impacts to less-than-significant levels and to achieve the CAPs NNI objective in the event that the Facility CAP emissions exceed the levels associated with the 93% Project Crude Blend Utilization and Maximum Hydrogen Plant Production Scenario.

TAC impacts are first evaluated by analyzing changes from Baseline TAC emissions for the 93% Project Crude Blend Utilization with Maximum Hydrogen Plant Production Scenario using a standardized HRA model that considers the location, amount, duration, and dispersal of each constituent emission, and the location and sensitivity of individuals (receptors) that could be affected by a TAC emission. The HRA was used to estimate the cancer risks, chronic HI, and acute HI associated with the TAC emissions. The cancer risks, chronic HI, and acute HI were compared against the applicable CEQA significance criteria and the

Modernization Project NNI objective for TACs (no net increase from Baseline level health risks). Mitigation measures are identified to reduce potential TAC impacts for the 93% Project Crude Blend Utilization with Maximum Hydrogen Plant Production Scenario to less-than-significant levels and to achieve the TACs NNI objective. Changes from Baseline TAC emissions and associated cancer risks, chronic HI, and acute HI are also evaluated for the 100% Project Crude Blend Utilization with Maximum Hydrogen Plant Production Scenario. Additional mitigation measures are identified that would be implemented to reduce impacts to less-than-significant levels and to achieve the TACs NNI objective in the event that the Facility TAC emissions exceed the levels associated with the 93% Project Crude Blend Utilization and Maximum Hydrogen Plant Production Scenario.

Finally, changes from Baseline TAC emissions are estimated for two other scenarios that represent conservative estimates of the highest level of future Facility shipping activity under reasonably foreseeable conditions. TAC impacts for these scenarios were evaluated to provide a conservative analysis of potential cancer risks, chronic HI, and acute HI that might occur to receptors located near the Long Wharf and other areas where marine shipping activities occur. Additional mitigation measures are identified that would be implemented to reduce impacts to less-than-significant levels and to achieve the TACs NNI objective in the event that TAC emissions associated with the highest levels of future Facility shipping activity in the two additional scenarios should occur.

4.3.6.2.2 *Modernization Project Scenarios Evaluated for Air Quality Impacts*

This EIR estimates changes from Baseline CAP emissions and evaluates CAP impacts for 19 Modernization Project future scenarios. Changes from Baseline TAC emissions, Baseline cancer risks, chronic HI, and acute HI were evaluated for four Modernization Project future scenarios. Table 4.3-17 lists the Modernization Project scenarios analyzed for CAPs and TACs impacts in this EIR.

As shown in Table 4.3-17, various blends of crude and gas oils (scenarios) were evaluated, most under both an assumed 93% Facility utilization level and a 100% Facility utilization level.

As used in this EIR and in the URM included as *Appendix 4.3-URM*, the Facility utilization rate refers to the percentage of (1) the maximum crude unit permitted capacity (257,200 barrels per day), and (2) the maximum daily throughput limits of the five processing units through which all purchased gas oil must initially be

TABLE 4.3-17 MODERNIZATION PROJECT SCENARIOS ANALYZED IN AIR QUALITY EVALUATION

		CAPs Estimated and Compared with Baseline	TACs and Heath Risks Estimated and Compared with Baseline[a]
1	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	X	X
2	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	X	X
3	Project Crude Blend, 100% Utilization Scenario	X	
4	Project Crude Blend, 93% Utilization Scenario	X	
5	Most Sour Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	X	
6	Most Sour Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	X	
7	Most Sour Crude Blend, 100% Utilization Scenario	X	
8	Most Sour Crude Blend, 93% Utilization Scenario	X	
9	Heaviest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	X	
10	Heaviest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	X	
11	Heaviest Crude Blend, 100% Utilization Scenario	X	
12	Heaviest Crude Blend, 93% Utilization Scenario	X	
13	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	X	X
14	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	X	X
15	Lightest Crude Blend, 100% Utilization Scenario	X	
16	Lightest Crude Blend, 93% Utilization Scenario	X	
17	Maximum Sulfur Utilization Scenario	X	
18	Very Heavy Crude Oil Utilization Scenario	X	
19	Very Light Crude Oil Utilization Scenario	X	

[a] Only cases #1, 2, 13, and 14 were analyzed for health risks because the Project Crude Blend and Lightest Crude Blend cases represent the highest health risks, and other cases would have lower health risk. See Impact 4.3-6 for further details.

fed (the gas oil gateway units).[5] Figure 4.3-9 shows the Refinery process flow diagram and shows the crude unit and each of the gas oil gateway units, which include the FCC FHT, hydrocracker, fluid catalytic cracker, and Richmond lube oil plant units.

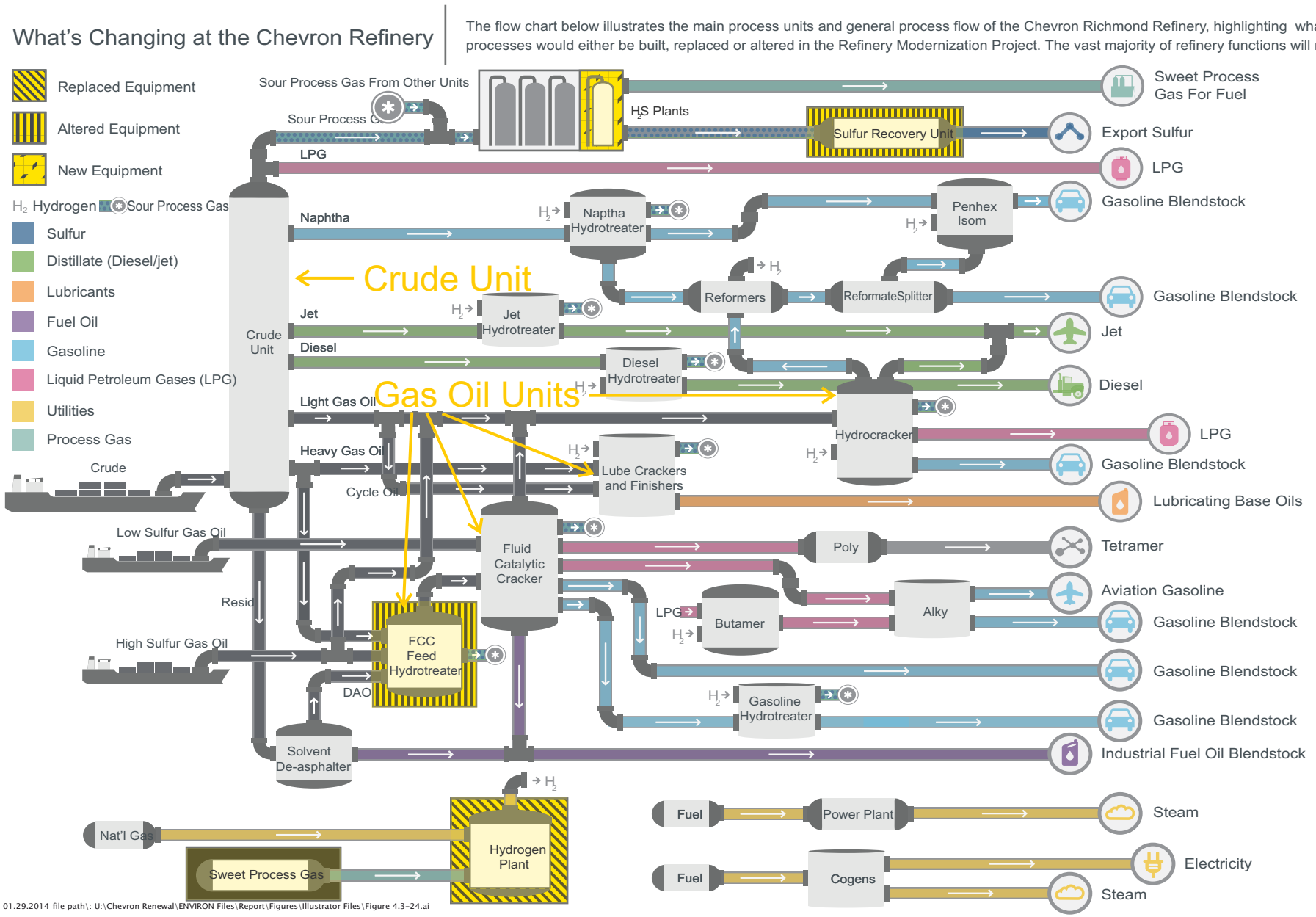
A 93% Utilization Scenario assumes both that 239,200 barrels per day of crude oil (93% of the permitted crude unit limit of 257,200 barrels per day) is used by the Facility and that the gas oil gateway units operate at 93% of permitted capacity. A 100% Utilization Scenario assumes both that 257,200 barrels per day of crude oil is used by the Facility, and that the gas oil gateway units operate at 100% of permitted capacity. Table 4.3-18 summarizes the crude unit and gas oil gateway unit throughputs for the Modernization Project in the 93% and 100% Utilization Scenarios. The URM considered these different utilization scenarios for 19 different blends of crude and gas oils.

The 93% and 100% scenarios are Modernization Project-related cases because they include a range of Modernization Project future operations that are representative of potential gravity, sulfur content, and fractional characteristics of crude oil blends and gas oils that could be run by the Facility at the specified utilization rates without exceeding one or more processing unit throughput limits.

Annual average utilization rates of 93% and 100% were analyzed to provide a conservative assessment of potential Modernization Project air quality impacts. First, refineries cannot practicably operate crude and gas oil processing units at 100% of capacity for more than short intervals of time, so the 100% utilization level is extremely conservative but incorporates the maximum permit limits for various refinery units.

Second, even the 93% Utilization Scenario is conservative and likely over-estimates Modernization Project emissions. For example, the Facility's average utilization rate was approximately 89% of crude unit capacity during 2008-2010, and 76% of crude unit capacity in 2011. Average annual refinery utilization data published by the U.S. Energy Information Administration for 1985-2012 shows that western United States refineries operated at an averaged utilization rate of

[5] The gas oil gateway units are discussed in *Appendix 4.3-URM*, Section II.B and include the FCC, FCC FHT, hydrocracker, and LNC and HNC. The URM assumes that all purchased gas oil is routed through one of these five units. The Facility's total purchased gas oil processing capacity is less than the sum of the units' throughput limits because certain of the gas oil gateway units are fed by other gas oil gateway units and by gas oil distilled from the crude unit and deasphalted gas oil from the SDA.



Source: Chevron (T39r2)

Figure 4.3-9

Chevron Refinery Modernization Project EIR

Refinery Process with Labeled Crude Unit and Each of the Gas Oil "Gateway" Units

TABLE 4.3-18 CRUDE UNIT AND GAS OIL GATEWAY UNIT THROUGHPUTS, 93% AND 100% UTILIZATION SCENARIOS (BARRELS PER DAY)

	93% Utilization Scenario (Rounded to Nearest 100)	100% Utilization Scenario (Modernization Project Limit)
Crude Unit	239,200	257,200
Gas Oil Gateway Units		
FCC FHT[a]	74,400	80,000
Fluid Catalytic Cracker	74,400	80,000
Hydrocracker	47,700	51,300
Light Neutral Hydrocracker	15,300	16,500
Heavy Neutral Hydrocracker	24,200	26,000

Note: FCC FHT = fluid catalytic cracker feed hydrotreater

[a] The Modernization Project would increase the maximum daily throughput of the FCC FHT by 15,000 barrels per day compared with existing permit limits. Taking account of feeds between Facility processing units, this increase would result in a net processing capacity increase for the Facility of approximately 1,200 barrels per day.

approximately 86.7% per year over this period and the highest annual average utilization rate was approximately 92.7% in 1998. In short, the 93% utilization rate used in many scenarios is slightly higher than the highest annual average utilization rate for all refineries in the western United States over 1985-2012, and substantially higher than the Facility crude unit utilization rates in 2008-2010 and 2011 (EIA, 2014).

As will be shown in greater detail below, Facility emissions increase with higher utilization. The vast majority of this EIR's modelled increases in emissions following Modernization Project construction and operation are attributable to increasing Facility utilization to 93% relative to the 2008-2010 crude unit utilization levels of 89%, and the 2011 crude unit utilization level of 76%.

Table 4.3-17 also notes that the Modernization Project-related cases assume that the new hydrogen plant that is part of the Modernization Project would operate at maximum, or 100% of capacity. As discussed below and in *Appendix 4.3-URM*, the URM indicates that the Facility will not use all of the new hydrogen plant's production capacity, even in scenarios that assume 100% utilization. Since hydrogen plant emissions increase with higher utilization, scenarios that assume 100% (or maximum) hydrogen plant production provide an additionally

conservative assessment of Modernization Project emissions. (This 100% hydrogen plant utilization assumption was made to ensure full public disclosure and mitigation of impacts based on the potential full utilization of the hydrogen plant in this EIR, notwithstanding the fact that the appellate court approved the 2008 EIR approach of considering full hydrogen plant utilization in the cumulative evaluation based on the potential that the hydrogen plant's owner [Praxair] would complete a separate project to obtain the authorizations required to export hydrogen plant capacity to other customers, including other refineries, in the Bay Area.)

Although the Modernization Project-related cases are considered more representative, and conservative future emission estimates are analyzed in this EIR, the writ also directed the City to consider the potential that the Facility would process heavier crudes, and the emissions that would result in that event. As explained in greater detail above and in *Appendix 4.3-URM*, the Maximum Sulfur, Very Heavy Crude Oil and Very Light Crude Oil Utilization Scenarios in Table 4.3-17 address the writ by considering Modernization Project operations using much heavier and much lighter crude oil than was used during 2008-2010. These scenarios also analyze operations assuming that the crude and gas oil feedstocks contain the maximum amount of sulfur (900 long tons per day) that the Facility would be able to process as a result of the Modernization Project.

As discussed below and in more detail in *Appendix 4.3-URM*, the Facility cannot use very heavy or very light crude oil up to the existing crude unit permit capacity due to the throughput constraints of the solvent deasphalting unit (SDA) (for very heavy crude oil) and the naphtha hydrotreater (for very light crude oil). The SDA and naphtha hydrotreater throughput constraints will not be increased by the Modernization Project. As a result, the Very Heavy Crude Oil and Very Light Crude Oil Utilization Scenarios indicate that Facility's total daily crude oil and purchased gas oil use, and the CAP and TAC emissions that are related to Facility activity, will be lower than Baseline levels because of processing unit capacity constraints.

The Modernization Project scenarios used to evaluate air quality impacts are described in more detail as follows:

1. Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario. This scenario assumes the Facility uses a crude oil blend with a higher sulfur content (2.5% versus 1.58% by weight[6]) and slightly lower API gravity (31.6°

[6]All crude and gas oil sulfur content percentages in this EIR refer to sulfur content by weight.

API versus 33.7° API), a higher sulfur content gas oil (2.25% versus 1.50%), and a higher Facility utilization rate (93% versus 89%) than during 2008-2010. The scenario also assumes that the hydrogen plant would operate at maximum capacity. The Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario includes a crude oil blend and sulfur content that is reasonably representative of potential crude oil blends and gas oils that could be run by the Facility consistent with Modernization Project objectives. The 93% Facility and 100% hydrogen plant utilization represent conservative operational assumptions. As a result, the Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario is used to initially analyze CAP and TAC changes from Baseline levels, and to identify mitigation that would be implemented to reduce impacts to less-than-significant levels and achieve CAP and TAC NNI objectives.

2. Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario. This scenario is the same as the Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario except that the Facility is assumed to operate at a 100% utilization rate to provide a more conservative assessment. The Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario is used to identify additional mitigation that may be implemented to reduce impacts to less-than-significant levels and achieve CAP and TAC NNI objectives if future emissions exceed the Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario levels.

3. Project Crude Blend, 93% and 100% Utilization Scenarios. These two scenarios are the same as the Project Crude Blend, Max Hydrogen Production, 93% and 100% Utilization Scenarios except that the hydrogen plant production level, and related emissions, reflect the lower values estimated by the URM. CAPs estimates are provided for these scenarios.

4. More Sour Crude Blend, Max Hydrogen Production, 93% and 100% Utilization Scenarios. These two scenarios assume that the crude oil blend has a higher sulfur content and a slightly lower API gravity than the Project Crude Blend scenarios and that the Facility operates at 93% and 100% utilization. The scenarios also assume that the hydrogen plant would operate at maximum capacity. CAPs estimates are provided for these scenarios.

5. More Sour Crude Blend, 93% and 100% Utilization Scenarios. These two scenarios are the same as the More Sour Crude Blend, Max Hydrogen Production, 93% and 100% Utilization Scenarios except that the hydrogen plant production level, and related emissions, reflect the lower values estimated by the URM. CAPs estimates are provided for these scenarios.

6. Heaviest Crude Blend, Max Hydrogen Production, 93% and 100% Utilization Scenarios. These two scenarios assume that the crude oil blend is heavier than the Project Crude Blend scenarios and that the Facility operates at 93% and 100% utilization. The scenarios also assume that the hydrogen plant would operate at maximum capacity. CAPs estimates are provided for these scenarios.

7. Heaviest Crude Blend, 93% and 100% Utilization Scenarios. These two scenarios are the same as the Heaviest Crude Blend, Max Hydrogen Production, 93% and 100% Utilization Scenarios except that the hydrogen plant production level, and related emissions, reflect the lower values estimated by the URM. CAPs estimates are provided for these scenarios.

8. Lightest Crude Blend, Max Hydrogen Production, 93% and 100% Utilization Scenarios. These two scenarios assume that the crude oil blend is lighter than the Project Crude Blend scenarios and that the Facility operates at 93% and 100% utilization. The scenarios also assume that the hydrogen plant would operate at maximum capacity. As discussed in more detail in *Appendix 4.3-URM*, lighter crude oil generally contains less gas oil by volume. To ensure that the gas oil gateway units operate at 93% or 100% of capacity, the URM calculates that more gas oil would be purchased by the Facility and that the total volume of crude oil and purchased gas oil would be higher than in other 93% and 100% Utilization Scenarios. Crude and purchased gas oil is conveyed by ship to the Facility, and higher levels of crude and purchased gas oil result in higher shipping-related emissions. As a result, the Lightest Crude Blend, Max Hydrogen Production, 93% and 100% Utilization Scenarios were used to assess the maximum potential TAC and health risk shipping impacts that could be associated with the Modernization Project. CAPs estimates are also provided for these scenarios.

9. Lightest Crude Blend, 93% and 100% Utilization Scenarios. These two scenarios are the same as the Lightest Crude Blend, Max Hydrogen Production, 93% and 100% Utilization Scenarios except that the hydrogen plant production level, and related emissions, reflect the lower values estimated by the URM. CAPs estimates are provided for these scenarios.

10. Maximum Sulfur Utilization Scenario. This scenario addresses the Appellate Court Decision by considering how Facility operations and emissions would change from Baseline levels in the event that the Facility processed crude and gas oils that contain the maximum amount of sulfur that could be recovered, assuming the sulfur recovery unit capacity is increased to 900 long tons per day as proposed by the Modernization Project. The scenario results are close

to the URM and emissions estimates for the More Sour Crude Blend, 100% Utilization Scenario. CAPs estimates are provided for this scenario.

11. Very Heavy Crude Oil Utilization Scenario. This scenario addresses the Appellate Court Decision by considering how Facility operations and emissions would change from Baseline levels in the event that the Facility processed very heavy crude oil and assuming the Facility is improved as proposed by the Modernization Project. The scenario assumes the use of Eocene crude oil with an API gravity of 18.3º, substantially heavier than the 2008-2010 average API gravity of 33.7º. As discussed in more detail in *Appendix 4.3-URM*, heavier crude oils generally contain more of the heaviest residuum fraction by volume. All of the residuum that enters the Facility is processed by the SDA, and the new SDA processing permit limit of 50,000 barrels per day would not be modified by the Modernization Project. As a result, the Facility cannot use very heavy crude oil up to the existing crude unit permit capacity due to SDA throughput constraints. Due to the substantial amount of residuum in the Eocene crude assumed in the Very Heavy Crude Oil Utilization Scenario, for example, the SDA throughput limit would be exceeded with crude oil use of 135,000 barrels per day. CAPs estimates are provided for this scenario.

12. Very Light Crude Oil Utilization Scenario. This scenario addresses the Appellate Court Decision by considering how Facility operations and emissions would change from Baseline levels in the event that the Facility processed very light crude oil and assuming the Facility is improved as proposed by the Modernization Project. The scenario assumes the use of Bakken crude oil with an API gravity of 41º, substantially lighter than the 2008-2010 average API gravity of 33.7º. As discussed in more detail in *Appendix 4.3-URM*, lighter crude oils generally contain more of the naphtha fraction by volume. All of the naphtha that enters the Facility, and additional naphtha feeds from other Facility processing units, is processed by the naphtha hydrotreater. The naphtha hydrotreater processing limit of 57,600 barrels per day would not be modified by the Modernization Project (Chevron Data Transmittal #82, 2014). As a result, the Facility cannot use very light crude oil up to the existing crude unit permit capacity due to naphtha hydrotreater throughput constraints. Due to the substantial amount of naphtha in the Bakken crude assumed in the Very Light Crude Oil Utilization Scenario, for example, the naphtha hydrotreater throughput limit would be maximized with crude oil use of 199,300 barrels per day. CAPs estimates are provided for this scenario.

Table 4.3-19 summarizes crude and gas oil and Facility and hydrogen plant utilization factors for each of the Modernization Project scenarios.

TABLE 4.3-19 MODERNIZATION PROJECT SCENARIOS CRUDE AND GAS OIL AND FACILITY AND HYDROGEN PLANT UTILIZATION FACTORS

		Crude Oil Gravity, Degrees API (Lower is Heavier)	Crude Oil Sulfur Content (% by Weight)	Purchased Gas Oil Sulfur Content (% by Weight)	Crude Unit Utilization Rate (% Permitted Capacity)	Gas Oil Gateway Unit Utilization Rate (% Permitted Capacity)
1	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	31.6	2.50%	2.25%	93%	93%
2	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	31.6	2.50%	2.25%	100%	100%
3	Project Crude Blend, 100% Utilization Scenario	31.6	2.50%	2.25%	100%	100%
4	Project Crude Blend, 93% Utilization Scenario	31.6	2.50%	2.25%	93%	93%
5	Most Sour Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	31.0	2.75%	2.25%	100%	100%
6	Most Sour Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	30.0	2.98%	2.25%	93%	93%
7	Most Sour Crude Blend, 100% Utilization Scenario	31.0	2.75%	2.25%	100%	100%
8	Most Sour Crude Blend, 93% Utilization Scenario	30.0	2.98%	2.25%	93%	93%
9	Heaviest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	30.3	2.42%	2.25%	100%	100%
10	Heaviest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	29.2	2.61%	2.25%	93%	93%
11	Heaviest Crude Blend, 100% Utilization Scenario	30.3	2.42%	2.25%	100%	100%
12	Heaviest Crude Blend, 93% Utilization Scenario	29.2	2.61%	2.25%	93%	93%
13	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	35.0	1.50%	2.25%	100%	100%
14	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	35.3	1.68%	2.25%	93%	93%

TABLE 4.3-19 MODERNIZATION PROJECT SCENARIOS CRUDE AND GAS OIL AND FACILITY AND HYDROGEN PLANT UTILIZATION FACTORS

		Crude Oil Gravity, Degrees API (Lower is Heavier)	Crude Oil Sulfur Content (% by Weight)	Purchased Gas Oil Sulfur Content (% by Weight)	Crude Unit Utilization Rate (% Permitted Capacity)	Gas Oil Gateway Unit Utilization Rate (% Permitted Capacity)
15	Lightest Crude Blend, 100% Utilization Scenario	35.0	1.50%	2.25%	100%	100%
16	Lightest Crude Blend, 93% Utilization Scenario	35.3	1.68%	2.25%	93%	93%
17	Maximum Sulfur Utilization Scenario	31.0	2.75%	2.66%	100%	100%
18	Very Heavy Crude Oil Utilization Scenario	18.3	4.57%	2.25%	52%[a]	100%
19	Very Light Crude Oil Utilization Scenario	41.0	0.20%	2.25%	77%[b]	100%

[a] 100% crude unit capacity cannot be achieved because residuum content in the crude oil exceeds the SDA throughput limit (50,000 barrels per day).

[b] 100% crude unit capacity cannot be achieved because naphtha content in the crude oil plus other Facility naphtha feeds exceed the naphtha hydrotreater throughput limit (56,700 barrels per day).

Based on crude oil blend, crude and gas oil sulfur content, and Facility utilization inputs, the URM generates estimates of processing units throughput (in barrels per day), gas oil purchases (in barrels per day) hydrogen demand (in million standard cubic feet per day), and total sulfur removed from crude and gas oil (in long tons per day). The model also takes account of applicable Facility throughput physical or permit limits, including the increased hydrogen plant production, sulfur recovery, and FCC FHT processing capacity that would result from the Modernization Project. The URM is discussed in detail in *Appendix 4.3-URM*.

Except for certain Refinery Operations (described below), CAP and TAC changes from Baseline levels are estimated by scaling Baseline Facility operational results against the URM throughput or total crude oil and purchased gas oil calculations. Under Baseline conditions, for example, a processing unit might generate 10 tons of NO_x per year with an average throughput of 1,000 barrels per day. If the same unit processes 1,200 barrels per day in a URM scenario, the impact assessment methodology increases NO_x emissions from the unit by 20% (1,200/1,000 barrels per day) from Baseline levels, or to 12 tons per year.

CAP and TAC changes from Baseline levels for other Facility activities, including shipping and trucks and rail emissions, are scaled against the Facility's Baseline total daily crude oil and gas oil purchases (approximately 273,300 barrels per day). The impact assessment methodology proportionately increases or decreases Baseline shipping, truck, rail, and certain other facility emissions by the amount that total daily crude oil and gas oil purchases in each URM scenario is greater or less than the Baseline level of 273,300 barrels per day, taking into account changes in trucking and rail that relate directly to the Modernization Project.

4.3.6.2.3 *Methodology for Evaluating Modernization Project Scenario Impacts*

The methodology used to estimate air quality impacts for each scenario includes the following steps:

- *Step 1: Modernization Project Utilization Levels for Designated URM Scenarios.* Estimate Facility processing unit throughputs, total crude and purchased gas oil volumes, total sulfur recovery, and Facility demand from the hydrogen plant based on applicable crude oil, gas oil and utilization inputs to the URM (see *Appendix 4.3-URM*, Attachment 1 for a summary of the URM inputs required to analyze each scenario). This step is described below.

- *Step 2: Scaling Factors Air Emissions.* Calculate the applicable scaling factor for estimating CAP and TAC air emissions for each emission source. This step is described below.
- *Step 3: Modernization Project CAP Emissions for Designated URM Scenarios.* Calculate the CAPs emissions for each of the 19 URM scenarios discussed above by multiplying Baseline CAP emission levels by the applicable air emission scaling factors. This step is described under Impact 4.3.5, which addresses operational CAP emission impacts.
- *Step 4: Modernization Project TAC Emission for Designated URM Scenarios.* Calculate TACs emissions by multiplying Baseline TAC emissions by the applicable scaling factors, and analyzing cancer risks, chronic HI, and acute HI using an appropriate health risk assessment model for 4 of the 19 URM scenarios representing maximum refinery utilization and maximum shipping volumes. This step is described under Impact 4.3.6, which addresses operational TAC impacts.
- *Step 5: Pre-Mitigation Significance Assessment.* Assess the significance of CAP and TAC impacts for each scenario with reference to applicable CEQA criteria and Modernization Project NNI objectives for CAPs and risks from TACs. This step is described under Impact 4.3.5 for CAPs and Impact 4.3.6 for TACs.
- *Step 6: Mitigation Measures and Post-Mitigation Significance Assessment.* Identify mitigation measures as required to reduce impacts to less-than-significant levels and achieve Modernization Project NNI objectives for CAPs and risks from TACs. This step is described under Impact 4.3.5 for CAPs and 4.3.6 for TACs.

Steps 1 and 2 provide the foundation for estimating Modernization Project CAP and TAC emissions. Steps 3 and 4 result in quantified Modernization Project CAP and TAC emission levels for the relevant scenarios, summarized in Table 4.3-22 (CAPs) and Table 4.3-24 (TACs). Steps 5 and 6 evaluate the significance of Modernization Project impacts, and identify mitigation measures to reduce impacts to less-than-significant levels for CEQA purposes and to NNI for Project Objective purposes.

Steps 1 and 2 are common to both CAPs and TACs, and are discussed below. Steps 3, 5, and 6 for CAPs are described under Impact 4.3-5, and Steps 4 through 6 for TACs are described under Impact 4.3-6.

4.3.6.2.3.1 Step 1 – Estimating Modernization Project Facility Operations

As discussed in *Appendix 4.3-URM*, Facility operations are estimated for each Modernization Project scenario by inputting applicable crude oil, gas oil, and utilization information into the URM. Table 4.3-20 illustrates the URM inputs in the context of the Project Crude Blend, 93% Utilization Scenario.

The URM was developed by oil industry experts retained by the City using published technical resources and Facility operational data for 2008-2010. The model calculates the volume of each fraction that would be produced from the crude oil used in each scenario, and assumes that the applicable fractions will be fed to other refinery processing units in accordance with allocation and operational parameters developed by the City's oil industry experts. These parameters are summarized in *Appendix 4.3-URM*, Attachment 2. All of the naphtha fraction, for example, is fed to the naphtha hydrotreater; all of the residuum fraction is fed to the SDA. Once the amount of each crude oil fraction has been calculated, the URM estimates how much additional gas oil must be purchased to operate the gas oil gateway units at the specified utilization level (e.g., 93% or 100%). The total volume of crude oil and purchased gas oil and the total throughput of each Facility processing unit (in barrels per day) is calculated by the model. As discussed above, in certain instances, such as the use of very heavy or very light crude oil, crude oil will be limited below the maximum capacity of the crude unit by one or more processing unit throughput constraints.

As discussed in *Section 3.3* of *Chapter 3, Project Description*, and *Appendix 3, Overview of Oil Refining Process*, sulfur in crude and gas oil must be removed to meet specifications for gasoline and other products produced by the Facility. Hydrogen is used by several Facility processing units for refining (e.g., cracking) and sulfur removal purposes. A portion of the hydrogen used by processing units is recovered from the Refinery-generated process gas stream and from the catalytic reformers, which are net hydrogen producers. The URM calculates the amount of sulfur that is recovered by the sulfur recovery unit (in long tons per day) based on the crude and gas oil sulfur content levels input to the model. The URM also calculates the amount of hydrogen that the Facility would need to obtain from the hydrogen plant after hydrogen supplies from Facility operations are subtracted from total Facility hydrogen demand (in million standard cubic feet per day). Table 4.3-21 illustrates the URM results for the Project Crude Blend, 93% Utilization Scenario and also summarizes the average daily Facility operational levels during 2008-2010.

TABLE 4.3-20 PROJECT CRUDE BLEND, MAX HYDROGEN PRODUCTION, 93% UTILIZATION SCENARIO URM INPUTS

Crude and Gas Oil Gateway Unit Capacity Utilization (%)	93%
Crude Oil Fractions (Percent in each Boiling Point Range from Assay Data, °F)	
Butane & Lighter Fractions	1.93
Naphtha (55-290)	17.36
Kerosene (290-510)	21.11
Diesel (510-625)	10.62
Gas Oil (625-770)	12.58
Heavy Oil (770-1020)	18.11
Residuum (1020+)	18.3
Feedstock Input Characteristics (Percentage by Weight, Unless Otherwise Specified)	
Crude Oil API Gravity (degrees)	31.6
Crude Oil Specific Gravity	0.868
Crude Oil Sulfur Content	2.5
Sour Gas Oil Sulfur Content	2.25
Sweet Gas Oil Sulfur Content	0.25
Crude Oil Sulfur in Residuum Fraction Processed in SDA	55

Source: *Appendix 4.3-URM*.

4.3.6.2.3.2 Step 2 – Calculating Applicable Scaling Factors

As discussed above, the total emissions and change from Baseline levels for each Modernization Project scenario are, in general, calculated by scaling the level of activity associated with Baseline emissions to the level of activity calculated by the URM. An increased level of activity, such as higher unit throughput rates or crude and purchased gas oil volumes, will produce higher levels of emissions. Lower activity levels generally produce lower emissions levels. Scaling factors for each Refinery Operations, shipping, trucking, and rail emissions source were developed by the City's air quality expert consultants (ENVIRON) in consultation with the BAAQMD and are discussed in detail in *Appendix 4.3-OP* for Refinery Operations, *Appendix 4.3-SHP* for shipping, and *Appendix 4.3-TRANS* for rail and trucking.

TABLE 4.3-21 URM RESULTS FOR THE PROJECT CRUDE BLEND, 93% UTILIZATION SCENARIO AND AVERAGE DAILY REFINERY OPERATIONS IN 2008-2010

	93% Project Crude Blend Scenario	2008-2010
Crude and Purchased Gas Oil Use (Barrels per Day, Rounded to Nearest 100)		
Crude Oil	239,200	227,900
Sweet Gas Oil	3,700	34,500
Sour Gas Oil	50,000	10,900
TOTAL	**292,900**	**273,300**
Refinery Unit Rates (Barrels per Day Except Where Noted, Rounded to Nearest 100)		
Crude Unit – Atmospheric Column	239,200	227,900
Crude Unit – Vacuum Column	106,700	89,900
NHT	48,500	49,800
Catalytic Reformers	45,500	45,500
Pen/Hex Isomerization Unit	25,200	24,600
Jet Fuel Hydrotreater	60,800	61,100
Diesel Hydrotreater	29,900	28,800
Fluid Catalytic Cracker	74,400	70,500
FCC FHT	74,400	36,300
Gas Hydrotreater	18,200	17,200
Alkylation Unit	25,800	27,700
Polymerization Unit	7,100	6,700
Hydrocracker	47,700	45,000
Richmond Lube Oil Plant		
LNC – Light Neutral Hydrocracker	15,300	12,600
LNF – Light Neutral Hydrofinisher	20,500	15,400
HNC – Heavy Neutral Hydrocracker	24,200	20,600
HNF – Heavy Neutral Hydrofinisher	11,200	6,000
SDA	43,800	33,900
Sulfur Recovery Unit (Long Tons/Day)	749	398
Hydrogen Plant Production (Million Standard Cubic Feet per Day)	197	164

Source: *Appendix 4.3-URM*.

Refinery Operations scaling factors include the following:

- For emissions from Facility process unit furnaces, the catalytic reformers and the fluid catalytic cracker, scaling factors are based on the URM throughput results compared with throughput levels during 2008-2010.
- For emissions from cooling water towers product loading racks and storage tanks (working losses only), scaling factors are based on the total level of crude and purchased gas oil calculated by the URM compared with the level of crude and purchased gas oil during 2008-2010.
- No scaling was applied to emissions from component fugitives, electricity and steam generation, flares, light ends product loading, maintenance shops, portable storage containers and wastewater treatment because emissions from these sources were assumed to remain relatively constant over time, be offset by anticipated future efficiencies, and other factors summarized in *Appendix 4.3-OP, Table 4.3-OP-23.*

As discussed above, Baseline shipping emissions, and emissions for certain Modernization Project scenarios, including the Project Crude Blend, 100% Utilization Scenario, were provided in a report prepared for Chevron by ICF International (2014). The ICF International report was peer reviewed by the City's experts (ENVIRON) and the BAAQMD. In consultations with the BAAQMD, and to provide a more conservative assessment, emissions for Modernization Project scenarios that were not analyzed in the ICF International report were estimated with reference to the Project Crude Blend, 100% Utilization Scenario rather than the shipping Baseline calculated by ICF International. The shipping scaling factor was based on the total level of crude and purchased gas oil calculated by the URM compared with the level of crude and purchased gas oil used in the ICF International report for the Project Crude Blend, 100% Utilization Scenario.

Scaling factors for rail and truck emissions are based on the total level of crude and purchased gas oil calculated by the URM compared with the level of crude and purchased gas oil during 2008-2010. Certain rail and truck activities were not scaled because they were related to conveyance functions that would not vary with Facility operational levels, or were scaled in a non-linear manner to more accurately reflect train or truck deployment for certain activities.

4.3.6.2.4 *Modernization Project Operational Criteria Air Pollutant Impacts*

Modernization Project operational CAPs were calculated for the 19 URM scenarios by multiplying Baseline CAP emission levels by the applicable air emission scaling factors as described in Steps 1 and 2, above.

Impact 4.3-5: Operation of the Modernization Project would result in increased emissions of criteria air pollutants (CAPs). This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Table 4.3-22 summarizes the total CAPs for the Facility, and change in CAPs emissions relative to the Baseline, for each of the 19 scenarios analyzed in this EIR.

Table 4.3-22 summarizes the CAP emission impacts of the Modernization Project using these 19 different Refinery Operations scenarios, which include variables based on utilization and crude oil quality, many of which also maximize utilization of the proposed new hydrogen plant even when less hydrogen would actually be needed by refinery processing operations. This impact summary table addresses both the anticipated sulfur content of feedstocks to be processed following Modernization Project construction and operation, and a wide variety of other crude blends to address the Appellate Court direction to evaluate the emission consequences of changing the API gravity of crude oil. Table 4.3-22 shows that:

- Refinery Operations NO_x, PM_{10}, $PM_{2.5}$ and sulfur oxides (SO_x) emissions would actually be lower, without mitigation, even when the Facility is operated at the substantially higher utilization rate of 93% instead of the 89% utilization level in 2008-2010. Lower Refinery Operations CAP emissions are attributed to Modernization Project components, including Project Design Features, that would reduce net Facility emissions to below Baseline even when the Refinery Operations are operating at higher utilization levels relative to the Baseline period, as listed in Table 4.3-23.
- Refinery Operations NO_x, PM_{10}, $PM_{2.5}$ and SO_x emissions would be higher than Baseline under most 100% operational scenarios, and warrant further mitigation to be below BAAQMD significance thresholds and achieve the No Net Increase Project Objective, as set forth in Mitigation Measures 4.3-5a (NO_x), 4.3-5b (PM_{10}), 4.3-5c ($PM_{2.5}$), and 4.3-5d (SO_x), below.
- For the lightest crude cases, involving maximum shipping volumes at both the 93% and 100% utilization levels, NO_x attributed to shipping and the Facility overall would occur above Baseline levels, and warrants further mitigation to be below BAAQMD significance thresholds and achieve the No Net Increase Project Objective, as set forth in Mitigation Measure 4.3-5a (NO_x), below.

TABLE 4.3-22 CAP EMISSIONS AND CHANGE FROM BASELINE BY SCENARIO

		Emissions (Tons/Year)						Change from Baseline (Tons/Year)					
	Scenario	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	ROGs	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	ROGs
	Baseline	525	1,303	503	502	373	973	--	--	--	--	--	--
1	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	573	1,269	501	499	359	998	47	-34	-2	-2	-14	25
2	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	597	1,344	535	533	374	1,026	72	41	31	31	1	54
3	Project Crude Blend, 100% Utilization Scenario	589	1,337	532	530	374	1,023	64	34	28	28	1	51
4	Project Crude Blend, 93% Utilization Scenario	560	1,259	497	495	359	993	35	-44	-6	-7	-14	21
5	Most Sour Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	599	1,345	535	533	374	1,026	73	42	32	31	1	53
6	Most Sour Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	574	1,267	502	500	359	995	49	-36	-2	-2	-14	22
7	Most Sour Crude Blend, 100% Utilization Scenario	592	1,339	533	531	374	1,023	67	36	29	29	1	50
8	Most Sour Crude Blend, 93% Utilization Scenario	565	1,259	498	496	358	991	39	-44	-5	-5	-15	18
9	Heaviest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	596	1,329	534	532	374	1,020	70	26	30	30	1	47
10	Heaviest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	571	1,250	500	498	358	989	46	-53	-3	-3	-15	16
11	Heaviest Crude Blend, 100% Utilization Scenario	588	1,323	531	529	374	1,017	63	19	28	27	1	44
12	Heaviest Crude Blend, 93% Utilization Scenario	560	1,242	497	495	358	985	35	-62	-7	-7	-15	12
13	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	598	1,378	535	533	376	1,037	73	75	31	31	3	65
14	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	576	1,325	503	501	359	1,014	50	22	-1	-1	-14	41

TABLE 4.3-22 CAP EMISSIONS AND CHANGE FROM BASELINE BY SCENARIO

		Emissions (Tons/Year)						Change from Baseline (Tons/Year)					
	Scenario	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	ROGs	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	ROGs
15	Lightest Crude Blend, 100% Utilization Scenario	584	1,367	530	528	376	1,032	59	64	26	26	3	60
16	Lightest Crude Blend, 93% Utilization Scenario	558	1,311	497	495	359	1,007	33	8	-7	-7	-14	35
17	Maximum Sulfur Utilization Scenario	592	1,339	533	531	374	1,023	67	36	29	29	1	50
18	Very Heavy Crude Oil Utilization Scenario	511	1,062	503	501	367	917	-14	-242	-1	-1	-6	-56
19	Very Light Crude Oil Utilization Scenario	495	1,239	513	511	341	1,005	-30	-64	9	9	-32	32

Notes: SO_x = oxides of sulfur. Includes one tank dome as PDF.
Baseline plus changes from Baseline for a particular case may not sum to the emissions for that case due to rounding.
Source: *Appendices 4.3-OP*, *4.3-SHP*, and *4.3-TRANS*.

TABLE 4.3-23 EMISSION REDUCTION PROJECT COMPONENTS AND PROJECT DESIGN FEATURES

	Project Components and Project Design Features	Reduced Criteria Air Pollutant(s)
1	Installation of a tank dome on Tank T-3225 to reduce wind related and other evaporation losses of VOCs from materials stored in tank.	ROG
2	Removal of three ocean-going vessels (called "SuezMax" because they can go through the existing Suez canal, and have cargo capacity of between 120,000 to 200,000 tons) from West Coast service, and replace these with new Chevron SuezMax ships that have cleaner engine technologies than what is required by law for ships built by or before 2014. Specifically, the main ship engine would meet a Tier 3 standard instead of the required Tier 2 standard, and the auxiliary engines would be upgraded with turborchargers that are cleaner than Tier 3 standards (and much cleaner than the required Tier 2 standard). These ships are already under construction, and the upgrades to clean main and auxiliary engines would not have any adverse secondary impacts.	NO_x PM_{10} $PM_{2.5}$
3	Installation of additional emission controls on existing sulfur removal units, including ultra-low NO_x burners, fuel induced recirculation, and a higher minimum temperature in the thermal oxidizers, would increase combustion efficiency.	CO[a] NO_x ROGs
4	Alterations of FCC FHT by replacing heat exchangers and other (non-furnace) equipment to increase energy efficiency, thereby partially reducing the need for additional fuel firing for additional throughput.	CO NO_x PM_{10} $PM_{2.5}$ SO_2 ROGs
5	Installation of five low-NO_x burners; three in the hydrocracker unit and two in the polymerization unit.	NO_x[a]
6	Replacement of existing hydrogen plant, which would decrease fuel use per unit of hydrogen produced, a result of the pressure swing adsorption technology of the replacement plant. In addition, the replacement hydrogen plant would be equipped with low-NO_x burners and SCRs.	NO_x[a] PM_{10}[a] $PM_{2.5}$[a] SO_2[a] ROGs[a]
7	Installation of wet electrostatic precipitators in existing sulfur recovery units, which use electrical charges to remove small liquid droplets and particulates from the exhaust gases.	PM_{10}[a] $PM_{2.5}$[a]
8	Collect, treat and re-use refinery process gas for use as feedstock in the replacement hydrogen plant by removing sulfur with a zinc oxide scrubber, and mix the remaining refinery process gas with a greater proportion of imported natural gas, which is already low in sulfur.	SO_2[a]

[a] These reductions are large enough to keep the specified process units' emissions below Baseline levels, regardless of throughput.

- Refinery Operations CO and ROG emissions would be higher than Baseline under all scenarios, resulting in the need for additional mitigation to be below BAAQMD significance thresholds and achieve the No Net Increase Project Objective, as set forth in Mitigation Measures 4.3-5e (CO) and 4.3-5f (ROGs), below.
- The Very Heavy and Very Light scenarios result in lower refinery utilization levels, and consequently much lower overall Refinery Operations levels than the Project scenario, addressing the question raised by the Appellate Court Decision. Additionally, the CAP emissions from the Maximum

Sulfur, Very Heavy Crude Oil, and Very Light Crude Oil scenarios are all lower than the 100% utilization Project scenario. Mitigation Measures 4.3-5a through 4.3-5f required for the 100% utilization Project scenario would also reduce CAP emissions from these unlikely scenarios to below the BAAQMD significance thresholds, and achieve the No Net Increase Project Objective.

Mitigation Measure 4.3-5: Chevron shall implement feasible mitigation measures to reduce CAP emissions below applicable BAAQMD significance thresholds and to ensure no net increase in Project CAP emissions over Baseline levels, as follows:

5a: NO_x Mitigation. No additional NO_x mitigation is required under any of the 93% Utilization Scenarios except the Lightest Crude Blend because the Modernization Project would result in a net decrease in NO_x emissions relative to the Baseline. NO_x mitigation is required for the Lightest Crude Blend, or for utilization above 93%. The quantity of NO_x mitigation reductions required would depend on actual NO_x emissions, as reported annually.[7] Any 1-year exceedance of the Baseline would trigger the need for additional NO_x mitigation, which would result in annual NO_x reductions below Baseline even if such exceedances do not recur in future years. Chevron shall implement the following measures in an amount sufficient to reduce NO_x emissions to below the BAAQMD NO_x significance threshold and to ensure no net increase in Project NO_x emissions above Baseline NO_x emission levels:

[7] Because BAAQMD periodically adjusts its EI methodology, BAAQMD will also assist the City in assuring that an accurate comparison between actual annual emissions relative to Baseline emissions occurs, and that mitigation is required for any emission increases over Baseline under a like-to-like emission estimation methodology for all CAP and TAC mitigation measures relating to exceedances over Baseline CAP and TAC emissions. BAAQMD and the City will be implementing the Mitigation Monitoring and Reporting Program requirements for air emissions (CAPs, TACs, and greenhouse gases), as described further in *Chapter 9, Mitigation Measure Monitoring and Reporting Program*.

(i) Chevron shall increase the average parcel size—the average ship cargo volume that is delivered or picked up from the Long Wharf—to reduce the number of ship calls, and thereby reduce NO_x emissions from shipping. This mitigation measure would result in NO_x emission decreases of up to 60 tons per year, a substantial portion of the 75-ton-per-year increase over Baseline that would occur under the highest NO_x emission scenario (100% utilization, Lightest Crude) included in Table 4.3-22. There would be no adverse secondary impacts associated with reducing the number of ship calls at the Long Wharf, nor would this mitigation measure authorize any ship to increase the volume of material shipped via the Long Wharf.

(ii) Chevron shall fund and require installation of cleaner main and auxiliary engines on up to six tug boats serving the Long Wharf. Tugs are used to push barges, escort ships and barges, and assisting ships and barges into berths. The Long Wharf is primarily served by six tugs. Under applicable CARB rules, four of these tugboats are required to be retrofitted with cleaner engines meeting designated Tier 2 emission standards, over a phase-in period ending as late as 2022. The remaining two tugboats are required to be retrofitted with cleaner engines meeting designated Tier 3 emission standards in 2017. Chevron shall fund the installation of new, cleaner Tier 4 main engines and Tier 3 auxiliary engines for the number of tugs required to remain below the BAAQMD NO_x significance threshold, and achieve the mandatory requirement that there be no net increase in Project NO_x emissions above Baseline NO_x emission levels. This mitigation measure would result in NO_x emission decreases of up to 82 tons per year, in excess of the 75-ton-per-year increase over Baseline that would occur under the highest NO_x emission scenario included in Table 4.3-22. The engine replacement activity would all occur on board tugs, and implementation of this mitigation measure would not result in any significant adverse environmental impacts.

(iii) If, after implementing Mitigation Measures 4.3-5(a)(i) and 4.3-5(a)(ii), either Project NO_x emissions have not been reduced below the BAAQMD NO_x significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission reduction credits in quantities sufficient to fully offset Project NO_x emissions to Baseline levels on a net basis. Permanent retirement of emission reduction credits ensures that these banked emissions cannot occur within Richmond or elsewhere.

(iv) If, after implementing Mitigation Measure 4.3-5(a)(iii), above, Project NO_x emissions remain above Baseline levels on a net basis, then Chevron shall

curtail Facility operations such that Project NO_x emissions are reduced to Baseline levels on a net basis.

5b: PM_{10} Mitigation. No additional PM_{10} mitigation is required under any of the 93% Utilization Scenarios. PM_{10} mitigation is required for the 100% Utilization Scenarios. The quantity of PM_{10} mitigation reductions required would depend on actual PM_{10} emissions, as reported annually. Any 1-year exceedance of the Baseline would trigger the need for additional PM_{10} mitigation, which would result in annual PM_{10} reductions below Baseline even if such exceedances do not recur in future years. Chevron shall implement the following feasible mitigation measures in an amount sufficient to reduce PM_{10} emissions to below the BAAQMD significance thresholds and to ensure no net increase in Project PM_{10} emissions above Baseline PM_{10} emission levels:

(i) Chevron shall increase the size of the Fluid Catalytic Cracking Electrostatic Precipitator (ESP) by approximately 50% to eliminate an existing NH_3 injection process in the flue gas in the Fluid Catalytic Cracking unit. The NH_3 injection process currently occurs before the flue gas is passed through the ESP, and conditions the particulates from the flue gas which helps removal in the ESP. Ammonia is also produced by the refinery process, and the reuse of NH_3 reduces the quantity of NH_3 stored and transported as a product. The ESP removes particulates from the flue gas with an electrical charge that causes the particulates to attach to a plate that is then periodically cleaned. Eliminating the NH_3 injection treatment of the flue gas would significantly reduce PM_{10} emissions, with the potential for up to 50 tons per year of PM_{10} reductions (or approximately double the quantity of PM_{10} reductions required to ensure no net increase over Baseline levels for the scenarios depicted in Table 4.3-22). Implementation of this mitigation would also slightly increase energy utilization by requiring a third pass of flue gas through the ESP beyond the two passes currently required (and increased energy consumption currently results in a corresponding increase greenhouse gas emissions), increase the amount of NH_3 transported as a product, increase the frequency of removing particulates from the enlarged ESP, and increase the quantity of particulates requiring off-site disposal. None of these secondary impacts is considered significant for CEQA purposes.

(ii) If, after implementing Mitigation Measure 4.3-5b(i), above, PM_{10} emissions have not been reduced below the BAAQMD significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission reduction credits in quantities sufficient to reduce Project PM_{10} emissions to Baseline levels on a net basis.

Permanent retirement of emission reduction credits would ensure that these banked emissions cannot occur within Richmond or elsewhere.

(iii) If, after implementing Mitigation Measure 4.3-5(b)(ii), above, Project PM_{10} emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project PM_{10} emissions are reduced to Baseline levels on a net basis.

5c: $PM_{2.5}$ Mitigation. $PM_{2.5}$ is considered both a CAP (for which an overall ambient air quality standard has been established) and a TAC (a pollutant that can cause adverse health consequences in a localized area). No additional CAP $PM_{2.5}$ mitigation is required under any of the 93% Utilization Scenarios.

$PM_{2.5}$ CAP mitigation is required for the 100% Utilization Scenarios. The quantity of $PM_{2.5}$ CAP mitigation reductions required would depend on actual $PM_{2.5}$ emissions, as reported annually. Any 1-year exceedance of the Baseline would trigger the need for additional $PM_{2.5}$ mitigation, which would result in annual $PM_{2.5}$ reductions below Baseline even if such exceedances do not recur in future years.

Chevron shall reduce $PM_{2.5}$ emissions to below BAAQMD significance thresholds, and to emission levels that ensure no net increase in Project $PM_{2.5}$ emission above Baseline $PM_{2.5}$ emissions, by implementing Mitigation Measure 4.3-5b (PM_{10}), which would also reduce $PM_{2.5}$ emissions. Additionally, Chevron shall complete a validation study quantifying the relative amount of $PM_{2.5}$ reductions achieved by Mitigation Measure 4.3-5b, for review and approval by BAAQMD and the City, to ensure that adequate quantities of $PM_{2.5}$ reductions are achieved as required by this Mitigation Measure 4.3-5c. Finally, Chevron shall implement Mitigation Measure 4.3-6, to reduce health risks from all TACs, including but not limited to $PM_{2.5}$, below the BAAQMD significance thresholds for cancer, and chronic or acute non-cancer risks, and as necessary to ensure no net increase in health risks from all TACs.

5d: SO_x Mitigation. No additional SO_x mitigation is required under any of the 93% Utilization Scenarios. Table 4.3-22 shows very slight increases in SO_x (1-3 tons per year, depending on the scenario) would occur at 100% utilization levels; thus, mitigation is required for the 100% Utilization Scenarios. The quantity of SO_x mitigation reductions required would depend on actual SO_x emissions, as reported annually. Any 1-year exceedance of the Baseline would trigger the need for additional SO_x mitigation, which would result in annual SO_x reductions below Baseline even if such exceedances do not recur in future years. Chevron shall implement the following feasible

mitigation measures in an amount sufficient to reduce SO_x emissions to below the BAAQMD significance threshold and to ensure no net increase in Project SO_x emissions above Baseline SO_x emissions:

(i) Chevron shall increase the use of SO_x-reducing catalyst in the Fluid Catalytic Cracking unit that has been demonstrated to substantially reduce SO_x emissions in refinery flue gases. This is a feasible means of reducing SO_x in flue gas in the very low quantities needed to make SO_x emissions below the BAAQMD significance threshold, and to ensure no net increase in Project SO_x emissions above Baseline SO_x emissions, even under the highest SO_x emission scenario identified in Table 4.3-22.

(ii) If, after implementing Mitigation Measure 4.3-5d(i), above, SO_x emissions have not been reduced below the BAAQMD significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission reduction credits in quantities sufficient to reduce Project SO_x emissions to Baseline levels on a net basis. Permanent retirement of emission reduction credits would ensure that these banked emissions cannot occur within Richmond or elsewhere in the Bay Area.

(iii) If, after implementing Mitigation Measure 4.3-5(d)(ii), above, Project SO_x emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project SO_x emissions are reduced to Baseline levels on a net basis.

5e: CO Mitigation. Unlike other BAAQMD significance criteria for CAPs that establish ton-per-year quantitative thresholds, there is no annual ton-per-year threshold for CO emissions. Instead, CO represents a typically localized ambient air quality condition that can adversely affect air quality if levels exceed specified numeric thresholds over either a 1-hour or 8-hour average. In order to evaluate whether CO emissions would exceed these 1-hour and 8-hour standards, the ambient air concentrations of CO emissions from the Facility were evaluated using the same methods that were used for the modeling of the health risks from the Facility. These are more fully described in *Appendix 4.3-HRA*. The combined maximum 1-hour CO concentration from Facility and shipping sources for the 100% Project scenario (maximum refinery utilization) and Light Crude scenario (maximum shipping volumes) was only 2.6 ppm, which is well below the 1-hour standard of 20 ppm maximum hourly emissions, and also below the more stringent 9 ppm 8-hour average. CO emissions from the Modernization Project are below the

BAAQMD threshold of significance, without mitigation, for all Project scenarios.

Table 4.3-22 confirms that there would be a net increase over Baseline, though not over the BAAQMD threshold of significance, for all scenarios. In contrast to other CAP emissions for which feasible Emission Reduction Project Components or mitigation measures were identified to avoid any CAP emissions over the Baseline, no such Project components or measures were determined to be available to reduce CO emissions. Accordingly, additional CO mitigation is required for all scenarios included in Table 4.3-22, in amounts ranging from 33 to 73 tons per year in order to offset CO emissions to ensure no net increase over Baseline levels.

The quantity of CO mitigation reductions initially required would be the 47 tons per year required under the Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario. Further CO reduction mitigation quantities would depend on actual CO emissions, as reported annually in the BAAQMD EI. Any unmitigated, 1-year exceedance of the Baseline would trigger the need for additional CO mitigation, which would result in annual CO reductions below Baseline even if such exceedances do not recur in future years. Chevron shall implement the following feasible mitigation measures to ensure no net increase in Project CO emissions above Baseline CO emission levels:

(i) Chevron shall reduce CO emissions to achieve the mandatory requirement that there be no net increase in Project CO emissions above Baseline CO emissions, by retiring BAAQMD-verified emission reduction credits in quantities sufficient to reduce Project CO emissions to Baseline levels on a net basis. Permanent retirement of emission reduction credits would ensure that these banked emissions cannot occur within Richmond or elsewhere.

(ii) If, after implementing Mitigation Measure 4.3-5(e)(ii), above, Project CO emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project CO emissions are reduced to Baseline levels on a net basis.

5f: ROG Mitigation. Additional ROG mitigation is required under all scenarios except Very Heavy Crude Oil, in quantities ranging from 12 to 65 tons per year. ROG reductions required under the 93% Project scenario are 25 tons per year. ROG emissions would increase with Facility utilization levels, with only the lowest utilization level – for Very Heavy Crude Oil - included in Table 4.3-22 having a net decrease in ROG relative to the Baseline.

Reducing ROGs requires lowering VOC emissions from the Facility. A very high percentage of these VOCs are emitted (or assumed to be emitted for BAAQMD rulemaking and inventory purposes) from miscellaneous small sources, such as the valves and flanges on pipes at the Facility. The most significant opportunity to reduce VOCs at the Facility is to install fixed domes over the large tanks used to store feedstocks and products. The tanks already have floating roofs to reduce VOCs, but adding a fixed dome would further reduce VOC emissions by minimizing the effect of wind on the floating roof tank seals. Chevron has proposed as a Project Design Feature to install a dome on Tank 3225 prior to commencement of Project operations, which is estimated to reduce ROG emissions by 2.1 tons per year. As mitigation, this EIR further requires Chevron to install two additional domes on Tanks 3189 and 3202 within three years following the commencement of Project operations, which is estimated to reduce ROG emissions by an additional 3.9 tons per year. Chevron has also identified an additional 27 tanks that could be domed, representing cumulative VOC reduction opportunities of approximately 52.5 tons per year. Tank dome installations also have secondary environmental impacts, the most environmentally significant of which are temporary air emissions from construction-related activities. Impacts associated with the proposed dome on Tank 3225 have been included as part of the Project throughout this EIR in relevant sections of *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*. Construction associated with Tanks 3189 and 3202 will be required to comply with the BAAQMD construction best management practices, as discussed in Mitigation Measure 4.8-1, and will involve only minor construction activity levels and neither will result in any construction-related emissions that exceed the BAAQMD thresholds of significance.

The quantity of additional ROG mitigation reductions required would depend on actual ROG emissions, as reported annually in the BAAQMD EI. Any 1-year exceedance of the Baseline would trigger the need for additional ROG mitigation, which would result in annual ROG reductions below Baseline even if such exceedances do not recur in future years.

Chevron shall complete the following feasible mitigation measures to reduce ROG emissions to below the BAAQMD significance thresholds and to ensure no net increase in Project ROG emissions above Baseline ROG emissions:

(i) Prior to the commencement of Project operations, Chevron shall install a tank dome on Tank 3225;

(ii) Within 3 years following the commencement of Project operations, Chevron shall install tank domes on Tanks 3189 and 3202;

(iii) Following the third anniversary of the commencement of Project operations, Chevron shall install domes on one or more of the following tanks to reduce VOC emissions as necessary to reduce ROG emissions below the BAAQMD significance threshold, and to ensure no net increase in Project ROG emissions above Baseline ROG emissions: Tanks 1491, 3213, 3134, 1688, 1514, 3133, 3071, 992, 3197, 1687, 990, 991, 3073, 1296, 3191, 1287, 3220, 3127, 1488, 1459, 3180, 3074, 3076, 3193, 3128, 3201, and 3075. If, following Project approval, Chevron identifies feasible ROG reduction measures other than tank domes that result in quantified emissions reductions as verified by BAAQMD, City shall consider implementation of such alternative reduction measures in lieu of, or in combination with, the reduction measures required by this Mitigation Measure 4.3-5f(iii), provided that such measures have completed all required CEQA review and permitting processes prior to implementation (it is noted, however, that no such measures are currently identified, planned or approved for implementation.)

(iv) If, after implementing Mitigation Measure 4.3-5f(i) through 4.3-5(iii), above, ROG emissions have not been reduced below the BAAQMD significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission reduction credits in quantities sufficient to reduce Project ROG emissions to Baseline levels on a net basis. Permanent retirement of emission reduction credits would ensure that these banked emissions cannot occur within Richmond or elsewhere.

(v) If, after implementing Mitigation Measure 4.3-5(f)(ii), above, Project ROG emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project ROG emissions are reduced to Baseline levels on a net basis.

5g: Supplemental Mitigation for all CAPs. Chevron shall fund and participate in a Clean Air Improvement Fund for any Facility emissions over Baseline.

Chevron is required to comply with applicable pollution control laws, which are anticipated to result in further decreases in Facility pollutants, as described in *Section 6.5.1 of Chapter 6, Alternatives Analysis.* If the Modernization Project is approved, operational emissions as mitigated would be lower than otherwise required by air quality laws, regulations, and permit

programs, due to the broader scope of CEQA and the No Net Increase Project Objective.

Nevertheless, it is possible that there would be years when emissions may temporarily exceed Baseline levels on a net basis if, for example, actual utilization and emission levels exceed those for which mitigation required by Mitigation Measures 4.3-5a through 4.3-5f, above, is already in place. To address this potential for a temporary emission increase over Baseline levels, and to further incentivize Chevron to avoid any such temporary increases, in any year that Chevron exceeds Baseline emissions for any CAP, Chevron shall contribute funding for, and participate in, a Clean Air Improvement Fund, which funding shall be in addition to, and payment thereof shall in no way relieve Chevron or the Project of the requirement that the Project achieve no net increase in CAP emissions, as follows:

- Funding shall be in an amount determined based on a benchmark price to be agreed to by the City, BAAQMD and Chevron, as thereafter annually adjusted by the Consumer Price Index value for the San Francisco Bay Area.
- Funding shall be paid annually within 60 days following approval by BAAQMD of the Emission Inventory for the prior calendar year.
- All payments into the Clean Air Improvement Fund shall be spent on emission reduction measures for criteria pollutant(s) that increased above Baseline in the following order: (1) reductions from Facility emissions, (2) reductions within the City, and (3) reductions from the North Richmond area closest to the Facility.
- Funding and implementation decisions shall be made in a public process by a stakeholder group consisting of representatives from the City, the community, and Chevron.
- A brief report shall be prepared for each major emission reduction measure implemented using such funds, and be made available to help inspire similar emission reduction opportunities.

Mitigation Measure 4.3-5g would not create any exception to Chevron's obligation to fully comply with all mitigation measures included in this EIR, including but not limited to Mitigation Measure 4.3-6, which requires the Project to ensure no net increase of health risks over Baseline levels caused by all TAC emissions.

5h: BAAQMD Permit. Chevron shall secure a permit amendment from BAAQMD reducing the annual throughput limit of the Solvent Deasphalting unit to 50,000 barrels per day. This must be completed prior to commencing operation of the new hydrogen plant.

5i: Chevron shall secure a permit amendment from BAAQMD reducing the hydrogen production limit of each train of the new hydrogen plant from 140 mmscf/day to 122 mmscf/day. This must be completed prior to commencing operation of the new hydrogen plant.

Implementation of Mitigation Measures 4.3-5a through 4.3-5i above would reduce the impact to a less-than-significant level.

4.3.6.2.5 *Modernization Project Operational Toxic Air Contaminant Impacts*

Impact 4.3-6: Modernization Project operations would not result in increases in toxic air contaminant (TAC) emissions that would exceed Bay Area Air Quality Management District (BAAQMD) significance thresholds for cancer risk, chronic health hazard index (HI), and acute HI. However under the lightest crude blend hydrogen case, emissions from increased shipping would exceed the BAAQMD significance threshold for TACs. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Table 4.3-24 summarizes the total TACs for the Facility, and change in TACs emissions relative to the Baseline, for each of the four Modernization Project scenarios for which HRAs were analyzed in this EIR. TAC emissions were estimated using the URM and emission scaling steps (Steps 1 and 2, above) from Baseline emission estimates, using the same scaling methodology used for CAPs.

The four Modernization Project scenarios were selected to present a conservative estimate of potential risks from Project air emissions, since TAC emissions are also a function of Facility utilization levels. The first two scenarios—93% and 100% utilization using the Project Crude Blend, along with 100% hydrogen plant utilization—maximize Refinery Operations utilization, and thus refinery processing-related TAC emissions. The other two scenarios—93% and 100% utilization using the Lightest Crude Blend—allow for the highest levels of shipping, and thus maximize shipping-related TAC emissions. These Lightest Crude Blend scenarios also have the highest CAP emissions.

The TAC emissions from these four scenarios were then input into the HRA for cancer risk, and non-cancer acute and chronic health risks. The HRA is included as *Appendix 4.3-HRA.*

TABLE 4.3-24 INDIVIDUAL CONSTITUENT (INCLUDING TAC) EMISSIONS AND CHANGE FROM BASELINE BY SCENARIO

	Emissions (lbs/year)					Change in Emissions (lbs/year)			
Chemical	Baseline	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario
Acetaldehyde	201.0	1,062.7	1,068.2	1,061.8	1,068.0	861.6	867.2	860.8	867.0
Ammonia	228,220.5	300,788.9	300,937.9	300,803.7	300,948.6	72,568.4	72,717.4	72,583.2	72,728.1
Antimony	0.3	8.0	8.0	8.0	8.0	7.6	7.6	7.6	7.6
Arsenic	2.2	16.4	16.5	16.4	16.5	14.2	14.3	14.2	14.3
Benzene	18,279.7	19,258.1	19,429.0	19,349.3	19,495.0	978.4	1,149.3	1,069.6	1,215.2
Benzo(a)anthracene	0.0	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
Benzo(a)pyrene	240.2	182.2	193.5	183.7	192.8	(58.0)	(46.8)	(56.5)	(47.5)
Benzo(b)fluoranthene	0.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Benzo(k)fluoranthene	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Beryllium	0.0	0.0	0.0	0.0	0.0	-	-	-	-
Bromine and compounds	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1,3-Butadiene	65.7	71.3	71.3	71.3	71.3	5.6	5.6	5.6	5.6
Biphenyl	-	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Butane	-	66.5	66.5	66.5	66.5	66.5	66.5	66.5	66.5
Methyl ethyl ketone	91.6	91.6	91.6	91.6	91.6	-	-	-	-
Butyl acetate	3.8	3.8	3.8	3.8	3.8	-	-	-	-

TABLE 4.3-24 INDIVIDUAL CONSTITUENT (INCLUDING TAC) EMISSIONS AND CHANGE FROM BASELINE BY SCENARIO

	Emissions (lbs/year)					Change in Emissions (lbs/year)			
Chemical	Baseline	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario
Cadmium	0.9	11.0	11.0	11.0	11.0	10.1	10.1	10.1	10.1
Carbon disulfide	2,909.2	2,908.5	2,908.5	2,846.3	2,908.5	(0.7)	(0.7)	(62.9)	(0.7)
Chlorine	1.9	2.9	3.0	3.0	3.1	0.9	1.1	1.1	1.2
Chlorobenzene	1.3	1.6	1.7	1.7	1.8	0.3	0.5	0.4	0.5
Chloroform	-	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9
Chromium	0.4	0.4	0.4	0.4	0.4	0.0	0.1	0.0	0.1
Chromium (hexavalent)	0.8	0.8	0.9	0.8	0.9	0.0	0.1	0.1	0.1
Chrysene	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper compounds	9.1	101.1	101.1	101.0	101.1	92.0	92.1	91.9	92.1
Cumene	125.9	141.1	142.8	142.1	143.6	15.2	16.9	16.2	17.7
Cyclohexane	537.5	540.3	543.6	542.2	544.9	2.9	6.1	4.7	7.5
1,2-Dibromoethane	1.1	1.1	1.1	1.1	1.1	–	–	–	–
DPM	20,211.3	20,508.9	21,955.5	22,158.5	23,109.6	297.6	1,744.22	1,947.2	2,898.3
Diethanolamine	38.3	1,645.9	1,648.8	1,647.6	1,650.0	1,607.6	1,610.5	1,609.2	1,611.7
Ethane	-	2,629.8	2,629.8	2,629.8	2,629.8	2,629.8	2,629.8	2,629.8	2,629.8
Ethanol	620.3	578.2	621.9	602.9	639.7	(42.1)	1.6	(17.4)	19.4

TABLE 4.3-24 INDIVIDUAL CONSTITUENT (INCLUDING TAC) EMISSIONS AND CHANGE FROM BASELINE BY SCENARIO

	Emissions (lbs/year)					Change in Emissions (lbs/year)			
Chemical	Baseline	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario
Ethanolamine	40.9	43.6	46.8	45.4	48.0	2.7	5.9	4.5	7.1
Ethylene	2,445.0	3,894.4	3,894.4	3,894.4	3,894.4	1,449.5	1,449.5	1,449.5	1,449.5
Ethylbenzene	1,340.8	1,741.0	1,771.5	1,757.9	1,783.9	400.3	430.7	417.1	443.1
Formaldehyde	1,345.7	3,019.8	3,029.0	3,017.8	3,029.1	1,674.1	1,683.3	1,672.1	1,683.4
N-Hexane	10,259.5	10,834.7	11,246.1	11,067.8	11,414.4	575.2	986.6	808.3	1,154.9
Cyanide compounds	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrogen sulfide	1,013.3	9,756.1	9,838.5	9,623.3	9,850.7	8,742.8	8,825.1	8,610.0	8,837.3
Indeno(1,2,3-cd)pyrene	0.0	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
Lead compounds	3.0	44.7	44.8	44.8	44.9	41.8	41.9	41.8	41.9
Tetra-ethyl lead	35.7	38.0	40.8	39.6	41.9	2.4	5.1	3.9	6.2
Manganese compounds	120.4	179.3	186.6	179.4	186.5	58.9	66.1	59.0	66.0
Mercury compounds	3.0	7.0	7.2	7.1	7.2	4.0	4.2	4.0	4.2
Methanol	2,892.9	6.5	6.5	6.5	6.5	(2,886.4)	(2,886.4)	(2,886.4)	(2,886.4)
2-heptanone	2.6	2.6	2.6	2.6	2.6	–	–	–	–
Cresols	0.4	6.9	6.9	6.9	6.9	6.5	6.5	6.5	6.5
Naphthalene	4.5	93.2	93.5	93.4	93.6	88.7	89.0	88.9	89.1

TABLE 4.3-24 INDIVIDUAL CONSTITUENT (INCLUDING TAC) EMISSIONS AND CHANGE FROM BASELINE BY SCENARIO

	Emissions (lbs/year)					Change in Emissions (lbs/year)			
Chemical	Baseline	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario
Nickel compounds	33.1	121.9	124.5	123.5	125.7	88.8	91.4	90.4	92.6
Polycyclic aromatic compounds	645.4	496.0	528.1	499.4	526.4	(149.4)	(117.4)	(146.0)	(119.0)
Phenol	53.0	160.9	164.0	161.1	163.9	107.9	111.0	108.1	110.9
Propane	-	367.4	367.4	367.4	367.4	367.4	367.4	367.4	367.4
Propylene glycol monomethyl	1.3	1.3	1.3	1.3	1.3	–	–	–	–
Propylene	1,563.0	2,190.2	2,201.3	2,198.2	2,207.0	627.2	638.2	635.2	644.0
Selenium	3.7	86.9	86.9	86.8	86.9	83.2	83.2	83.0	83.2
Silicon	30.7	38.5	41.5	40.7	43.0	7.9	10.8	10.0	12.3
Sulfate	1,522.6	1,912.7	2,058.2	2,018.0	2,134.3	390.1	535.6	495.5	611.7
Sulfuric acid mist	52,873.1	8,510.6	8,510.7	8,345.1	8,510.8	(44,362.6)	(44,362.4)	(44,528.0)	(44,362.3)
Perchloroethylene	26.4	26.5	26.7	26.6	26.7	0.1	0.3	0.2	0.4
Toluene	24,649.9	26,610.0	27,569.4	27,147.7	27,959.0	1,960.2	2,919.6	2,497.8	3,309.2
1,2,4-trimethylbenzene	884.5	952.7	952.7	952.7	952.7	68.3	68.3	68.3	68.3
Vanadium	63.1	79.3	85.3	83.6	88.5	16.2	22.2	20.5	25.4
Xylene	16,194.1	17,372.4	17,522.9	17,456.9	17,584.6	1,178.3	1,328.8	1,262.8	1,390.5

TABLE 4.3-24 INDIVIDUAL CONSTITUENT (INCLUDING TAC) EMISSIONS AND CHANGE FROM BASELINE BY SCENARIO

	Emissions (lbs/year)					Change in Emissions (lbs/year)			
Chemical	Baseline	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario
2,2,4-trimethylpentane	3,230.6	3,334.4	3,449.8	3,399.6	3,496.9	103.8	219.2	169.0	266.3
Zinc compounds	135.8	381.6	390.5	381.8	390.2	245.8	254.8	246.1	254.5
Amine – other	6.3	6.3	6.3	6.3	6.3	–	–	–	–
Avgas	810.3	864.7	926.6	899.6	951.8	54.4	116.3	89.3	141.5
Bunker C fuel oil	0.8	0.9	1.0	0.9	1.0	0.1	0.1	0.1	0.2
Cycloparaffins – other	608.4	459.3	487.8	463.0	486.0	(149.1)	(120.6)	(145.4)	(122.4)
Diesel oil	3,544.2	3,782.0	4,052.7	3,934.9	4,163.1	237.8	508.5	390.8	618.9
Fuel – jet 'A'	7,675.2	8,190.3	8,776.5	8,521.5	9,015.6	515.0	1,101.2	846.3	1,340.4
Gas oil	3,533.2	3,770.3	4,040.1	3,922.8	4,150.2	237.1	506.9	389.6	617.0
Glycols	7.6	7.6	7.6	7.6	7.6	–	–	–	–
Ketone – other/not spec	12.6	13.5	14.4	14.0	14.8	0.9	1.8	1.4	2.2
LPG	13,273.8	13,273.8	13,273.8	13,273.8	13,273.8	–	–	–	–
Mineral spirits	17.9	17.9	17.9	17.9	17.9	–	–	–	–
Oil – non-fuel, other	4,343.5	4,343.5	4,343.5	4,343.5	4,343.5	–	–	–	–
Oil/water mixture	12,405.9	13,172.5	14,045.1	13,665.6	14,401.1	766.6	1,639.1	1,259.7	1,995.1
Organic liquid – other	9,206.7	9,819.2	10,516.3	10,213.1	10,800.7	612.5	1,309.6	1,006.4	1,594.0

TABLE 4.3-24 INDIVIDUAL CONSTITUENT (INCLUDING TAC) EMISSIONS AND CHANGE FROM BASELINE BY SCENARIO

	Emissions (lbs/year)					Change in Emissions (lbs/year)			
Chemical	Baseline	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	Lightest Crude Blend, Max Hydrogen Production, 100% Utilization Scenario
PAHs (non-carcinogenic)	1,601.1	1,208.7	1,283.6	1,218.4	1,279.0	(392.4)	(317.5)	(382.7)	(322.1)
Paraffins – C3+	4,534.7	4,549.2	4,565.7	4,558.5	4,572.4	14.5	31.0	23.8	37.7
Petroleum products – other	1,387.0	1,480.1	1,586.0	1,540.0	1,629.3	93.1	199.0	152.9	242.2
Facility feedstock – other	6,593.7	7,036.1	7,539.6	7,320.6	7,745.1	442.4	945.9	727.0	1,151.4
Reformate	10.5	10.5	10.5	10.5	10.5	–	–	–	–
Stoddard solvent	5.2	5.2	5.2	5.2	5.2	–	–	–	–
Sulfur or sulfur compounds	1,501.5	1,602.3	1,716.9	1,667.1	1,763.7	100.8	215.4	165.6	262.2
Wastewater – refin, other	2,284.9	2,438.2	2,612.7	2,536.8	2,683.9	153.3	327.8	251.9	399.0
Water/organics mixture	559.1	559.1	559.2	559.2	559.2	0.1	0.1	0.1	0.2

Source: *Appendices 4.3-OP, 4.3-SHP, and 4.3-TRANS.*

The HRA considered, among other factors, the location, duration, timing, toxicity, and dispersion (including metrological and terrain factors) of each TAC constituent, and the sensitivity, location, timing and duration of exposure for potential receptors - people - located near and in the region surrounding the Facility. Each of these factors plays a critical role in the HRA. Terrain plays an important role in risk. For example, elevated emissions may impact higher terrain and result in increased risks at higher elevations.

Sensitive populations are also taken into consideration. For example, the toxicity factor for a TAC is developed by California's toxicology experts at the Office of Health Hazard Assessment and takes into account the different exposure levels that could adversely affect different population segments like children (with smaller lungs, and smaller body weight, and hence higher sensitivity to many TACs), residents (who typically spend many more hours of the day, and many more years, being exposed to TACs), and workers (who tend to be healthy adults exposed for 8-hour periods for many years).

The HRA also considered three potential pathways by which people could be exposed to a TAC: inhalation of airborne TACs, dermal contact (TAC residues on skin), and ingestion (TAC residues on locally produced food). For operational emissions, inhalation was determined in the HRA to be the critical exposure pathway, and was evaluated in detail.

Understanding this inhalation pathway required simulating the dispersion of TACs through the air. This air dispersion component of the HRA takes factors such as wind pattern, climate, and topography into account to understand the manner in which TACs are dispersed in the air—from TAC sources—and to the sensitive receptors located nearest to the Facility. Two different types of sources were evaluated, and each has its own air dispersion modeling methodology:

- Stationary sources are located within the Facility, and consist of the many existing and new refinery processing units affected by either the physical modifications included in the Modernization Project (e.g., the hydrogen plant) or the operational consequences of increasing Facility utilization (e.g., higher throughput through the crude unit and other existing Refinery Operations components considered in the URM). Appendix 4.3-HRA includes a description of how TAC emissions from stationary sources were mapped for dispersion purposes.
- Mobile sources include ships, trucks, and rail that also emit TACs, both while at the Facility and while in transport—maneuvering in the Bay (shipping), or traversing community streets (trucking and rail). Mobile source emissions at or closest to the Facility are particularly important to assess because these emissions add to the Facility emissions and contribute to overall community

TAC exposure levels. Appendix 4.3-HRA includes a description of how TAC emissions from mobile sources were mapped for dispersion purposes. Moreover, emissions from mobile sources can extend well inland due to the impact of DPM from shipping, for example.

The HRA simulates the distribution of TAC emissions into the air and identifies the maximum exposed individual—the location where health impacts from the TAC concentrations are the highest. For this EIR, land uses that are particularly sensitive to TAC-related risks were also mapped to ensure a sufficient level of detailed analysis was included in the HRA for sensitive receptors such as residences, schools, parks, convalescent homes, and hospitals. The TAC risks for approximately 8,000 locations in the neighborhoods nearest the Facility were separately calculated, and resulting figures show the relative risk levels for all of the neighborhoods nearest the Facility.

Separate figures were then prepared to depict cancer risk, and non-cancer chronic HI, acute HI, and $PM_{2.5}$ concentrations for the scenarios included in Table 4.3-24. The locations of greatest impact for cancer risk, chronic HI, acute HI, and $PM_{2.5}$ concentrations, are shown in Figure 4.3-10.

The combined cancer risk at all modeled receptors for the Modernization Project with Project Design Features for the 93% Utilization Scenario is shown in Figure 4.3-11. This figure, as well as figures showing the chronic HI, acute HI, and $PM_{2.5}$ concentrations at all modeled receptors for the Modernization Project with Project Design Features for the 93% Utilization Scenario, are included in *Appendix 4.3-HRA*. Because the source location and emission types differs for stationary sources and each type of mobile source (shipping and trucking), separate figures were also prepared in *Appendix 4.3-HRA* showing the relative TAC risks from the Refinery Operations, shipping, and trucking.

The results from the HRA, as depicted in Figures 4.3-10 through 4.3-19, were then compared to applicable BAAQMD significance thresholds for cancer risk and non-cancer chronic HI and acute HI. The HRA results were also compared to the No Net Increase in risk Project Objective. The HRA demonstrates that:

- Even under the 100% Project and Light Crude Utilization Scenarios, Facility operations (exclusive of transportation) do not exceed any BAAQMD significance threshold for health risk.



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: BAAQMD, 2012b; Chevron (T38r1)

Figure 4.3-10
Chevron Refinery Modernization Project EIR
Maximum Exposed Individual Receptor Locations Relative to the BAAQMD CARE 2015 Map of Community Risk Estimates

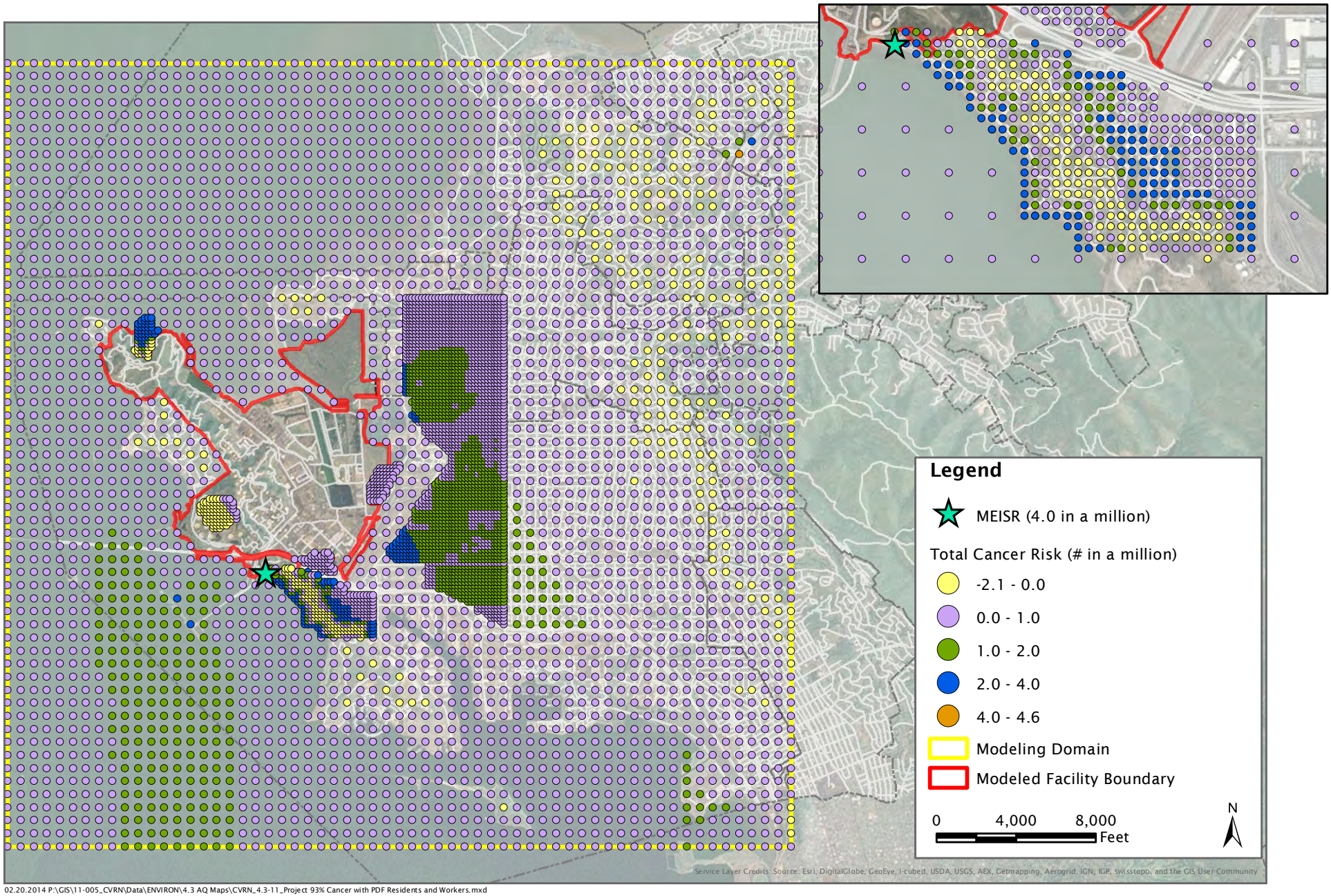


Figure 4.3-11
Chevron Refinery Modernization Project EIR
Modernization Project Cancer Risk
at 93% Utilization (Project Case)

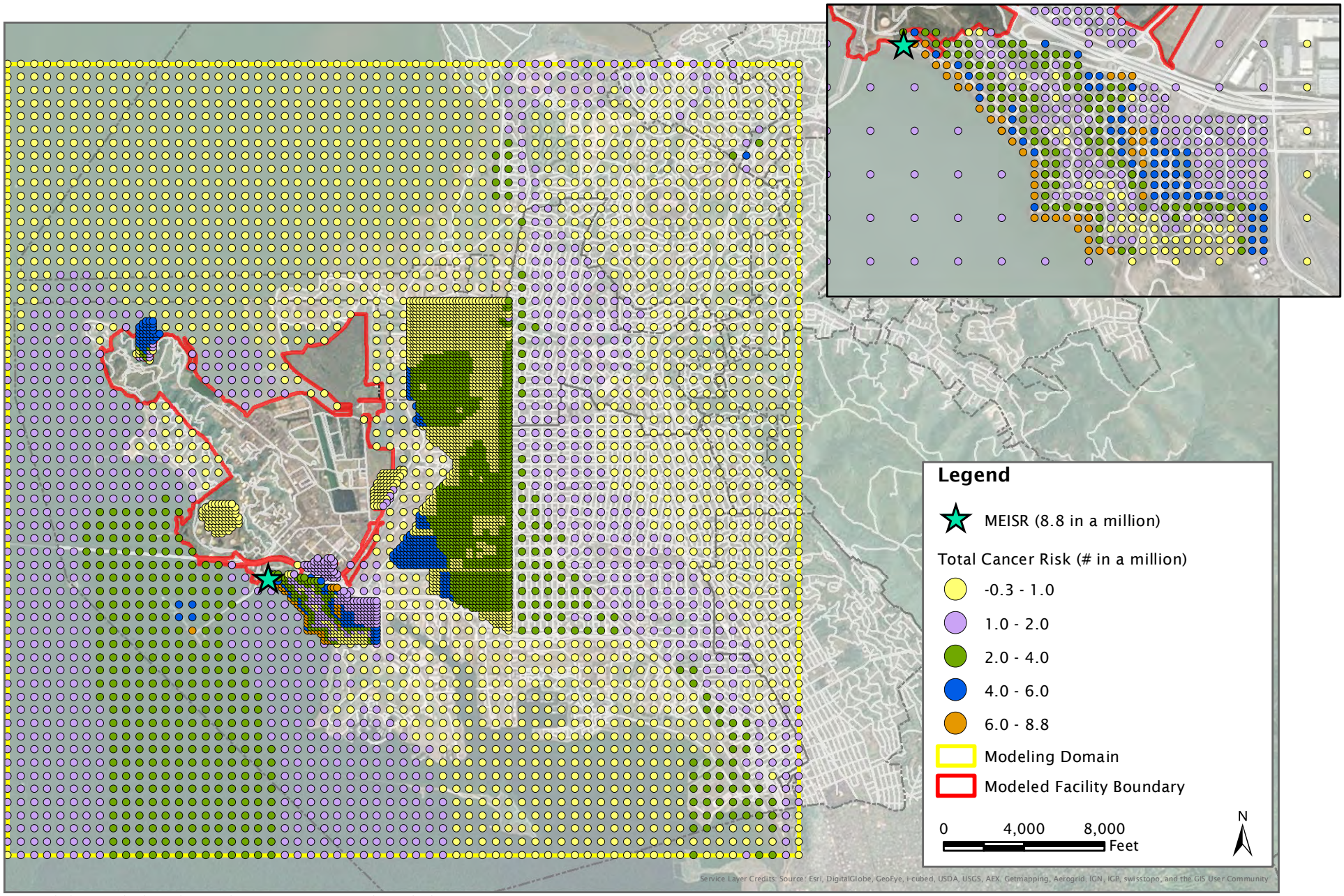


Figure 4.3-12
Chevron Refinery Modernization Project EIR
Modernization Project Cancer Risk
at 100% Utilization (Project Case)

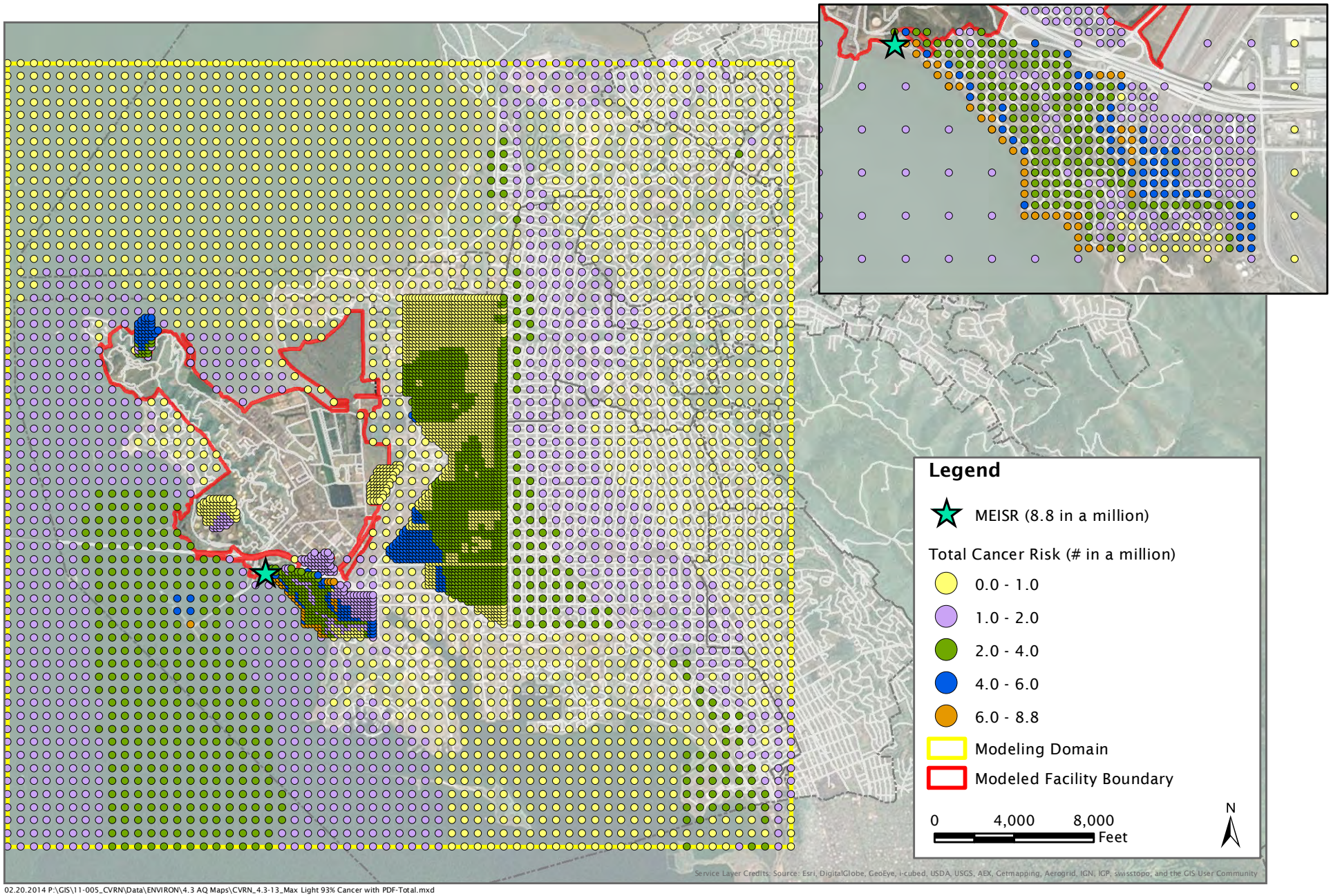
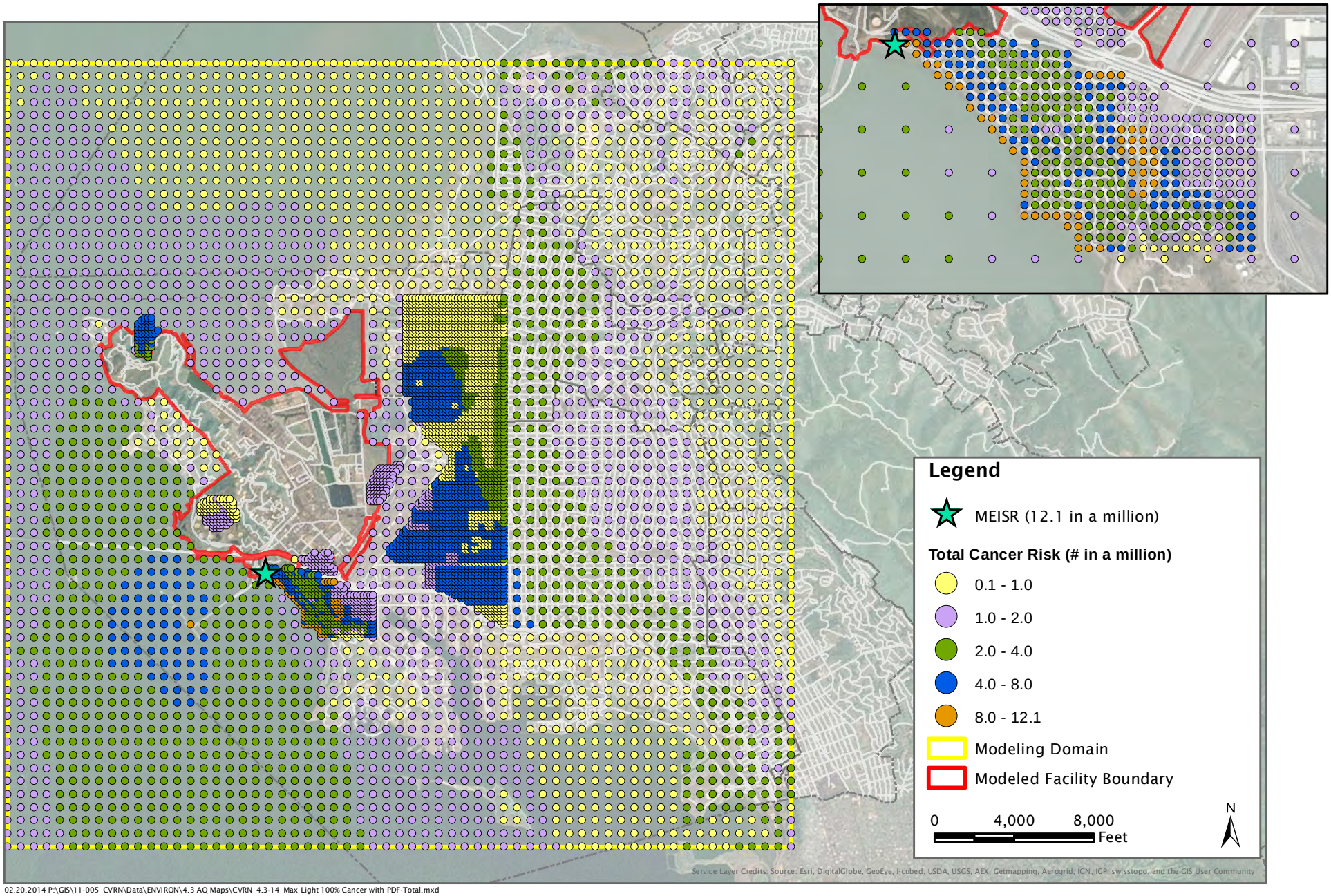


Figure 4.3-13
Chevron Refinery Modernization Project EIR
Modernization Project Cancer Risk
at 93% Utilization (Light/Max Shipping Case)



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Figure 4.3-14
Chevron Refinery Modernization Project EIR
Modernization Project Cancer Risk at
100% Utilization (Light/Max Shipping Case)

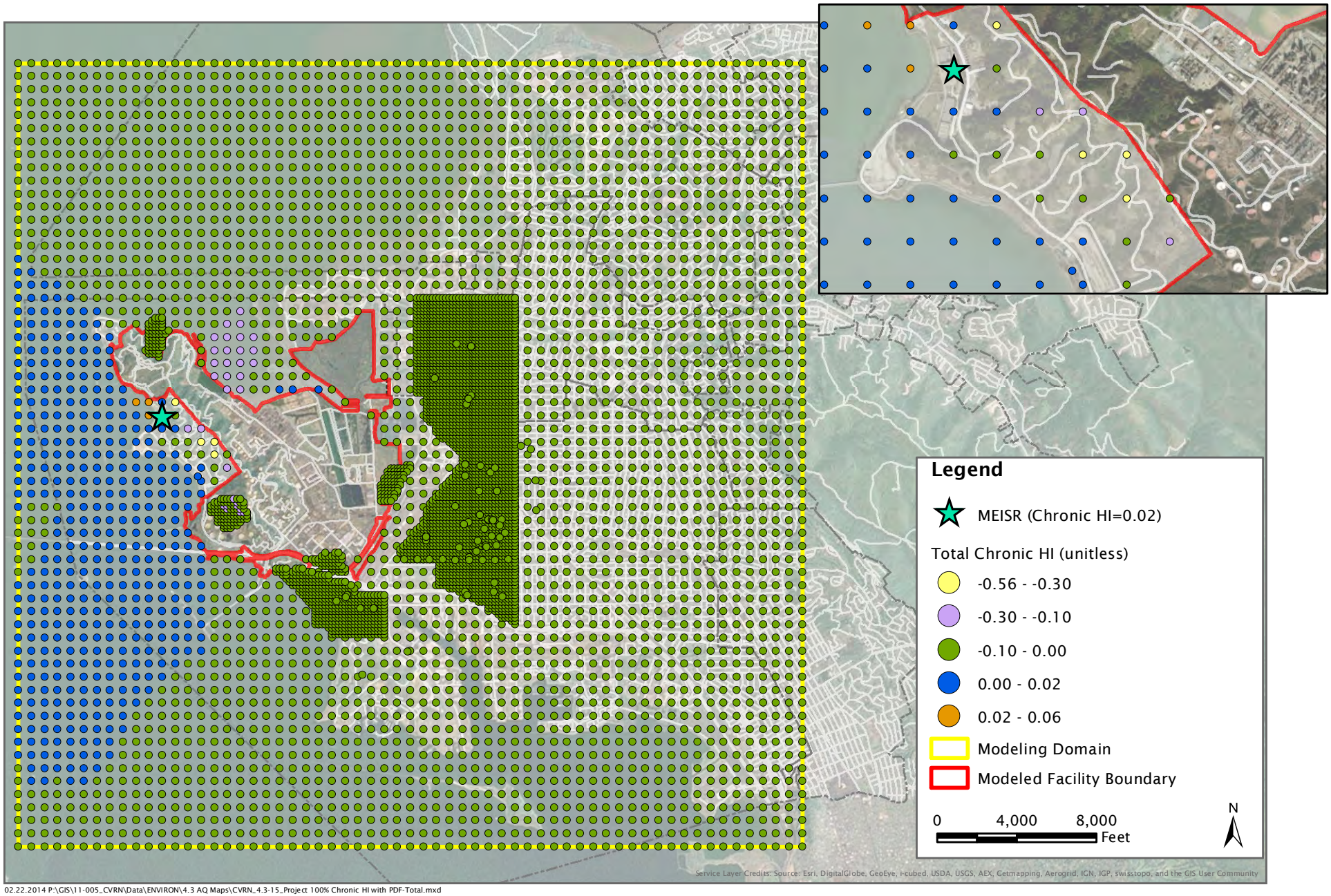


Figure 4.3-15
Chevron Refinery Modernization Project EIR
Modernization Project Chronic Hazard
Index Risk at 100% Utilization (Project Case)

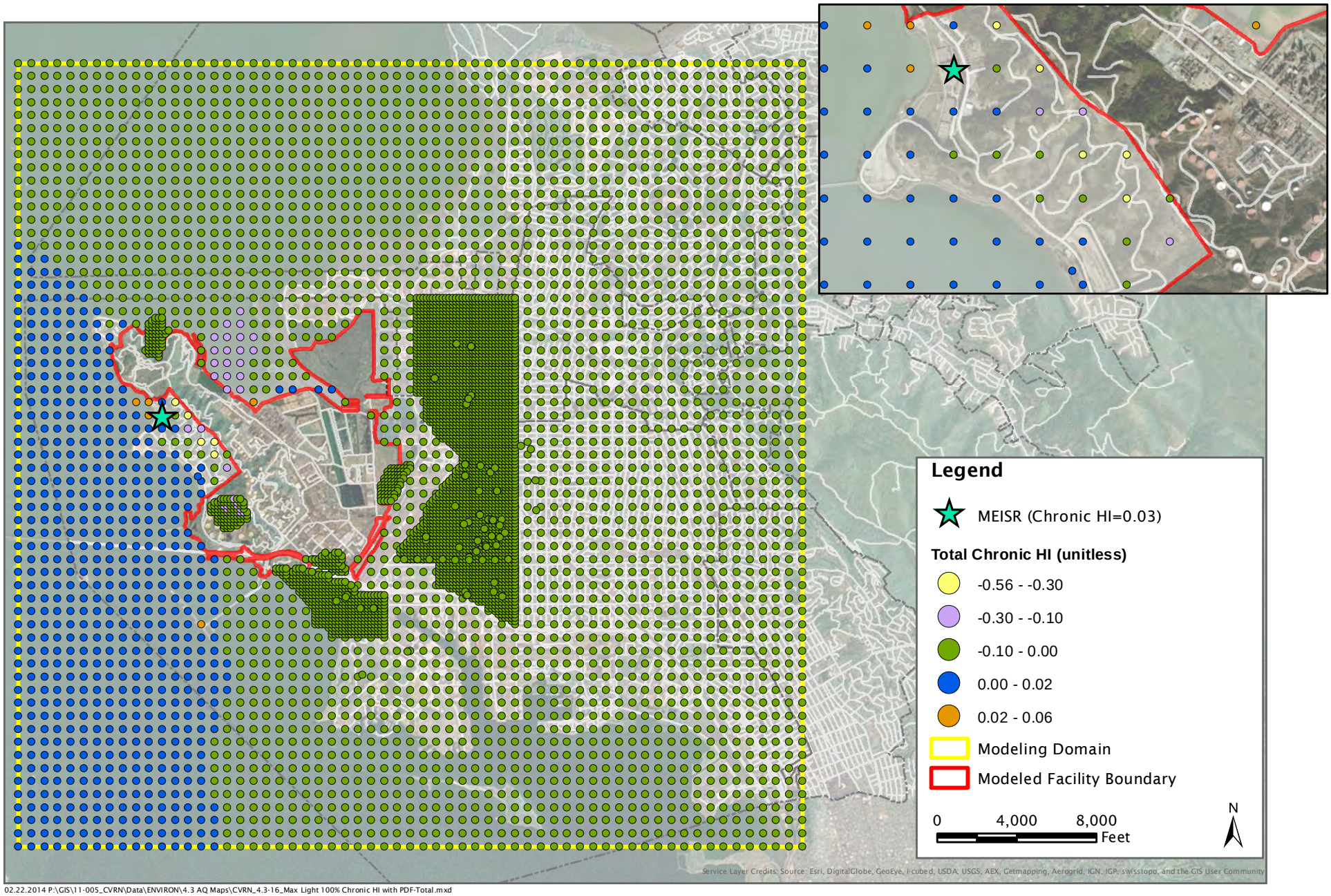


Figure 4.3-16
Chevron Refinery Modernization Project EIR
Modernization Project Chronic Hazard Index
Risk at 100% Utilization (Light/Max Case)

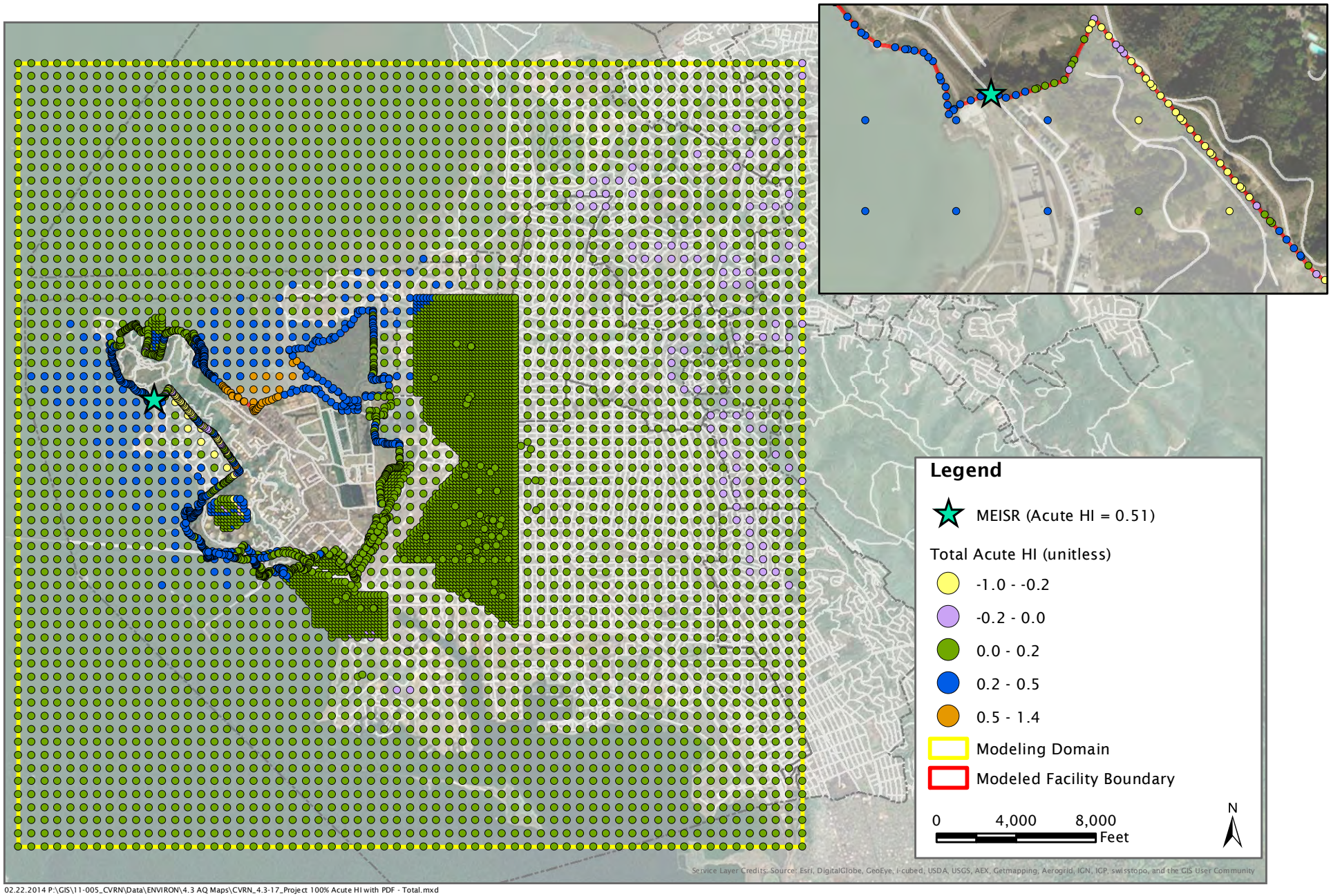


Figure 4.3-17
Chevron Refinery Modernization Project EIR
Modernization Project Acute Hazard Index
at 100% Utilization (Project Case)

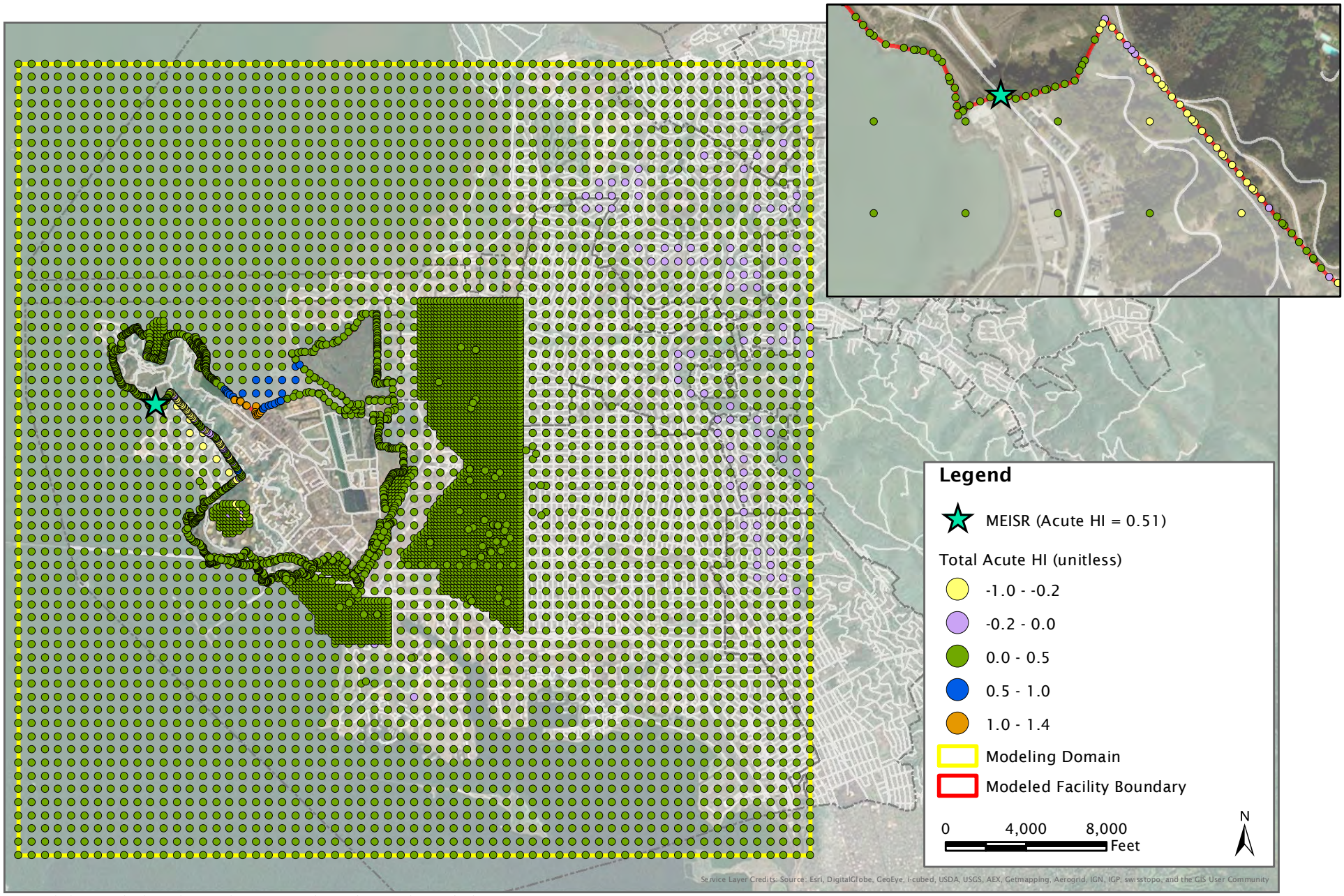


Figure 4.3-18
Chevron Refinery Modernization Project EIR
Modernization Project Acute Hazard Index Risk
at 100% Utilization (Light/Max Case)

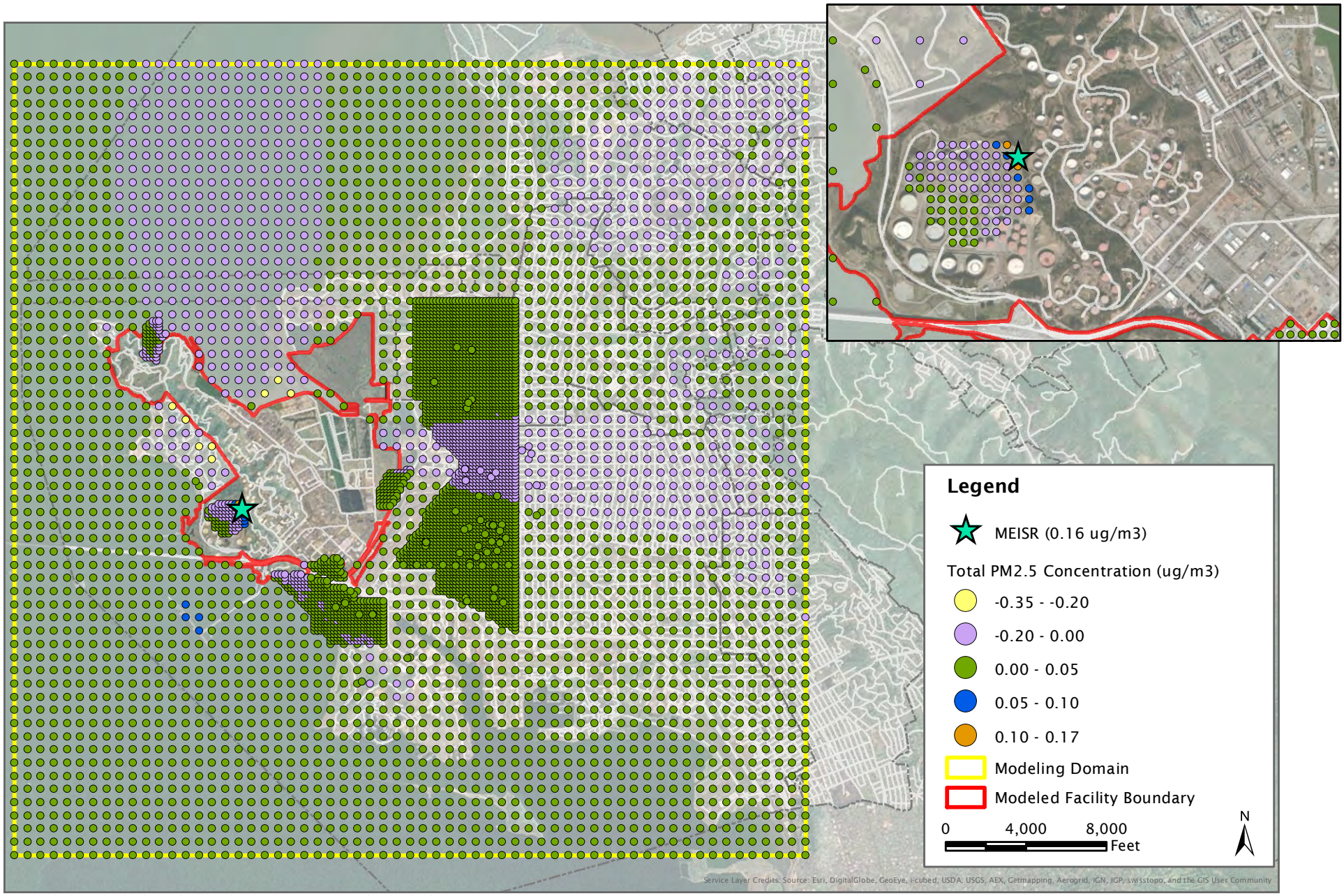


Figure 4.3-19
Chevron Refinery Modernization Project EIR
Modernization Project PM2.5
at 100% Utilization (Project Case)

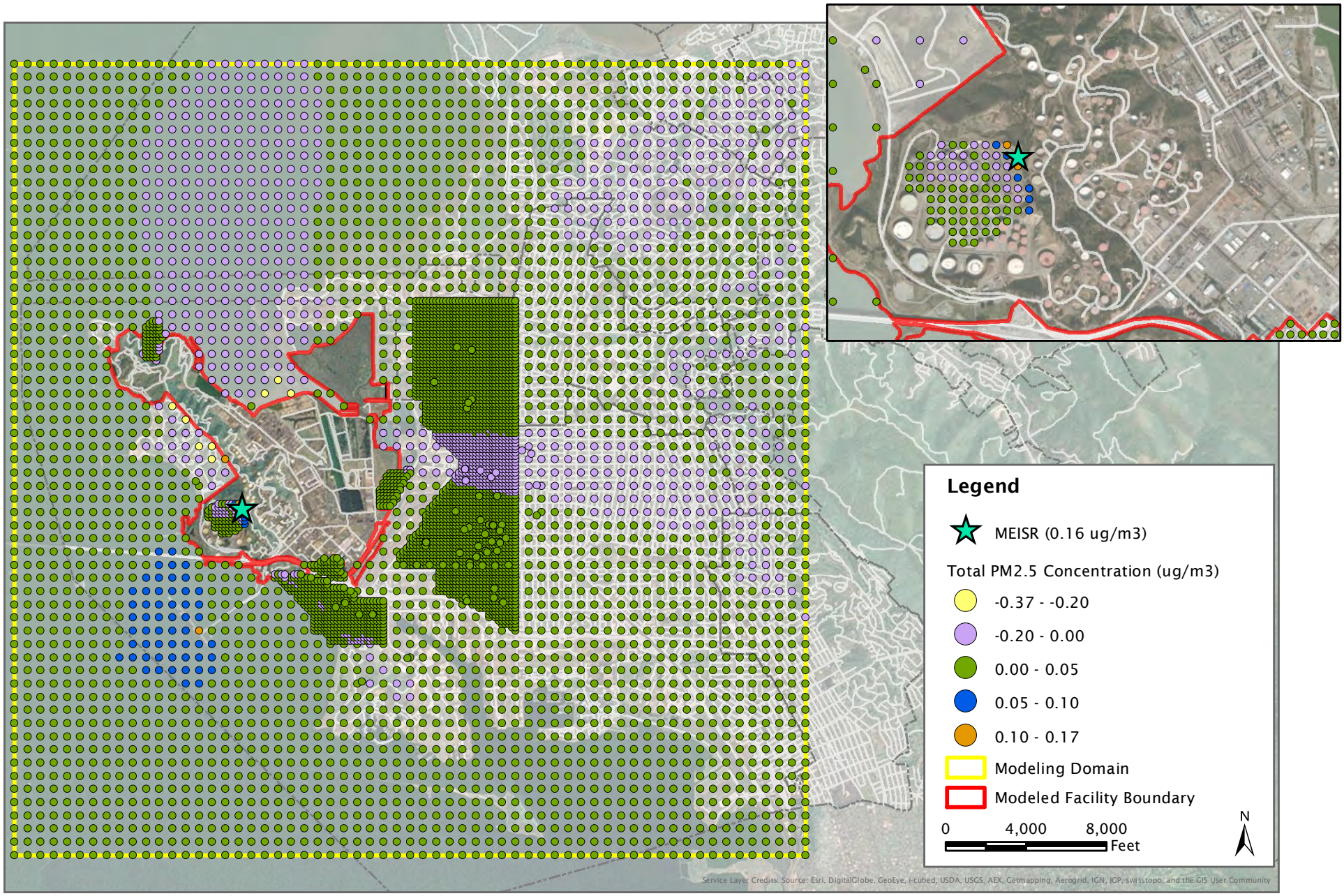


Figure 4.3-20
Chevron Refinery Modernization Project EIR
Mondernization Project PM2.5 Concentration
at 100% Utilization (Light/Max Shipping Case)

- The Maximum Exposed Individual Sensitive Receptor (MEISR) is 0.4 for cancer risk for Refinery Operations, well below the BAAQMD significance threshold of 10.0.[8]
- The MEISR is 0.02 for non-cancer chronic health risks,[9] and 0.2 for acute health risks, well below the BAAQMD significance threshold of less than 1.0.

Under all scenarios except the 100% utilization, maximum shipping scenario, TAC emissions from transportation activities—particularly particulate emissions from diesel exhaust (DPM)—resulted in health risks (for cancer, and non-cancer chronic and acute, risks) below the BAAQMD significance thresholds. Because this represents an extremely conservative case (100% utilization annualized, and excess shipping from unusually large gas oil imports), risks over the BAAQMD significance thresholds would be very unlikely to occur. The mitigation prescribed below, which focuses on shipping emissions, is required to reduce health risks from TACs to achieve the No Net Increase in risk Project Objective. Once implemented, the Project is expected to result in some localized net public health benefits.

In addition to the cancer, and non-cancer chronic and acute, risk thresholds noted above, the BAAQMD significance thresholds also establish a separate significance threshold for an increase in the concentrations of $PM_{2.5}$ above 0.3 micrograms per meter squared. As with the cancer risk, and chronic and acute non-cancer risks, Refinery Operations emissions (without transportation activities such as shipping) would be below this $PM_{2.5}$ risk-based threshold, but with transportation—and again primarily shipping—$PM_{2.5}$ levels would exceed this threshold and would warrant mitigation to be reduced to less-than-significant levels, and to achieve the No Net Increase in risk Project Objective.

Mitigation Measure 4.3-6: Chevron shall implement the following measures:

6a1: Prior to operation of the Project, Chevron shall implement the following measures to reduce Diesel Particulate Matter (DPM), inclusive of $PM_{2.5}$, to reduce health risk from all Project TAC emissions to below BAAQMD significance criteria (for the 93% Project Shipping Scenario) and to ensure no net increase of health risks from Project TAC emissions over Baseline levels:

[8] Using HRA methodology, it is not possible to derive a risk of zero for cancer risk. Risks below 1 are considered nominal by BAAQMD Regulation 2, Rule 5, equivalent to No Net Risks for purposes of this EIR.

[9] As described in Appendix 4.3-HRA, the maximum non-cancer chronic hazard index considering all pathways is 0.1, still well below the CEQA threshold and NNI.

(i) Chevron shall fund and require installation of cleaner main and auxiliary engines on one tug boat serving the Long Wharf as well as non-Chevron facilities. Tugs are used to push barges, escort ships and barges, and assisting ships and barges into berths. The Long Wharf is primarily served by six tugs. Under applicable CARB rules, four of these tugboats are required to be retrofitted with cleaner engines meeting designated Tier 2 emission standards, over a phase-in period ending as late as 2022. The remaining two tugboats are required to be retrofitted with cleaner engines meeting designated Tier 3 emission standards in 2017. Prior to operation of the Project, Chevron shall fund the installation of new, cleaner Tier 4 main engines and Tier 3 auxiliary engines for one of the six tugboats. The engine replacement activity would all occur on board the tugboat, and implementation of this mitigation measure would not result in any significant adverse environmental impacts.

(ii) Chevron shall fund and cause to have implemented the project design feature described in the EIR as the removal of three ocean-going vessels (called "SuezMax" because they can go through the existing Suez canal, and have cargo capacity of between 120,000 to 200,000 tons) from West Coast service, and replacement of these vessels with two new Chevron SuezMax ships. The main ship engines of each replacement ship shall meet a Tier 3 standard instead of the required Tier 2 standard, and the auxiliary engines shall be upgraded with turbochargers that are cleaner than Tier 3 standards. These ships are already under construction, and the upgrades to clean main and auxiliary engines would not have any adverse secondary impacts.

6a2: Prior to operating the Project in excess of 93% Project utilization, Chevron shall implement a combination of the following measures to reduce DPM, inclusive of $PM_{2.5}$, to reduce health risk from all Project TAC emissions to below the BAAQMD significance criteria and to ensure no net increase of health risks from Project TAC emissions over Baseline levels, with all emission reduction amounts from such measures requiring validation by the BAAQMD:

(i) Chevron shall increase the average parcel size—the average ship cargo volume that is delivered or picked up from the Long Wharf—to reduce the number of ship calls, and thereby reduce DPM emissions from shipping. There would be no adverse secondary impacts associated with reducing the number of ship calls at the Long Wharf, nor would this mitigation measure authorize any ship to increase the volume of material shipped via the Long Wharf.

(ii) Chevron shall fund and require installation of cleaner main and auxiliary engines on up to five non-retrofitted tug boat serving the Long Wharf as well as non-Chevron facilities. The Long Wharf is primarily served by six tugs, one of which will have been retrofitted as described in Mitigation Measure 4.3-a1(i) prior to Project operation. Under applicable CARB rules, four of these tugboats are required to be retrofitted with cleaner engines meeting designated Tier 2 emission standards, over a phase-in period ending as late as 2022. The remaining two tugboats are required to be retrofitted with cleaner engines meeting designated Tier 3 emission standards in 2017. Chevron shall fund the installation of new, cleaner Tier 4 main engines and Tier 3 auxiliary engines on the number of tugs required to reduce DPM, and achieve the No Net Increase Project Objective. The engine replacement activity would occur on board the tugboats, and implementation of this mitigation measure would not result in any significant adverse environmental impacts.

(iii) If, after implementing Mitigation Measures 4.3-6(a)(2)(i) and 4.3-6(a)(2)(ii), above, health risk from Project TAC emissions remains above Baseline levels on a net basis, as determined by the health risk assessment required by Mitigation Measure 4.3-6b, below, Chevron shall install electric shore power, and require one or more of the ships using the Long Wharf to use such shore power in lieu of continuing to burn diesel fuel while berthed. As explained in *Appendix 4.3-MIT*, this measure, also referred to as "cold ironing," has been demonstrated to substantially reduce DPM-related emissions (and associated risks) from shipping (CARB, 2006) and would reduce Project DPM emissions by 1.66 tons/year under the 100% Utilization, Maximum Shipping, Light Crude Blend Scenario. This measure would require construction activities in and near the Long Wharf that would result in secondary impacts that are beyond the scope of this EIR. Before implementing this mitigation measure, Chevron shall apply to the City and other responsible agencies for necessary permits, and shall complete the environmental process required under CEQA. Implementation of this measure is not required to achieve the performance standard included in this Mitigation Measure 4.3-6.

(iv) If, after implementing Mitigation Measures 4.3-6(a)(2)(i) though 4.3-6a(2)(iii), above, health risk from Project TAC emissions remains above Baseline levels on a net basis, as determined by the health risk assessment required by Mitigation Measure 4.3-6b, below, then Chevron shall curtail Facility operations as necessary to ensure that such health risk is reduced to Baseline levels on a net basis.

6b: Chevron shall fund and participate in a Clean Air Improvement Fund for any net increase in health risks from TACs not avoided or mitigated as required in this EIR. Chevron is required to comply with applicable pollution control laws which are anticipated to result in further decreases in Facility risks from TACs. If the Modernization Project is approved, operational emissions, as mitigated, would be lower than otherwise required by air quality laws, regulations, and permit programs, due to the broader scope of CEQA and the No Net Increase Project Objective.

Nevertheless, it is possible that there would be years when risks from Project TAC emissions may exceed Baseline levels on a net basis prior to curtailment, as required by Mitigation Measure 4.3-6(a)(iv), if, for example, risks levels exceed those for which mitigation required by Mitigation Measure 4.3-6(a)(1)(i) is already in place. To address this potential for a temporary increase in risk, and to further incentivize Chevron to avoid any such temporary increases, Chevron shall implement the following measures:

(i) In any year for which the BAAQMD-approved emissions inventory, combined with annual emission estimates from shipping, results in an increase over Baseline levels identified in Table 4.3-24 of the three primary risk drivers (DPM, benzene, and napthalene), even if such emissions are adequately mitigated as CAP emissions through implementation of Mitigation Measure 4.3-5 such that there is no net increase of such CAP emissions over Baseline levels, then Chevron shall, within 60 days, fund the cost of the City's preparation of a new health risk assessment to identify whether these TAC emissions resulted in an increase in risk over Baseline.

(ii) If the new risk assessment required by Mitigation Measure 4.3-6(b)(i), above, identifies an increase in risk over Baseline risks, then Chevron shall contribute an additional $100,000 in further funding for the Clean Air Improvement Fund identified in this Mitigation Measure 4.3-6b.

This Mitigation Measure 4.3-6b does not create any exception to Chevron's obligation to fully comply with all mitigation measures included in this EIR, including but not limited to Mitigation Measure 4.3-6a requiring that risks from TAC emissions not exceed Baseline levels on a net basis.

6c: Chevron shall monitor designated metals in Facility feedstock and refinery fuel gas (RFG) and report annually on the correlation, if any, between total annual designated metal emissions (as calculated from RFG samples) and average annual concentrations of such metals in feedstocks. The annual report shall address the following metals of concern: nickel, vanadium, selenium, cadmium, and mercury.

Additionally, a comprehensive literature search was completed to evaluate whether metal content would likely increase, either with increased crude oil sulfur content or with decreasing gravity (BP, 2013; Capline, 2013; Eni, 2012; Environment Canada, 2008; Exxon, 2013; Satoil, 2013; Total, 2003). The crude oil data found from various agencies and institutions were evaluated to investigate the potential relationship between the crude oil sulfur concentration and the concentration of barium, iron, magnesium, nickel, titanium, vanadium, and zinc. Little data were available for mercury, lead, copper, cadmium, and arsenic.

The analysis consisted of evaluating the potential correlation between sulfur and the listed metals. A weak statistical relationship was found for the dependence of barium, iron, nickel, and vanadium on sulfur concentration. Thus, it is reasonably foreseeable that slight increases in barium, iron, nickel, and vanadium content of crude oils could occur with higher sulfur content crude oils expected with the Modernization Project given the weak correlation. A similar analysis was undertaken for the correlation between metals and gravity. A weak statistical relationship was found for the dependence of calcium, iron, magnesium, nickel, and vanadium on gravity (API). Thus, it is reasonably foreseeable that slight increases in calcium, iron, magnesium, nickel, and vanadium could occur with lower API crude oils expected with the Modernization Project given the weak correlation.

This EIR accordingly concludes that it is possible that the crude oils processed by the Facility if the Modernization Project is implemented could contain relatively higher concentrations of vanadium, nickel, barium, iron, calcium, and magnesium.

The Facility includes catalyst processing steps that are designed to remove metals from incoming crude oil feedstocks. Metals are generally not present in refinery fuel gas because the vast majority of this refinery fuel gas has contacted this demetallation catalyst (or is natural gas that does not contain metals). Such catalysts would need to be changed somewhat more frequently if slightly higher metal concentrations occur.

An increase in catalyst changeout may lead to small emissions of metals as a result of handling the metal-laden catalysts during the changeout process. Accordingly, metals emissions may rise as a result of changes in the crude blends.

Because there is considerable variation in the natural metals content of crude oils, both between different oil production fields and even within fields, it is not possible to estimate the potential for increased concentrations of metals

in the crude or gas oils processed by the Facility. Metals are TACs, and contribute to health risks, and any net increase in metal emissions would also trigger the mitigation measure compliance requirements in Mitigation Measures 4.3-6a and 4.3-6b, above.

6d: Chevron shall monitor average annual sulfur and nitrogen concentrations in Facility feedstocks, and nitrogen-related refinery fuel gas air emissions, and report annually on the correlation, if any, between total annual nitrogen-related CAP and TAC emissions (as reported in the BAAQMD annual Emissions Inventory) and average annual concentrations of sulfur and nitrogen in feedstocks.

In the comprehensive evaluation of crude oil constituents completed for this EIR, a weak statistical relationship was found between increased API gravity for the type of intermediate range crude oils to be processed at the Facility following Modernization Project construction and operation relative to the Baseline gravity level, and the amount of nitrogen present in this heavier end of the intermediate range, as further described in *Appendix 4.3-MET*.

If nitrogen content did increase, emissions could also increase, such as increasing the utilization of the hydrogen plant to supply the additional hydrogen needed to remove nitrogen during the refining process. Additionally, the nitrogen content (and therefore NO_x emissions) of the Facility process gas produced and used by Facility process units could increase.

Full utilization of the hydrogen plant, rather than the hydrogen plant production levels required to produce the quantity of hydrogen included in the URM for various scenarios, is already conservatively assumed—and mitigated for—in this Draft EIR. Increased emissions of nitrogen compounds, including NO_x and nitrogen-related TACs, are not anticipated as part of this Project, nor is any increase in risk from a nitrogen-related TAC. Any such increase over Baseline would require compliance with mitigation measures specified above to ensure no net increase in CAPs or risks from TACs over Baseline levels.

Implementation of Mitigation Measures 4.3-6a through 4.3-6d above would reduce the impact to a less-than-significant level.

Impact 4.3-7: The Modernization Project would allow the Facility to process crude and gas oils containing higher concentrations of sulfur, which could result in increased emissions of sulfur-related compounds and TACs. This

impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Sulfur removal is an integral part of the refinery process, both to meet low-sulfur legal mandates and specifications for refined products and to optimize refinery processing operations that occur following sulfur removal. Gaining the flexibility to process higher sulfur crude and gas oils is an inherent part of the Modernization Project.

However, increased emissions of sulfur-related compounds such as SO_x are not anticipated as part of this Project, nor is any increase in risk from a sulfur-related TAC. Any such increase over Baseline would require compliance with Mitigation Measures 4.3-6a through 4.3-6d to ensure compliance with the Project Objective of No Net Increase in CAPs or risks from TACs.

> Mitigation Measure 4.3-7: Chevron shall implement Mitigation Measures 4.3-6a through 4.3-6d.
>
> Implementation of Mitigation Measure 4.3-7 (Mitigation Measures 4.3-6a through 4.3-6d) above would reduce the impact to a less-than-significant level.

4.3.6.2.6 *Modernization Project Operational Odor Impacts*

Impact 4.3-8: The Modernization Project could result in increased odors from sulfur-related compounds. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Some substances present in products and byproducts of the refining processes and in materials used by the Facility are known to cause odors. Relevant to the Modernization Project are such substances as H_2S, SO_2, and other reduced-sulfur compounds; NH_3; and some organic compounds, including benzene, naphthalene, and toluene. The potential Project sources of odor are described in Table 4.3-25.

TABLE 4.3-25 POTENTIAL SOURCES OF ODOR AT THE FACILITY

Odor Source	Odorous Compounds	Change with Revised Project?
Sulfur recovery unit (including piping)	H_2S, SO_2	Yes
Hydrogen plant (including piping); selective catalytic reduction emission control units	NH_3	Yes
Fugitive component leaks	VOCs	Yes
Storage tanks	VOCs	Yes
Wastewater treatment plant	VOCs, SO_2	No

Source: Chevron Data Transmittal #21, 2012.

The BAAQMD regulates odors under Regulation 7 of its Rules and Regulations. The purpose of Regulation 7 is the general control of odorous compounds. All of the Modernization Project sources are expected to comply with Regulation 7. Ammonia is mentioned specifically in Regulation 7. H_2S is not specifically mentioned in Regulation 7 other than to direct the reader to Regulation 9, Rule 2. However, Regulation 7-301 and 302 have project general limit on odorous substances and a limit on odorous substances at or beyond the property line that may apply to H_2S emissions.

According to the BAAQMD significance thresholds, a project would have a significant air quality impact if would result in an additional five or more confirmed odor complaints per year, averaged over 3 years.

For context, there were 62 confirmed odor complaints filed against Chevron with BAAQMD between January 1, 2008 and February 18, 2014, which is an average of 10.1 confirmed complaints per year. The odor descriptions associated with confirmed complaints includes “petroleum/diesel/gasoline/oily,” “burning/ burnt,” “acrid/noxious/chemical,” and “strong/bad/horrible” or another nonspecific descriptor.

There are two odorous compounds of concern based on existing and reasonably foreseeable future Refinery Operations:

- Hydrogen sulfide, particularly associated with sulfur loading rack activities and sulfur recovery units. (Separately from the Modernization Project, Chevron has applied to replace the sulfur loading rack to address reliability concerns. The new loading rack design will reduce odors relative to the existing rack.)

- Ammonia, particularly associated with hydrogen plant production and the use of selective catalytic emission reduction units. To control odors, BAAQMD Regulation 7-303 limits the concentration of NH_3 from stacks to 5,000 ppm. The heaters would comply because the heaters have a limit of 10 ppm NH_3 at 3% oxygen in the stack, which is less than 5,000 ppm. It is expected that the sulfur recovery unit would comply because tests for NH_3 at the other sulfur recovery units have measured concentrations less than 30 ppm10 at 3% oxygen (O_2). The concentration of NH_3 in the stacks of both source categories will be measured by source test after construction. Therefore, new point sources of emissions are unlikely to cause odors resulting from NH_3.

Additionally, increased Facility utilization would increase use of storage tanks and associated piping, and increases in emissions associated with filling and emptying tanks. This increased activity may lead to periodic increases in hydrocarbon odors.

Mitigation Measure 4.3-8: Chevron shall implement the following measures:

(a) Chevron shall report annually to the City in writing on the number of odor complaints confirmed by the BAAQMD, and shall specify in such report, where available, whether each complaint relates to hydrogen sulfide, NH_3, or an unspecified compound or source.

(b) If, in any year following commencement of Project operations, there is an increase in odor complaints confirmed by the BAAQMD relative to the number of odor complaints that occurred during the Baseline period, and such increase is due to H_2S or NH_3 odors, Chevron shall prepare, and submit to the City and BAAQMD for approval, an Odor Management Plan. At minimum, the Odor Management Plan shall:

- Establish protocols for monitoring odors at or from the Facility on an ongoing basis;
- Provide for the establishment of a regular odor patrol to monitor odors at or from the Facility and to investigate, and take corrective actions with respect to, odor complaints on an ongoing basis;
- Establish protocols for the prompt recordation and annual reporting to City of odor complaints confirmed by BAAQMD;
- Establish community outreach protocols describing procedures for informing the public about how and where to submit odor complaints;

[10] Measured concentration of 10 ppm at 15% O_2 was converted into a concentration at 3% O_2 to be consistent with the regulation.

- Describe measures to be implemented as necessary to reduce BAAQMD-confirmed odor complaints below the BAAQMD threshold of significance, which measures shall include, but not be limited to, the following odor mitigation strategies recommended for refineries in the BAAQMD CEQA Guidelines (collectively, the "Odor Reduction Measures"):
- (i) implementation of water injections into the hydrocracking process;
- (ii) installation of vapor recovery systems;
- (iii)_injection of masking odorants into refinery process streams;
- (iv) installation of flare meters and controls;
- (v) implementation of wastewater circulation technology for aerated ponds;
- (vi) implementation of thermal oxidizers;
- (vii) implementation of carbon absorption mechanisms;
- (viii) implementation of biofiltration and/or bio-trickling filters.
- Establish protocols for (1) the annual review and reporting on the effectiveness of any Odor Reduction Measures implemented pursuant to this Mitigation Measure 4.3-8 and (2) adaptively managing the implementation of Odor Reduction Measures as necessary to maintain complaints below the BAAQMD threshold of significance on an ongoing basis.

(c) If, in any year following commencement of Project operations, there is an increase in odor complaints confirmed by the BAAQMD relative to the number of odor complaints that occurred during the Baseline period, and such increase is due to H_2S or NH_3 odors, Chevron shall implement the odor patrol provided for under the Odor Management Plan and cause it to immediately commence monitoring odors at or from Facility on an ongoing basis, to investigate any odor complaint, to ensure that appropriate action is taken to reduce odors from the affected source, and to document the implementation and effectiveness of the corrective action.

(d) If odor complaints above Baseline levels persist for more than 2 consecutive years following commencement of Project operations, Chevron shall fund a qualified third-party engineering firm to assume responsibility for:

- Immediately investigating odor complaints confirmed by the BAAQMD in accordance with Odor Management Plan protocols;
- Implementing and adaptively managing, at Chevron's sole expense and in consultation with the City and the BAAQMD, one or more of the Odor

Reduction Measures described in the approved Odor Management Plan, to reduce or maintain BAAQMD-confirmed odor complaints below the BAAQMD threshold of significance;

- Monitoring and documenting the implementation and effectiveness of such Odor Reduction Measures and the adaptive management thereof in accordance with Odor Management Plan protocols; and
- Annually reporting in writing to the City and the BAAQMD on the implementation and effectiveness of such Odor Reduction Measures and the adaptive management thereof in accordance with Odor Management Plan protocols.

(e) Chevron shall cause the Project to comply with the City's odor standards and with BAAQMD Regulation 7-303, which limits the concentration of NH_3 from stacks to 5,000 ppm. The Facility heaters shall comply with the BAAQMD Permit Condition 24136, Item #16 limit of 10 ppm NH_3 at 3% oxygen in the stack, which is less than 5,000 ppm. Chevron shall further cause the Replacement Hydrogen Plant to comply with BAAQMD Regulations 7-303 for NH_3 at the other sulfur recovery units. Chevron shall confirm concentration of NH_3 in the stacks of both source categories after construction.

Implementation of Mitigation Measure 4.3-8 above would reduce this impact to a less-than-significant level.

4.3.6.2.7 *Modernization Project Operational Conflicts with Relevant Plans*

Impact 4.3-9: The Modernization Project would not conflict with or obstruct implementation of the 2010 Bay Area Clean Air Plan. This impact would be less than significant and no mitigation is necessary. (LTS)

The most recently adopted air quality plan for the Bay Area is the 2010 Clean Air Plan (Clean Air Plan), which is an update to the BAAQMD's 2005 Ozone Strategy to comply with State air quality planning requirements. The Clean Air Plan also serves as a multi-pollutant air quality plan to protect public health and the climate. The Clean Air Plan control strategy includes revised, updated, and new measures in the three traditional control measure categories: stationary sources measures, mobile source measures, and transportation control measures. In addition, the Clean Air Plan identifies two new categories of control measures, including land use and local impact measures and energy and climate measures.

The 2010 BAAQMD CEQA Guidelines recommend that consistency with the Clean Air Plan be used to evaluate plan-level projects (BAAQMD, 2011). This recommendation is applicable to long range plans (e.g., general plan,

redevelopment plans, specific plans, area plans, community plans, regional plans, congestion management plans, etc.), (BAAQMD, 2011). The 2010 BAAQMD CEQA Guidelines do not offer recommendations to determine consistency with the Clean Air Plan for projects that are not long-range plans. While the Modernization Project is not a long-range plan, the criteria recommended for evaluating consistency of plans with the Clean Air Plan are discussed in this section.

The 2010 BAAQMD CEQA Guidelines recommend the consideration of three questions:

1. Does the project support the primary goals of the air quality plan;

2. Does the project include applicable control measures from the air quality plan; and

3. Does the project disrupt or hinder implementation of any Clean Air Plan control measures?

With regards to the first question, the BAAQMD CEQA Guidelines provide a basis for assessing support of the primary goals:

> The primary goals of the 2010 Bay Area Clean Air Plan, the current AQP to date, are to:
>
> - Attain air quality standards;
> - Reduce population exposure and protect public health in the Bay Area; and
> - Reduce GHG emissions and protect the climate.
> - Any project (i.e. project or plan) that would not support these goals would not be considered consistent with the 2010 Clean Air Plan. If approval of a project would not result in significant and unavoidable air quality impacts, after the application of all feasible mitigation, the project may be considered consistent with the 2010 Clean Air Plan.

The second question recommended in the 2010 BAAQMD CEQA Guidelines for evaluating consistency with the Clean Air Plan is whether the project includes applicable control measures from the air quality plan. The Clean Air Plan includes 55 control measures to reduce emissions of PM, PM precursors and other air pollutants from a wide variety of emission sources. The control measures can be classified into six main categories: Stationary Source Measures, Mobile Source Measures, Transportation Control Measures, Land Use and Local Impact

Measures, Energy and Climate Measures, and Further Study Measures. The Clean Air Plan control measure relevant to construction of the Modernization Project is Mobile Source Measure MSM C-1 – Construction and Farming Equipment. The Modernization Project would implement measure MM-AQ-2, Implement Additional Construction Mitigation Measures, including fleet-wide average 20% NO_x emission reductions for Modernization Project off-road construction equipment, achieved by options including the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available. This is consistent with the Clean Air Plan Mobile Source Measure C-1, and consequently the Modernization Project does include applicable control measures from the air quality plan and does meet the second criterion for consistency with the Clean Air Plan.

The final basis for evaluation consistency with the Clean Air Plan is whether the Modernization Project would disrupt or hinder implementation of any Clean Air Plan control measure. The Modernization Project would not affect any Stationary Source Measures, Transportation Control Measures, Land Use and Local Impact Measures, Energy and Climate Measures, or Further Study Measures and is consistent with applicable Transportation Control Measures.

The Modernization Project therefore would not conflict with or obstruct implementation of the Clean Air Plan. The Modernization Project's impacts relative to the goals of the Clean Air Plan would be less than significant.

Mitigation Measure 4.3-9: None required.

4.3.7 Cumulative Impacts

This section evaluates cumulative impacts on air quality, and includes an evaluation of CAPs and TACs, under the BAAQMD significance thresholds and under an additional Disparate Impact Threshold. The Modernization Project would not cause any significant cumulative CAP or TAC-related impacts under either threshold.

4.3.7.1 BAAQMD Cumulative Impacts Significance Thresholds

BAAQMD's CEQA Guidelines establish numerical criteria for determining when an emissions increase is considered cumulatively considerable and thus triggers the need for a quantitative cumulative impacts assessment.

In developing thresholds of significance for air pollutants, BAAQMD considered the emission levels for which a project's individual emissions would be cumulatively considerable. If a project does not exceed the identified significance

thresholds, its emissions would not be cumulatively considerable, resulting in less-than-significant air quality impacts on the region's existing air quality conditions. Therefore, additional analysis to assess cumulative impacts is unnecessary.

For TACs, the Modernization Project would have a cumulatively considerable impact if Modernization Project emissions would result in:

- Non-compliance with a qualified risk reduction plan; or
- An excess cancer risk level of 10 per million; or
- A non-cancer HI of greater than 1.0; or
- An incremental increase of greater than 0.3 $\mu g/m^3$ annual average emission of $PM_{2.5}$.

Based on the Modernization Project-level analysis included above, the Modernization Project would not have a cumulatively considerable impact based on these BAAQMD criteria because:

- There is no qualified risk reduction plan in effect for the Facility, Richmond, or Contra Costa County.
- The Modernization Project would not cause any net increase in cancer risk, or acute or chronic health risks, and thus is not cumulatively considerable for CEQA purposes.

Because the Modernization Project would not result in any significant adverse impact in short-term construction impacts, or any increase in CAPs or risks from TACs above the Baseline level, it would not contribute to any potential adverse cumulative air impact. Richmond will continue to be eligible for the CARE community program based on existing ambient air pollution levels that would not be changed by the Modernization Project.

4.3.7.2 Additional Community and Disparate Impact Analysis

In addition to evaluating Modernization Project impacts based on BAAQMD's significance thresholds, the Modernization Project was evaluated based on the public health, economic, demographic, educational, and other factors considered in the Cal/EPA CalEnviroScreen. CalEnviroScreen ranks zip codes based on a formula that aggregates a diverse group of pollutants, socio-economic data, and other factors into a single scalable value. Cal/EPA uses this tool to help determine which portions of the State have higher pollution burdens and vulnerabilities than other areas, and therefore are most in need of assistance. Here, it is also used to help evaluate the potential for disproportionate impacts.

The zip codes surrounding the Facility rank in the higher percentage level of CalEnviroScreen.

Also, as described in *Section 4.3.2.1.4.2*, the City of Richmond was also designated by BAAQMD as a CARE community, based on a combination of the TAC emissions, locations of sensitive populations, and income levels.

In 2006, the Pacific Institute prepared a study to conduct neighborhood research for economic and environmental health and justice in Richmond, North Richmond, and San Pablo (The Pacific Institute, 2009). The report focused on the westernmost communities of Contra Costa County and the City of Richmond, including North Richmond, Parchester Village, Iron Triangle, Atchison Village, Santa Fe, Coronado, Belding Woods, Shields-Reid, and West San Pablo. It found that these neighborhoods are culturally diverse and economically disadvantaged, and include approximately 47,000 residents, 90% of whom are people of color, with a median household income of $32,000.

According to the Pacific Institute report, these neighborhoods also struggle with many economic, social, and environmental challenges. The report states that West County has numerous sources of environmental pollution, including General Chemical; the Facility; the Port of Richmond; two rail yards; an older, possibly lead-contaminated housing stock; and several abandoned brownfield sites. In addition, two major freeways, I-80 and I-580, traverse West County.

According to the 2007 Contra Costa County Community Health Indicators Report, Community Health Indicators for Contra Costa County (Contra Costa Health Services, 2007), San Pablo and Richmond mothers have higher proportions of low birth weight babies than the county rate overall. People living in San Pablo and Richmond are more likely to die from cancer and heart disease compared to the county overall. Diabetes disproportionately affects the people in these communities as well, with deaths from diabetes more than twice as likely here than the surrounding county. According to this County report, Children living in Richmond and San Pablo are also hospitalized for asthma at almost twice the rate of children in the rest of the county.

As discussed above, the Modernization Project as proposed would achieve Chevron's No Net Increase Project Objectives for CAPs and for risks from TACs, with implementation of the mitigation measures set forth in this *Section 4.3, Air Quality*.

4.3.8 Mitigation Monitoring and Reporting

4.3.8.1 Summary of CEQA Mitigation Monitoring and Reporting Program Obligations

CEQA requires the City, as the lead agency, to adopt a Mitigation Monitoring and Reporting Program to ensure implementation of mitigation measures and conditions of project approval that avoid, minimize, or mitigate a significant adverse impact. CEQA also allows a lead agency to delegate this mitigation monitoring and reporting obligation to another public agency which accepts the delegation, but the lead agency remains responsible for assuring that these measures are implemented. Implementation of Project Design Features is required as a mitigation measure, and implementation of all mitigation measures would be required as a condition of Modernization Project approval.

4.3.8.2 BAAQMD Role in Mitigation Monitoring and Reporting Program

The City has requested, and BAAQMD has agreed, to monitor Chevron's implementation of the air quality Project Design Features and mitigation measures identified in this EIR. Monitoring emissions and assuring compliance with the NNI Project Objective will require expert advice from BAAQMD, particularly to assure that future changes in methodologies for calculating emissions are taken into account to assure that actual emission reductions occur in sufficient quantities to remain at or below Baseline for CAPs, and for risks from TACs, and to ensure that there is an “apples-to-apples” comparison between Baseline emissions and future emission reductions.

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4.4 BIOLOGICAL RESOURCES

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) changes to relevant plans and policies, including the adoption of a new Richmond General Plan. These revisions do not change the 2008 EIR's conclusions that the Modernization Project's potential adverse significant impacts to biological resources would be mitigated to a less-than-significant level.

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- The potentially adverse biological resources impacts of the Modernization Project would be less than significant with implementation of mitigation.
- With mitigation, the Modernization Project would not have a significant adverse impact, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife (CDFW) or United States Fish and Wildlife Service (USFWS). Most of the Project components are proposed within the Refinery Process and Tank Farm areas, which do not provide potential habitat for special-status species. The Project components are separated from San Pablo Bay and salt marsh features by the Refinery Process Area and from San Francisco Bay by Interstate 580 (I-580). Placement and construction of Project components would have no significant adverse impact on sensitive species, as mitigated.
- The Modernization Project would not have a significant adverse impact on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the CDFW or USFWS. Potential impacts to biological resources could result if additional wastewater or pollutant discharges into bay waters were to occur. However, as described in detail in *Section 4.9, Hydrology and Water Quality*, with mitigation, the Modernization Project would not result in any increase in wastewater discharges or significantly change the pollutant load. Continued compliance with the discharge requirements of the Facility's National Pollutant Discharge Elimination System (NPDES) permit would ensure that impacts to beneficial uses are reduced to a less-than-significant level.
- The Modernization Project would not have a significant adverse impact on federally protected waters or wetlands as defined by Section 404 of the Clean Water Act.
- The Modernization Project would not interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use

of native wildlife nursery sites.

- The Modernization Project would not conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.
- The Modernization Project location is not subject to, and the Project would not itself conflict with, the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan.

4.4.1 Introduction

This section first generally describes biological resources located within the Project site and adjacent areas including San Francisco and San Pablo Bays, and then assesses the potential for the Modernization Project to result in significant adverse environmental impacts to biological resources.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities that could potentially affect biological resources. For example, as described in *Chapter 3, Project Description, Section 3.3*, construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

4.4.2 Setting

The following section describes the regional and local biological setting of the Project site. General biological descriptions of geographic location and habitat were compiled during an initial site reconnaissance survey[1] as mapped on Figure 4.4-1.

4.4.2.1 Regional and Local Setting

4.4.2.1.1 *Regional Setting*

The Project site is located in the City of Richmond in western Contra Costa County (see Figure 4.4-1). The Project site is found on the western extremity of the San Pablo Peninsula. Point San Pablo combined with opposing Point San Pedro in Marin County frame the San Pablo Strait, separating San Francisco and San Pablo Bays. These bays are both part of the San Francisco Bay Estuary, the largest estuary on the Pacific Coast of the United States.

4.4.2.1.2 *Local Setting*

The Project site, covering approximately 2,153 acres, occupies a major portion of the San Pablo Peninsula. The majority of Refinery Operations occur in the southeastern portion, while less developed scrub and woodland cover much of the northwestern Facility lands along the ridge of the peninsula, extending north to San Pablo Point. The Project components are primarily restricted to the southern portion of the Project site that encompasses the Refinery Process and Tank Farm areas. The Tank Farm Area contains storage tanks and other facilities located on the southeast to northeast slopes of Potrero Hills/San Pablo Peninsula Ridge, extending into the adjacent lowlands bordering I-580. As mentioned above, in *Section 4.4.1*, two construction staging areas would be located outside the Refinery Process Area but within the Project site.

To the west and northwest, the Project site is bounded primarily by open space extending up the San Pablo Peninsula including subtidal areas of San Pablo Bay in the vicinity of Long Wharf shoreline extending from Switch Gear House north along the bay shoreline to Castro Cove at Point Molate Beach Regional Park, just outside of the Project site. Railroad tracks run along a majority of the shoreline along the western portion of the San Pablo Peninsula, which is lined by rock revetment and is intermittently vegetated. Large stands of Eucalyptus and Monterey pine have been planted along access roads from the Long Wharf all the way to Point San Pablo. Rock outcrops along the northern peninsula grade

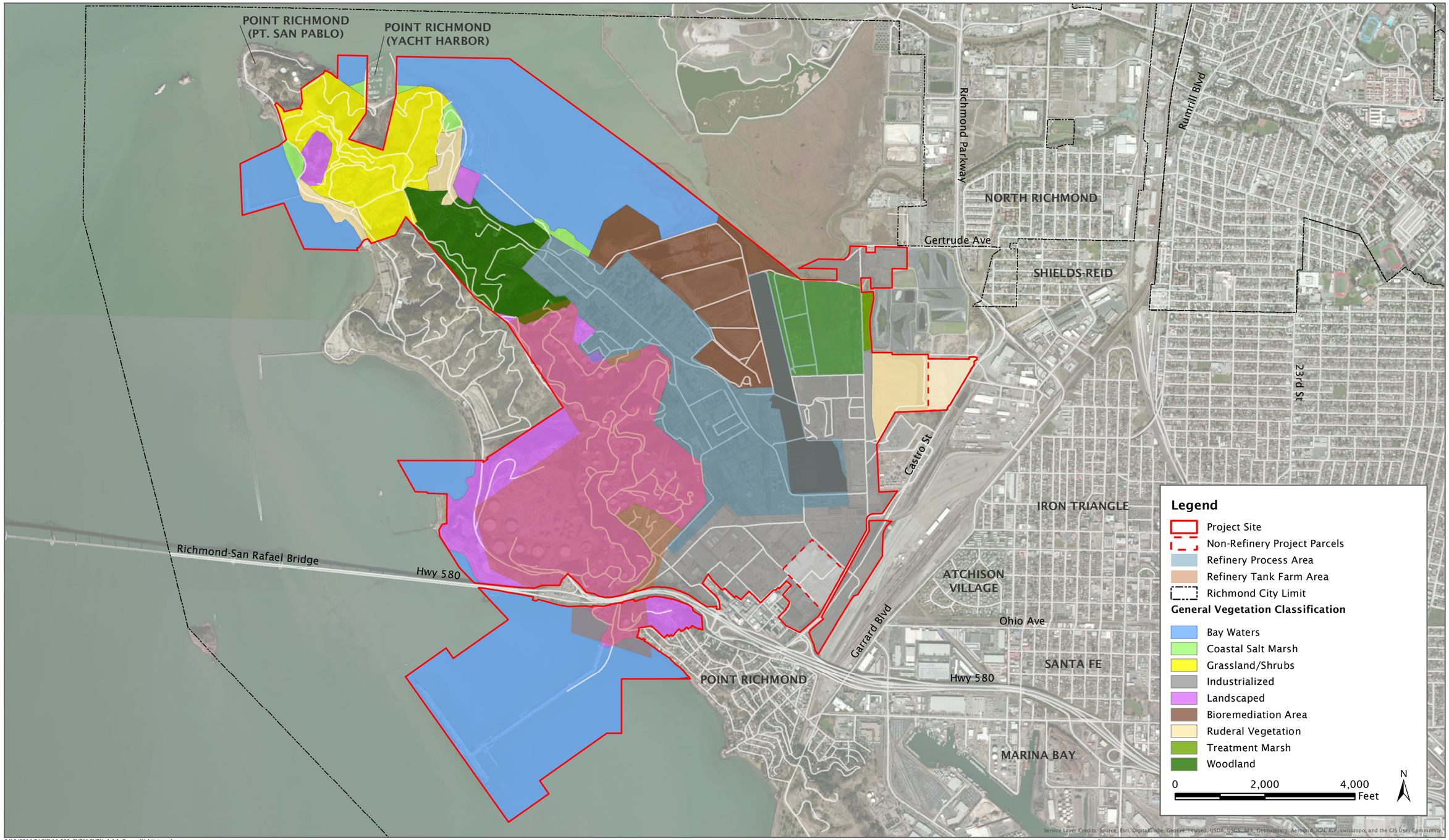
[1] ENVIRON conducted site surveys on August 29, 2011, and March 20 and 21, May 21, and August 2, 2012.

steeply down into the bay. There is no coastal marsh fringe along the west/southwest coastline of the peninsula. There is a small remnant coastal salt marsh impoundment between the railroad berm and the shoreline access road near Point Orient.

To the north and northeast of the Project site are associated subtidal habitats of San Pablo Bay and associated coastal marsh areas along the shoreline of San Pablo Point and the Point San Pablo Yacht Harbor. Between the Yacht Harbor and Refinery Process Area, Chevron maintains an employee recreation facility including tennis courts, swimming pool, playing fields and boating facilities. Within northern interior portions of the Project site, grasslands and Northern coastal scrub occur along a narrow ridgeline flanked to the east by coast live oak and California bay laurel woodlands in east facing canyons and to the west by ruderal vegetation and eucalyptus groves in steep west facing drainages. Non-native broom, Monterey pine, pampas grass, and eucalyptus are found throughout the peninsula in formerly disturbed areas.

Northeast of the Refinery Process and Tank Farm areas is a relatively extensive area of coastal salt marsh. This marsh area, for the most part owned by Chevron, is separated from the Refinery Process Area by the terminus of Wildcat Creek, San Pablo Canal, and the extensive Facility water treatment facilities, including constructed marsh areas that are part of a biological treatment process for Facility wastewaters and storm waters. The salt marsh plain and constructed marsh area would not be affected by the construction or operation of any Project components due to their physical separation from the Project. The vast majority of the remaining area within the Project site is largely unvegetated and has been developed and used for Refinery Operations, or has plant species that have been planted to serve Facility purposes (e.g., biofiltration, remediation, slope stabilization, and aesthetics).

The easternmost portion of the Project site borders the mouth of Wildcat Creek at its confluence with San Pablo Bay, which separates Chevron Treatment Marsh areas from the extensive coastal salt marsh plain and intertidal mudflats of Wildcat Marsh that are exposed during high tides that provide abundant foraging area for a variety of shorebirds. Eastern portions of the Project site are separated from these features by the Refinery Process Area, and the Facility's wastewater treatment system. To the east, the Project site extends to Castro Street, and is separated from residential areas further east by the Refinery Process Area and also light industry and other uses.



2/10/2014 P:\GIS\11-005_CVRN\CVRN_4.4-1_GeneralHabitat.mxd

Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T38r1 and T54)

Figure 4.4-1
Chevron Refinery Modernization Project EIR
General Habitat Map

4.4.2.2 Existing Biological Resources

The following section provides a classification and description of vegetation communities and/or habitat types found within the area of the Facility near areas that would be disturbed by the Modernization Project.

The biological resources within and adjacent to the Facility were identified during a reconnaissance visit and are mapped in Figure 4.4-1 and described above in the Local Setting section. The areas of the Facility where change may occur as a result of the Modernization Project were inspected in the field to assess potential impacts that could occur during the construction and operational phases of the Project. A biological records search was completed by ENVIRON, for the purpose of updating the 2008 EIR.

For purposes of the 2008 EIR, an ESA biologist conducted site evaluations on May 25 and November 7, 2005 (for Methods see special-status species below). For purposes of this EIR, ENVIRON biologists conducted additional site evaluations on August 29, 2011, and March 20, 21, May 21, and August 2, 2012. These site visits focused on evaluating and mapping habitat in the Project site and confirming that no changes have occurred since these areas were previously evaluated by an ESA biologist on May 25 and November 7, 2005.

4.4.2.2.1 *Habitats Within Modernization Project Area (Refinery Process Area and Tank Farm Areas)*

All portions within the Project site where change may occur as a result of the Modernization Project support industrial land uses and provide limited biological resources due to the intensity of current operations. With the exception of small areas of weedy vegetation or landscaping surrounding parking lots, the Refinery Process Area is completely developed.

Vegetated areas surrounding the Tank Farm Area consist of landscaped areas or include industrialized areas that are maintained in an unvegetated condition for fire prevention and safety purposes. None of the vegetation types have been identified as sensitive vegetative communities. Additionally, no special-status plant or animal species were identified during the site visits conducted by ENVIRON's biological resource personnel, nor were any identified by the ESA biological resource personnel during the 2008 EIR preparation process.

Four general categories were identified for purposes of evaluating biological resources: industrial areas, landscaped areas, natural terrestrial plant communities, and San Francisco Bay waters and shoreline areas surrounding the Long Wharf. Where applicable, natural terrestrial communities were identified that most closely matched vegetation alliance and association descriptions from

A Manual of California Vegetation (Sawyer et. al, 2009), as this classification system is recognized by the California Department of Fish and Wildlife (CDFW). In other cases, it was necessary to identify variants of plant alliances or associations to describe vegetated areas that do not closely match the classification system in A Manual of California Vegetation due to their composition by several associated species with no clear dominant plant species (i.e., Northern coastal scrub). A 100-foot study area also examined vegetated portions of the Project site where change may occur as a result of the Modernization Project in order to assess biological impacts that may result from Project construction or operation.

4.4.2.2.1.1 *Industrial Areas*

The most abundant category in the Refinery Process and Tank Farm areas (areas where nearly all of the Modernization Project construction would occur) is industrial land with little to no vegetation. This includes areas with buildings or pavement with no vegetative cover, and industrialized areas with less than 2% total herbaceous vegetative cover or less than 10% tree or shrub cover occurring along streets and other landscaped features within parking lots, along pathways, and surrounding buildings along Castro Street and Channel Street. The developed areas of the Project site have, for the most part, been cleared of vegetation and are maintained this way for fire prevention purposes. Scattered ruderal plant species (non-native weedy vegetation) such as ripgut brome (*Bromus diandrus*), wild oat (*Avena* sp.), prickly ox-tongue (*Helminthotheca echioides*), and wild radish (*Raphanus sativus*) are found occasionally in gravel road shoulders and similar areas.

The industrial areas include structures, roadways, and paved surfaces that provide little to no habitat for plants or animals. While in theory some urban-adapted birds such as rock dove (*Columba livia*), mourning dove (*Zenaida macroura*), house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), could make use of structures for roosts or other purposes, the high and constant amount of disturbance involved with operations, in addition to the large continuous areas lacking in vegetation and associated food resources, and the numerous barriers to movement are likely to dissuade even occasional use by wildlife.

4.4.2.2.1.2 *Landscaped Areas*

Chevron has planted areas of the Facility to serve a variety of purposes, ranging from operational processes, to remediation (e.g., stabilization planting on areas of the site that are "capped" to prevent migration of subsurface pollutants), to

geotechnical stabilization (e.g., hillside plantings), to aesthetics (e.g., ornamental plantings).

Landscaped areas in the Tank Farm Area include stands of previously planted trees (including eucalyptus (*Eucalyptus* sp.), Monterey cypress (*Cupressus macrocarpa*), Monterey pine (*Pinus radiata*), and revegetated areas that support a mix of native and ornamental shrub and herbaceous species.

4.4.2.2.1.2.1 *Planted Trees*

Eucalyptus habitats (Eucalyptus naturalized forest), introduced to California in 1856 and planted or naturalized throughout the State, usually form dense stands and are often monotypic in composition. The most common dominant is blue gum (*Eucalyptus globulus*) although other species in the genus may be mixed in or may dominate. The understory is often sparse, due in large part to the prolific accumulation of bark and leaf litter with growth-suppressing properties. Non-native annual grasses, with an assortment of common weedy species such as mustard (*Brassica* spp.) and thistle (e.g., *Centaurea* spp.), occur in the understory. Native shrubs such as coyote brush (*Baccharis pilularis*), chamise (*Adenostoma fasciculatum*), California blackberry (*Rubus ursinus*), toyon (*Heteromeles arbutifolia*), and California sage (*Artemisia californica*) occur in the understory where eucalyptus groves have established in areas bordering native Coyote Brush Alliance and Northern coastal scrub habitat.

Monterey pines (*Pinus radiata*) and Monterey cypress (*Cupressus macrocarpa*) occur along with blue gum in many of these areas and in some places form relatively monotypic groves. Monterey pines and Monterey cypress are also not native to the region and those that are present are derived from plantings in the past.

In the Tank Farm Area, a relatively extensive mixed grove of eucalyptus trees and Monterey pine cover much of the northeast face of the hill, generally traversing the Tank Farm Area from south to north and also in places along the northeast side of the Tank Farm Area. This vegetation type is also found between the Tank Farm Area and I-580, and in places along the northeast slope of Potrero Ridge bordering the northwest extent of the lowland Refinery Process Area.

Wildlife habitat values associated with groves of planted trees include limited shelter and foraging opportunities for occasional mule deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), and gray fox, and small mammals such as rats, mice, voles, and gophers. In addition, eucalyptus, Monterey pine, and Monterey cypress groves can serve as roosts, perches and nest sites for raptors such as red-tailed hawk (*Buteo jamaicensis*) and other birds, including American

crow (*Corvus brachyrhynchos*) and barn owl (*Tyto alba*). In addition, developed stands of eucalyptus have limited potential to serve as overwintering sites for monarch butterflies (*Danaus plexippus*).

Developed stands of eucalyptus have potential to serve as overwintering sites for monarch butterflies (*Danaus plexippus*), but no monarch butterflies have been observed in the trees present in the Tank Farm Area.

4.4.2.2.1.2.2 *Other Revegetated Areas*

In addition to stands of eucalyptus, Monterey pine, and Monterey cypress, a mix of native and non-native plants are interspersed in revegetated areas along the side slopes of quarry terraces and along road cuts, and parking areas, and in surrounding footprints of proposed Project components. Revegetated areas consist of a mix of planted native and ornamental shrubs do not exhibit clear dominant type species. Various non-native species include Ngaio tree (*Myoporum laetum*), pyracantha (*Pyracantha angustifolia*), oleander (*Nereum oleander*), and acacia (*Acacia* spp.). Native plantings that have been incorporated into restored areas include coyote brush (*Baccharis pilularis*), toyon (*Heteromeles arbutifolia*), and coast live oak (*Quercus agrifolia).* Also present are non-native annual grasses, with a mix of ruderal, native and invasive species, including occasional French broom (*Genista monspessulana*), poison oak (*Toxicodendron diversil*oba), milk thistle (*Silybum marianum*), gamble weed (*Sanicula crassicaulis*), pampas grass (*Cortaderia selloana*), iceplant (*Carpobrotus edulis*), and other non-native annual grasses such as slender wild oat (*Avena barbata*), rattlesnake grass (*Briza maxima*), and rattail fescue (*Vulpia myuros*). Restored areas with mixed ornamental and native plant species have low overall wildlife habitat value, but may provide limited shelter, foraging opportunities and nesting sites for common, disturbance-adapted songbirds, reptiles (e.g., fence lizard [*Sceloporus occidentalis*]) and rodents such as rats, mice, voles, and gophers.

4.4.2.2.1.3 *Ruderal Vegetation*

A majority of the vegetated portions of the Tank Farm Area supports stands of invasive species such as acacia, iceplant, pampas grass, Scotch (*Cytisus scoparius*), and/or French broom (*Genista monspessulana*), and/or a ruderal mix of multiple non-native, weedy, and/or invasive species that have become established due to disturbed site conditions resulting from Facility Tank Farm development and ongoing operations. Invasive species are commonly found surrounding footprints of proposed Project components. Common species include fennel (*Foeniculum vulgare*), pampas grass, milk thistle, bristly ox's tongue (*Picris echioides*), bull thistle (*Cirsium vulgare*), tarweed, redstem filaree (*Erodium cicutarium*), acacia, Himalayan blackberry (*Rubus armeniacus*),

perennial field mustard (*Hirschfeldia incana*),wild radish, ripgut brome (*Bromus diandrus*;), black mustard (*Brassica nigra*), common sow thistle (*Sonchus oleraceus*), seaside barley (*Hordeum marinem* ssp. *gussoneanum*), wild oats (*Avena* spp.), wall barley (*Hordeum murinum* ssp. *leporinum*;), Italian thistle (*Carduus pycnocephalus*), prickly lettuce (*Lactuca serriola*). Areas dominated by invasive species provide very limited habitat value for wildlife species and would be similar to those described above for revegetated areas.

4.4.2.2.1.3.1 *Natural Terrestrial Communities*

Natural terrestrial communities occur on the Project site as remnant, isolated patches of Coast live oak (*Quercus agrifolius*) and California Bay (*Umbellularia californica*) woodland, grasslands, and native shrub-dominated communities that historically characterized the ridgeline and side slopes of the San Pablo Peninsula prior to development of the existing Refinery Tank Farm.

4.4.2.2.1.3.2 *Northern Coastal Scrub*

Within the Project site, disturbed Northern coastal scrub is present in scattered remnant patches throughout the Tank Farm Area and tends to occur in association with pure stands of eucalyptus and Monterey pine. This plant community consist of low- to medium-sized shrubs along south and west facing ridges, ranging in cover from patchy assemblages to dense, relatively impenetrable continuous cover. An understory ranging from a perennial/sub-shrub layer to annual grasses and herbs is present. Co-dominant plant species include coyote brush, poison oak, toyon (*Heteromeles arbutifolia*), California sagebrush (*Artemisia californica*), and sticky monkeyflower (*Mimulus aurantiacus*), with occasional coffee berry (*Rhamnus californicus*), bee plant (*Scrophularia californica*), and bracken fern (*Pteridium aquilinum*) individuals. Pampas grass is a common associate and dominates some patches. Non-native grassland species usually comprise the understory. Common wildlife expected in this habitat type includes western fence lizard (*Sceloporus occidentalis*) and a variety of birds including California quail (*Callipepla californica*), Anna's hummingbird (*Calypte anna*), western scrub jay (*Aphelocoma californica*), Bewick's wren (*Thryomanes bewickii*), and California towhee (*Pipilo crissalis*).

4.4.2.2.1.3.3 *Coast Live Oak-California Bay Laurel Association*

A woodland community co-dominated by coast live oak and California Bay laurel within the Tank Farm Area is distributed in the central and southwest portions of the Tank Farm Area. Species composition is characterized by a dense and continuous canopy of California bay laurel and coast live oak in the overstory with California buckeye (*Aesculus californicus*), poison oak, toyon, French broom, and acacia in the substratum. This vegetation type typically supports wildlife

species including western fence lizard (*Sceloporus occidentalis*); mammals, such as bobcat (*Felis rufus*) and mule deer, and several bird species, including (but not limited to) California quail, Bewick's wren, western scrub jay, and wild turkey (*Meleagris gallopavo*), white bushtit (*Psaltiparus minimus*), chickadee (*Parus* spp.), and house finch (*Carpodacus mexicanus*).

4.4.2.2.1.4 *San Francisco Bay Waters, Shoreline Areas, and Long Wharf*

The remaining habitat type near the Project site includes open water and shoreline areas of the San Francisco Bay surrounding the Long Wharf area in the southwest portion of the Project site and San Pablo Bay to the northeast. Since no Project components are proposed that would physically change any shoreline area, the Modernization Project would not impact these resources. As discussed further below, any increased shipping activity at the Long Wharf associated with the Project would remain below the 900 vessel calls previously analyzed in the Long Wharf EIR, and the increase in shipping that would result from the Modernization Project would not create new impacts that were not addressed in that environmental document. A summary of the biological resources present in these areas is provided for informational purposes.

The Bay shoreline at the landward end of Long Wharf consists of manmade hard substrate and does not support vegetated tidal marsh habitats. Eelgrass beds occur in nearshore areas surrounding Long Wharf; this habitat is recognized as a particularly productive marine habitat that enhances the physical and biological environment. Significant shallow water fish habitat is found on the eastern Bay shore near the Long Wharf that commonly supports the plainfin midshipman (*Porichthys notatus*), among several additional species. Bay waters also provide critical areas for salmonid migration between the Pacific Ocean and the Sacramento Delta. Special-status fish species associated with the Bay-Delta are green sturgeon (*Acipenser medirostris*), Sacramento perch (*Archoplites interruptus*), Tidewater goby (*Eucyclogobius newberryi*), Delta smelt (*Hypomesus transpacificus*), steelhead trout (*Oncorhynchus mykiss*), Chinook salmon (*Oncorhyncus tshawytscha*), Sacramento splittail (*Pogonichthys macrolepidotus*), and LongfinSmelt (*Spirinchus thaleichthys*).

4.4.2.2.2 *Special-Status Species*

A number of species known to occur in the vicinity of the Project site are protected pursuant to federal and/or State species protection statutes administered by the U.S. Fish and Wildlife Service (USFWS), and/or the CDFW. In addition, Section 15380(b) of the CEQA Guidelines include a definition of rare, endangered, or threatened species required to be considered under CEQA that is broader than species protected under these federal and state species protection statutes laws. Species recognized under these terms are collectively referred to

as "special-status species." The discussion under *Section 4.4.2.3* below provides additional information on special-status species.

For the 2008 EIR, ESA compiled a list of special-status plant and animal species that have potential to occur in the Project site vicinity based on information from the USFWS Proposed and Candidate Species list for Contra Costa County (USFWS, 2013), the CDFW California Natural Diversity Data Base (CNDDB) List of California Terrestrial Natural Communities Recognized (CDFW, 2013), and the California Native Plant Society (CNPS) Electronic Inventory of Rare and Endangered Vascular Plants (CNPS, 2014). Additionally, an ESA biologist conducted site habitat evaluations on May 25 and November 7, 2005. The 2008 EIR concluded that the Modernization Project would not adversely impact any protected biological resources, including sensitive species.

To evaluate the potential for the Modernization Project to have any new significant adverse impacts to sensitive species, ENVIRON biologists compiled an updated list of special-status plant and animal species based on a review of updated CNDDB, USFWS, and CNPS species occurrence records. ENVIRON conducted site habitat evaluations on August 29, 2011, and March 20 and 21, May 21, and August 2, 2012 to confirm that no substantive changes have occurred with respect to the 2008 EIR's conclusions and that the Modernization Project would not cause any new significant adverse impact to any sensitive species identified in the updated database search.

Tables 4.4-1and 4.4-2 list the animals and plants considered in this evaluation, as well as their status, habitat requirements and potential for occurrence. Species included in Tables 4.4-1and 4.4-2 are: (1) species for which suitable habitat occurs in site areas where Project components are proposed to occur, including the Refinery Process and Tank Farm areas; and/or (2) species for which there are occurrences documented by CNDDB, generally within a 5-mile radius. The potential for occurrence of each species included on the list was evaluated based on the habitat requirements of each species relative to the conditions observed during the field surveys. Each species was evaluated for its potential to occur on or in the immediate vicinity of the Project components according to the following criteria:

- None: There is no suitable habitat present (i.e., habitats on the Project site are clearly unsuitable for the species requirements [e.g., foraging, breeding, cover, substrate, elevation hydrology, plant community, disturbance regime, etc.]). The species has no probability of occurrence.

TABLE 4.4-1 FOCUSED LIST OF SPECIAL-STATUS ANIMAL SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/CDFW	General Habitat	Potential To Be Impacted by the Modernization Project
INVERTEBRATES			
Branchinecta conservatio Conservancy fairy shrimp	FE/*	Endemic to the grasslands of the northern two-thirds of the Central Valley; found in large, turbid pools. Inhabit astatic pools located in swales formed by old, braided alluvium; filled by winter/spring rains, last until June.	None. No suitable vernal pool habitat is present within Refinery Process or Tank Farm areas.
Calicina diminua Marin blind harvestman	--/*	Known only from the type locality, Mount Burdell, Novato, Marin County. Known only from the type series. Serpentine endemic.	None. No suitable habitat is present within Refinery Process or Tank Farm areas.
Callophrys mossii bayensis San Bruno elfin butterfly	FE/--	Coastal, mountainous areas with grassy ground cover, mainly in the vicinity of San Bruno Mountain, San Mateo County. Colonies are located on steep, north-facing slopes within the fog belt. Larval host plant is *Sedum spathulifolium*.	None. No suitable habitat or host plants are present within Refinery Process or Tank Farm areas.
Cicindela hirticollis gravida Sandy Beach tiger beetle	--/*	Found in moist sand near the ocean.	None. No suitable habitat is present within Refinery Process or Tank Farm areas.
Danaus plexippus Monarch butterfly	Wintering sites protected by CDFW	Roosts located in wind-protected tree groves (eucalyptus, Monterey pine, cypress), with nectar and water sources nearby.	Moderate. Wintering roosts are found at the Richmond Field Site, approximately 3 miles southeast of the Project site and at Point Pinole Regional Shoreline, about 5 mile north of the Project site on the San Pablo Peninsula. Species has not been observed in the Project site. However, eucalyptus stands within Tank Farm margins provide potential roosting habitat.
Euphydrya seditha bayensis Bay checkerspot butterfly	FT/*	Shallow, serpentine-derived soils in native grasslands supporting larval host plants, dwarf plantain or purple owl's clover.	None. No suitable serpentine soils or larval host plants present within Refinery Process or Tank Farm areas.

TABLE 4.4-1 FOCUSED LIST OF SPECIAL-STATUS ANIMAL SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/CDFW	General Habitat	Potential To Be Impacted by the Modernization Project
Helminthoglypta nickliniana bridgesi Bridges' Coast Range shoulderband	--/*	Inhabits open hillsides of Alameda and Contra Costa Counties. Tends to colonize under tall grasses and weeds.	Low. May occur in areas of disturbed vegetation surrounding Tank Farm Area.
Lichnanthe ursina bumblebee scarab beetle	--/*	Coastal sand dunes from Sonoma County south to San Mateo County. Usually flies close to sand surface near the crest of the dunes.	None. No suitable coastal sand dune habitat is present within Refinery Process or Tank Farm areas.
Microcina leei Lee's micro-blind harvestman	--/*	Xeric habitats in the San Francisco Bay region. Found beneath sandstone rocks in open oak grassland.	None. No suitable sandstone rock outcrop habitat is present within the dense coast live oak-California bay woodlands surrounding the Tank Farm Area.
Microcina tiburona Tiburon micro-blind harvestman	--/*	Open hilly grassland habitat in areas of serpentine bedrock.	None. Serpentine outcrop habitat is not present within Refinery Process or Tank Farm areas.
Plebejus icarioides missionensis Mission blue butterfly	FE/*	Coastal chaparral and coastal grasslands dominate the vegetation type where colonies are found. Adults do not wander far from lupine, the larval food plant. Adults feed on golden aster, bluedicks, Ithuriel's spear, and coast buckwheat.	None. No suitable habitat or host plants are present within Refinery Process or Tank Farm areas.
Pomatiopsis binneyi Robust walker	--/*	Freshwater.	None. No freshwater aquatic habitats are present within the Refinery Process or Tank Farm areas.
Speyeria callippe callippe Callippe silverspot butterfly	FE/*	Restricted to the Northern Coastal scrub of the San Francisco Peninsula. Host plants are Johnny jump up and canary violet.	None. No suitable host plants were observed in the disturbed patches of Northern coastal scrub or revegetated areas surrounding the Tank Farm Area. Furthermore, disturbed site conditions would likely preclude the occurrence of this species.

TABLE 4.4-1 FOCUSED LIST OF SPECIAL-STATUS ANIMAL SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/CDFW	General Habitat	Potential To Be Impacted by the Modernization Project
Speyeria zerene myrtleae Myrtle's silverspot butterfly	FE/*	Restricted to the foggy, coastal dunes/hills of the Point Reyes Peninsula; extirpated from coastal San Mateo County. Larval food plant thought to be *Viola adunca.*	None. No suitable habitat is present within Refinery Process or Tank Farm areas. Larval food plant not present and the San Pablo Peninsula does not support foggy coastal dune habitat that characterizes type localities on the Point Reyes Peninsula.
Syncaris pacifica California freshwater shrimp	FE/--	Endemic to Marin, Napa, & Sonoma Counties. Found in low elevation, low gradient streams where riparian cover is moderate to heavy. Shallow pools away from main streamflow. Winter: undercut banks w/exposed roots. Summer: leafy branches touching water.	None. Not known from Contra Costa County and suitable habitat consisting of low gradient streams with riparian overstory is not present.
Talanites ubicki Ubick's gnaphosid spider	--/*	Known only from the type locality, Mount Burdell, Novato, Marin County. Serpentine endemic.	None. Project site is outside of the range of this species and suitable serpentine habitat is not present within the Refinery Process or Tank Farm areas.
AMPHIBIANS			
Ambystoma californiense California tiger salamander	FT/ST	Grasslands and open oak woodlands; necessary habitat components include ground squirrel or gopher burrows for underground retreats, and breeding ponds such as seasonal wetlands, vernal pools or slow-moving streams that do not support predatory fish or frog populations.	None. Suitable breeding habitat consisting of seasonal wetlands or vernal pools is not present within Refinery Process or Tank Farm areas.
Rana boylii Foothill yellow-legged frog	-- /CSC	Partially shaded, rocky streams at low to moderate elevations, in areas of chaparral, open woodland, and forest.	None. Project site is outside of documented range of this species and no suitable habitat is present.

TABLE 4.4-1 FOCUSED LIST OF SPECIAL-STATUS ANIMAL SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/CDFW	General Habitat	Potential To Be Impacted by the Modernization Project
Rana aurora draytonii California red-legged frog	FT/CSC	Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development.	Low. No suitable habitat in Refinery Process or Tank Farm areas; furthermore, suitable habitat lacking on San Pablo Peninsula.
REPTILES			
Emys marmorata Western pond turtle	--/CSC	Permanent or nearly permanent bodies of water with protected areas for basking, such as partially submerged rocks or logs, floating vegetation mats or open mud banks.	None. Suitable habitat does not occur within the Refinery Process or Tank Farm areas.
Masticophis lateralis euryxanthus Alameda whipsnake	FT/ST	Inhabits south-facing slopes and ravines where shrubs form a vegetative mosaic with oak trees and grasses. Restricted to the coast ranges between San Francisco Bay and Monterey.	None. Project site is outside the range of this species.
BIRDS			
Accipiter cooperi Cooper's hawk	*(nesting)	Woodland, chiefly of open, interrupted or marginal type. Nest sites mainly in riparian growths of deciduous trees, as in canyon bottoms on river flood-plains; also, live oaks.	Moderate. May occasionally fly over or forage over the site. Observed on San Pablo Peninsula (LSA, 2005). There is a remote possibility that this species may nest in coast live oak trees within the Tank Farm Area.
Aquila chrysaetos golden eagle	-- /Cwl/Cfp (nesting and wintering)	Generally open country, in prairies, arctic and alpine tundra, open wooded country, and barren areas, especially in hilly or mountainous regions. Nests on rock ledge of cliff or in large tree.	Low. May occasionally fly over or forage over the site, but no suitable nesting habitat consisting of large trees that could support a nest platform or cliffs is present along the shoreline area of Long Wharf or within Refinery Process or Tank Farm areas.
Ardea alba great egret	--/* (rookery site)	Variety of habitats, including marshes, tidal estuaries, lagoons, streams, lakes, and ponds. Nests primarily in tall trees near water.	None. No rookeries observed during field surveys. This species is present in coastal marsh complexes located to the east of the

TABLE 4.4-1 FOCUSED LIST OF SPECIAL-STATUS ANIMAL SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/CDFW	General Habitat	Potential To Be Impacted by the Modernization Project
			Project site, but suitable rookery habitat is not present along shoreline areas of Long Wharf or within Refinery Process or Tank Farm areas.
Ardea herodias great blue heron	--/* (rookery site)	Variety of habitats, including freshwater and brackish marshes, lakes, rivers, bays, lagoons, beaches, fields, and meadows. Nests commonly high in trees in swamps and forested areas.	None. No rookeries observed during field surveys. This species is present in coastal marsh complexes to the east of the Project site, but suitable rookery habitat is not present along the shoreline area of Long Wharf or within Refinery Process or Tank Farm areas.
Asio flammeus short-eared owl	--/ CSC (nesting)	Broad expanses of open land with low vegetation for nesting and foraging. Suitable habitats include such types as fresh and saltwater marshes, bogs, dunes, prairies, grassy plains, old fields, tundra, moorlands, river valleys, meadows, savanna, and open woodland. Roost by day on ground, on low open perch, under low shrub, or in conifer.	None. No nesting or foraging habitat present within Refinery Process or Tank Farm areas.
Athene cunicularia western burrowing owl	--/CSC (burrowing sites and some wintering sites)	Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports, nesting and roosting in burrow dug by a mammal or by owl (rarely).	Low. No suitable habitat observed in Refinery Process or Tank Farm areas. Ruderal vegetation in Tank Farm Area provides low quality foraging habitat and no burrows or ground squirrel activity was observed during the site visits.
Brachyramphus marmoratus marbled murrelet	FT/SE	Feeds near-shore; nests inland along coast from Eureka to Oregon border & from Half Moon Bay to Santa Cruz. Nests in old-growth redwood-dominated forests, up to 6 miles inland, often in Douglas-fir.	None. No suitable foraging or nesting habitat is present along the shoreline area near Long Wharf or within Refinery Process or Tank Farm areas.
Charadrius alexandrines nivosus western snowy plover	FT/CSC (nesting)	Breeds primarily above the high tide line on coastal beaches, sand spits, dune-backed beaches, sparsely vegetated dunes, beaches at creek and river mouths, and salt pans at	None. No suitable habitat available near Long Wharf or within Refinery Process or Tank Farm areas, consisting of sandy substrate, salt ponds or mud flats.

TABLE 4.4-1 FOCUSED LIST OF SPECIAL-STATUS ANIMAL SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/CDFW	General Habitat	Potential To Be Impacted by the Modernization Project
		lagoons and estuaries. In winter, found on many of the beaches used for nesting as well as on beaches where they do not nest, in man-made salt ponds, and on estuarine sand and mud flats.	
Circus cyaneus northern harrier	--/ CSC (wintering)	Marshes, meadows, grasslands, and cultivated fields. Nests on the ground, commonly near low shrubs, in tall weeds or reeds.	Low. Suitable nesting habitat consisting of abandoned fields, wet meadows, and coastal and inland marshes is not present near Long Wharf or within Refinery Process or Tank Farm areas. May occasionally forage over the Tank Farm Area.
Egretta hula snowy egret	--/* (rookery site)	Variety of habitats, including marshes, lakes, ponds, lagoons, and shallow coastal habitats. Nests in trees or shrubs or, in some areas, on ground or in marsh vegetation.	None. No rookeries were observed during field surveys. This species is present in coastal marsh complexes surrounding the eastern portion of the Project site, but the shoreline area of Long Wharf and the Refinery Process and Tank Farm areas do not support suitable rookery habitat
Elanus leucurus white-tailed kite	--/Cfp (nesting)	Savanna, open woodland, marshes, partially cleared lands and cultivated fields, mostly in lowland situations.	Moderate. This species has been documented from Wildcat Marsh. Coast live oak woodland, ruderal vegetation, and restored areas surrounding Tank Farm Area supports marginal nesting habitat. There is a possibility that this species could establish a nest prior to dome placement activities in the Tank Farm Area.
Geothlypis trichassinuosa saltmarsh common yellowthroat	--/CSC	Freshwater marshes, coastal swales, swampy riparian thickets, brackish marshes, salt marshes, and edges of disturbed weed fields and grasslands that border soggy habitats.	None. No suitable salt or brackish marsh habitat is present along the shoreline area of Long Wharf or within Refinery Process or Tank Farm areas.
Hydroprogne caspia	--/*	Nests on sandy or gravely beaches and shell banks in small colonies inland and along the	None. May occasionally fly over the Project site and Long Wharf, but no suitable near shore

TABLE 4.4-1 FOCUSED LIST OF SPECIAL-STATUS ANIMAL SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/CDFW	General Habitat	Potential To Be Impacted by the Modernization Project
Caspian tern		coast. Inland fresh-water lakes and marshes; also, brackish or salt waters of estuaries and bays.	nesting habitat is present along the shoreline area of Long Wharf or within Refinery Process or Tank Farm areas.
Laterallus jamaicensis coturniculus California black rail	--/ST Cfp	Marshlands with unrestricted tidal influence (estuarine, intertidal, emergent, regularly flooded). Prefers areas dominated by pickleweed, bulrushes, matted salt grass, and other marsh vegetation. Nests and forages in tidal emergent wetland with pickleweed.	None. Recorded from east of Project site in Wildcat Marsh, located over 1 mile from Project components. No tidally influenced marshland is present along the shoreline areas near Long Wharf or within Refinery Process or Tank Farm areas.
Lanius ludovicianus loggerhead shrike	--/CSC	Nests in shrublands and forages in open grasslands.	Moderate. Degraded scrub and ruderal habitats surrounding Tank Farm Area provide marginally adequate nesting/foraging habitat.
Melospiza melodia maxillaris Suisun song sparrow	--/CSC	Resident of brackish-water marshes surrounding Suisun bay. Inhabits cattails, tules and other sedges, and pickleweed; also known to frequent tangles bordering sloughs.	None. No brackish marsh habitat is present along the shoreline areas surrounding Long Wharf or within Refinery Process or Tank Farm areas. Distribution restricted to Suisun Marsh from the Carquinez Strait east to the Sacramento and San Joaquin Rivers near Antioch (Shuford and Gardali, 2008)
Melospiza melodia pusillula Alameda song sparrow	--/CSC	Resident of salt marshes bordering south arm of the San Francisco Bay (CNM, 2012). Requires dense vegetation for nesting, perches, and cover from predators.	None. No salt marsh habitat is present along the shoreline areas near Long Wharf or within Refinery Process or Tank Farm areas. May occur over 1 mile from Project components in Wildcat Marsh, located east of the Project site.
Melospiza melodias amuelis San Pablo song sparrow	--/ CSC	Resident of salt marshes bordering the north side of the San Francisco and San Pablo Bays. Requires dense vegetation for nesting, perches, and cover from predators.	None. Documented occurrences east of Project site in Wildcat Marsh, but no salt marsh habitat is present along the shoreline areas surrounding Long Wharf or within Refinery Process or Tank Farm areas.

TABLE 4.4-1 FOCUSED LIST OF SPECIAL-STATUS ANIMAL SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/CDFW	General Habitat	Potential To Be Impacted by the Modernization Project
Nycticorax nycticorax black-crowned night heron	--/* (rookery site)	Variety of habitats, including fresh and saltwater marshes, swamps, streams, lakes, and ponds. Nests in groves of trees near water.	Low. Recorded east of Project site in Wildcat Marsh. However, no suitable marsh habitat is present along the shoreline areas surrounding of Long Wharf or within Refinery Process or Tank Farm areas.
Pandion haliaetus Osprey	--/Cwl	Ocean shore, bays, fresh-water lakes, and larger streams. Large nests built in tree-tops within 15 miles of a good fish-producing body of water.	Low. May occasionally fly over or forage over the site, but no suitable nesting habitat consisting of large trees that could support a nest platform are present within Refinery Process or Tank Farm areas. Furthermore, Refinery Operations between Project components and habitat are intensive enough to effectively exclude potential for nesting the Tank Farm Area.
Riparia riparia Bank swallow	ST (nesting)	Open and partly open habitats, frequently near flowing water. Nests in steep sand, dirt, or gravel banks, in a burrow dug near the top of the bank, along the edge of inland water or along the coast, or in gravel pits or road embankments.	None. Suitable nesting habitat not present within Refinery Process or Tank Farm areas.
Sternula antillarum browni California least tern	FE/SE Cfp (nesting colony)	Bays and lagoons, nesting on the adjacent open sandy beaches, dunes, or disturbed sites. Nesting is limited to colonies in the San Francisco Bay, Sacramento River delta, and areas along the coast from San Luis Obispo County to San Diego County.	None. Sandy beaches or dunes habitat not present within Refinery Process or Tank Farm areas.
Strix occidentalis caurina Northern spotted owl	FT/CSC	Old-growth forests or mixed stands of old-growth & mature trees. Occasionally in younger forests w/patches of big trees. High, multistory canopy dominated by big trees, many trees with cavities or broken tops,	None. No suitable old growth forest habitat is present within Refinery Process or Tank Farm areas.

TABLE 4.4-1 FOCUSED LIST OF SPECIAL-STATUS ANIMAL SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/CDFW	General Habitat	Potential To Be Impacted by the Modernization Project
		woody debris, and space under canopy.	
Xanthocephalus xanthocephalus yellow-headed blackbird	--/CSC	Nests in freshwater emergent wetlands with dense vegetation and deep water. Often along borders of lakes or ponds. Nests only where large insects such as *Odonata* spp. are abundant, nesting timed with maximum emergence of aquatic insects.	None. No suitable freshwater emergent wetlands within Refinery Process or Tank Farm areas.
MAMMALS			
Antrozous pallidus pallid bat	--/CSC	Arid deserts and grasslands, often near rocky outcrops and water. Usually roosts in rock crevice or building, less often in cave, tree hollow, mine, etc. Prefers narrow crevices in caves as hibernation sites. In northern California, this species is associated with oak habitat, particularly lower elevation oak savannah. It is also found in association with coast redwoods, and mid- to higher elevation coniferous forest (Pierson and Rainey 1998a)	Moderate. Possible roost habitat in oak woodlands within Tank Farm Area.
Corynorhinus townsendi townsendi Townsend's western big-eared bat	--/CSC	Various habitats; roosting sites include buildings and other man-made structures and trees. Commonly occurs in mesic habitats characterized by coniferous and deciduous forest, but occupies a broad range of habitats. Maternity and hibernation colonies generally are in caves and mine tunnels.	Moderate. Some trees along periphery of Tank Farm may provide potential roost sites.
Lasionycteris noctivagans silver-haired bat	--/CSC	Primarily a coastal & montane forest dweller feeding over streams, ponds & open brushy areas. Roosts in hollow trees, beneath	Moderate. Mature trees surrounding the tanks in the southern portion of the Tank Farm may provide suitable roost habitat.

TABLE 4.4-1 FOCUSED LIST OF SPECIAL-STATUS ANIMAL SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/CDFW	General Habitat	Potential To Be Impacted by the Modernization Project
		exfoliating bark, abandoned woodpecker holes & rarely under rocks. Needs drinking water.	
Lasiurus blossevillii western red bat	--/CSC	Roost primarily in the foliage of trees or shrubs.	Moderate. Mature trees and scrub habitats surrounding the tanks in the southern and central portion of the Tank Farm may provide suitable roost habitat.
Lasiurus cinereus hoary bat	--/*	Associated with forested habitats.	Moderate. Mature trees surrounding the tanks in the southern portion of the Tank Farm Area may provide suitable roost habitat.
Microtus californicus sanpabloensis San Pablo vole	--/CSC	Salt marshes of San Pablo Creek on the south shore of San Pablo Bay. Requires soft soils for burrow construction.	None. Suitable salt marsh habitat is not present along the shoreline areas surrounding Long Wharf or within Refinery Process or Tank Farm areas. Recorded from Wildcat Marsh, located east of the Project site.
Nyctinomops macrotis big free-tailed bat	-- /CSC	Low-lying arid areas in Southern California. Need high cliffs or rocky outcrops for roosting sites. Feeds principally on large moths (Pierson and Rainey 1998).	None. Suitable roost habitat not present within Refinery Process or Tank Farm areas.
Reithrodontomys raviventris salt marsh harvest mouse	FE/SE	Found only in the marshes of Corte Madera, Richmond, and South San Francisco Bay (Shellhammer 1989). Critically dependent on dense cover and preferred habitat is pickleweed. Seldom found in cordgrass or alkali bulrush.	None. Suitable salt marsh habitat is not present along the shoreline areas surrounding Long Wharf or within Refinery Process or Tank Farm areas. Recorded from Wildcat Marsh, located east of the Project site.
Sorex ornatus sinuosus Suisun shrew	--/CSC	Tidal marshes of the northern shores of San Pablo and Suisun bays. Require dense low-lying cover and driftweed and other litter above the mean high tide line for nesting and foraging. (Collins 1998b)	None. Suitable marsh habitat is not present within Refinery Process or Tank Farm areas. Recorded from Wildcat Marsh, located east of the Project site.
Sorexvagrans halicoetes salt marsh wandering shrew	--/CSC	Tidal salt marsh plains above cordgrass zone, moist, lower pickleweed-dominated marsh,	None. Refinery Process or Tank Farm areas do not contain suitable marsh habitat and are

TABLE 4.4-1 FOCUSED LIST OF SPECIAL-STATUS ANIMAL SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/CDFW	General Habitat	Potential To Be Impacted by the Modernization Project
		with abundant invertebrates, tidal debris, and flood escape habitat in the South San Francisco Bay.	located over 1 mile form recorded occurrences at Wildcat Marsh, located east of the Project site;
Taxidea taxus American badger	-- /CSC	Prefers open areas and may also frequent brushlands with little groundcover. Although may prefer habitats with more friable soils for digging burrows, which are used for dens, escape, and predation, the hard-baked earth in the middle of an unpaved road is no obstacle. When inactive, occupies underground burrows that are elliptical shaped and eight or more inches in diameter.	Low. No suitable badger burrow habitat was observed within Refinery Process or Tank Farm areas. Ongoing Refinery Operations are intensive enough to effectively exclude potential for occurrence within the scrub and grassland areas surrounding Tank Farm.
Zapus trinotatus orarius Point Reyes jumping mouse	--/CSC	Primarily found in bunchgrass marshes on the uplands of Point Reyes. Also, found in coastal scrub, grassland, and meadow habitats. (Linzey and Hammerson, 2008)	None. Project site is outside of the documented range of this species and no suitable habitat is present within Refinery Process or Tank Farm areas.

Federal Categories (USFWS):
FE = Federally listed Endangered
FT = Federally listed Threatened
FC = Candidate to be Proposed for Federal Listing
FD = Delisted by the Federal Government

State Categories (CDFW):
SE = Listed as Endangered by the State of California
ST = Listed as Threatened by the State of California
SD = State Delisted
CSC = California Species of Special Concern
Cfp= California Fully Protected species
Cwl = California Watch List

Notes:
* = California Special Animal (species with no official federal or state status, but are included on the CDFW's Special Animal List due to limited distribution).
(nesting and/or wintering) = For most taxa, the CNDDB is interested in information that indicates the presence of a resident population. For some species (primarily birds), the CNDDB only tracks certain parts of the species range or life history (e.g., nesting locations).
Sources: CDFW, 2013; CNPS, 2014; CNM, 2013; Collins, 1998a, 1998b; IUCN Redlist, 2012; Linzey and Hammerson, 2008; LSA, 2005, 2009; NatureServe, 2012; NOAA Fisheries, 2014a, 2014b; Pierson and Rainey, 1998a, 1998b, 1998c, 1998d; Shellhammer, 1989; Shuford and Gardali, 2008; SLC, 2007; USFWS, 2013.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Plant			
Amorpha californica Napa false indigo	--/--/List 1B.2	Broadleaved upland forest (openings), Chaparral, Cismontane woodland. 120-2000 m. Blooms April-July.	None. Limited suitable habitat present surrounding Tank Farm Area and species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Amsinckia lunaris Bent-flowered fiddleneck	--/--/List 1B.2	Cismontane woodland, valley and foothill grassland. 50-500 m. Blooms March-June.	None. Limited suitable habitat present surrounding Tank Farm Area and species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Arctostaphylos franciscana Franciscan manzanita	--/--/List 1B.1	Serpentine outcrops in chaparral. 60-300 m. Blooms February-April.	None. No members of the *Arctostaphylos* genus were observed during focused surveys conducted during Spring 2012 and no serpentine outcrops are present.
Arctostaphylos hookeri ssp. *ravenii* Presidio manzanita	FE/SE/List 1B.1	Chaparral, coastal prairie, coastal scrub/serpentine outcrop. Blooms February – March.	None. No members of the *Arctostaphylos* genus were observed during focused surveys conducted during Spring 2012 and no serpentine outcrops are present.
Arctostaphylos montana ssp. *montana* Mt. Tamalpais manzanita	--/--/List 1B.3	Chaparral and valley and foothill grassland; associated with serpentine slopes. 160-760 m. Blooms February-March.	None. No members of the *Arctostaphylos* genus were observed during focused surveys conducted during Spring 2012 and no serpentine soils are present.
Arctostaphylos pallida pallid manzanita	FT/SE/List /1B.1	Broadleaved upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, coastal scrub. Grows on uplifted marine terraces on siliceous shale or thin chert. May require fire for reproduction. 185-465 m. Blooms December-March.	None. No members of the *Arctostaphylos* genus were observed during focused surveys conducted during Spring 2012.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Arctostaphylos virgata Marin manzanita	--/--/List 1B.2	Broadleaved upland forest, Closed-cone coniferous forest, Chaparral, North Coast coniferous forest/sandstone or granitic. 60-700 ft. Blooms January-March.	None. No members of the *Arctostaphylos* genus were observed during focused surveys conducted during Spring 2012.
Arenaria paludicola marsh sandwort	FE/SE/List 1B.1	Openings in sandy marshes and freshwater and brackish swamps. Growing up through dense mats of *Typha, Juncus, Scirpus,* etc. In freshwater marsh. 10-170 m. Blooms May-August.	None. Species not observed during focused surveys conducted in Summer 2012 during peak blooming period.
Astragalus tener var. *tener* alkali milk-vetch	--/--/List 1B.2	Alkali playa, valley and foothill grassland, vernal pools. Low ground, alkali flats, and flooded lands; in annual grassland or in playas or vernal pools. 1-170 m. Blooms March-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period. No suitable vernal pool habitat present.
Atriplex joaquiniana San Joaquin spearscale	--/--/List 1B.2	Chenopod scrub, alkali meadow, valley and foothill grassland. In seasonal alkali wetlands or alkali sink scrub with *Distichlis spicata*, *Frankenia*, etc. 1-250 m. Blooms April-October.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period and no alkali sink scrub habitat is present.
California macrophylla round-leaved filaree	--/--/List 1B.1	Cismontane woodland, valley and foothill grassland. Clay soils. 15-1200 m. Blooms March-May.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Calochortus tiburonensis Tiburon mariposa lily	FT/ST/List 1B.1	Valley and foothill grasslands; on open, rocky, slopes in serpentine grassland. 50-150 m. Blooms March-June.	None. No serpentine grassland present. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Calystegia purpurata ssp. *saxicola* coastal bluff morning-glory	--/--/List 1B.2	Coastal dunes, Coastal scrub, North Coast coniferous forest. 10-105 m. Blooms May-September.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Carex comosa bristly sedge	--/--/ List 2.1	Margins of marshes and swamps. -5-1005 m. Blooms May-September.	None. Species not observed during focused surveys conducted in Summer 2012 during peak blooming period.
Castilleja affinis ssp. *neglecta* Tiburon paintbrush	FE/ST/List 1B.2	Valley and foothill grassland; associated with rocky serpentinite soils. 75-400 m. Blooms April-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period and no serpentine soils are present.
Centromadia parryi ssp. *congdonii* Congdon's tarplant	--/--/List 1B.2	Valley and foothill grassland. Alkaline soils, sometimes described as heavy white clay. 1-230 m. Blooms May-October.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Chloropyron maritimum ssp. *palustre* Point Reyes bird's-beak	--/--/List 1B.2	Coastal salt marshes and swamps usually with *Salicornia, Distichlis, Jaumea, Spartina*, etc. 0-15 m. Blooms June-October.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Chloropyron molle ssp. *molle* soft bird's-beak	FE/SR/List 1B.2	Coastal salt marsh. In coastal salt marsh with *Distichlis, Salicornia, Frankenia,* etc. 0-3m. Blooms July-November.	None. Species not observed during focused surveys conducted during Summer 2012 in potentially suitable coastal salt marsh habitat.
Chorizanthe cuspidata var. *cuspidata* San Francisco Bay spineflower	--/--/List 1B.2	Coastal bluff scrub, coastal dunes, coastal prairie, and coastal scrub; associated with sandy soils on terraces and slopes. 5-550M. Blooms April-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Chorizanthe robusta var. *robusta* robust spineflower	FE/--/List 1B.1	Cismontane woodland, coastal dunes, coastal scrub. Sandy terraces and bluffs or in loose sand. 3-120m. Blooms April-September.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Chorizanthe valida Sonoma spineflower	FE/SE/List 1B.1	Coastal prairie (sandy). 10-305 m. Blooms June-August.	None. Species not observed during focused surveys conducted in Summer 2012 during peak blooming period.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Cirsium andrewsii Franciscan thistle	--/--/List 1B.2	Broadleaved upland forest, coastal bluff scrub, coastal prairie, and coastal scrub; associated with mesic, and sometimes serpentinite, soils. 0-135 m. Blooms March-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Cirsium hydrophilum var. *vaseyi* Mt. Tamalpais thistle	--/--/List 1B.2	Broadleaved upland forest, Chaparral, Meadows and seeps/serpentinite seeps. 240-620 m. Blooms May-August.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Clarkia franciscana Presidio clarkia	FE/ SE/List 1B.1	Coastal scrub valley and foothill grassland on serpentine outcrops. 20-335 m. Blooms May-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Collinsia corymbosa round-headed Chinese-houses	--/--/List 1B.2	Coastal dunes and coastal prairie. 10-30 m. Blooms April-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Collinsia multicolor San Francisco collinsia	--/--/List 1B.2	Closed-cone coniferous forest and coastal scrub ON decomposed shale (mudstone) mixed with humus. 30-250 m. Blooms March-May.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Dirca occidentalis Western leatherwood	--/--/List 1B.2	Broadleaved upland forest, chaparral, closed-cone coniferous forest, cismontane woodland, north coast coniferous forest, riparian forest, and riparian woodland. On brushy slopes, mesic sites; mostly in mixed evergreen & foothill woodland communities. 30-550m. Blooms January-March.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Eriogonum luteolum var. *caninum* Tiburon buckwheat	--/--/List 1B.2	Chaparral, cismontane woodland, coastal prairie, and valley and foothill grassland; associated with serpentine soils, on sandy to gravelly sites. 0-700 m. Blooms May-September.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Fissidens pauperculus minute pocket moss	--/--/List 1B.2	North Coast coniferous forest (damp coastal soil). 10-1024 m.	None. No suitable habitat and species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Fritillaria lanceolata var. *tristulis* Marin checker lily	--/--/List 1B.1	Coastal bluff scrub, Coastal prairie, Coastal scrub. 15-150 m. Blooms February-May.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Fritillaria liliacea Fragrant fritillary	--/--/List 1B.2	Coastal scrub, valley and foothill grassland, coastal prairie. Often on serpentine; various soils reported though usually clay, in grassland. 3-410m. Blooms February-April	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Gilia capitata ssp. *chamissonis* blue coast gilia	--/--/List 1B.1	Coastal dunes and coastal scrub. 2-200 m. Blooms April-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Gilia capitata ssp. *tomentosa* woolly-headed gilia	--/--/List 1B.1	Coastal bluff scrub, Valley and foothill grassland/ serpentinite, rocky, outcrops. 10-200 m. Blooms May-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Gilia millefoliata dark-eyed gilia	--/--/List 1B.2	Coastal dunes. 2-20 m. Blooms April-July.	None. No coastal dune habitat present and species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Grindelia hirsutula var. *maritima* San Francisco gumplant	--/--/List 3.2	Coastal bluff scrub, coastal scrub, and valley and foothill grassland; associated with sandy or serpentinite slopes, seas bluffs. 15-400 m. Blooms June-September.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Helianthella castanea Diablo helianthella	--/--/List 1B.2	Broadleaved upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, and valley and foothill grassland. 25-1150M. Blooms March-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Hemizonia congesta ssp. *congesta* white seaside tarplant	--/--/List 1B.2	Coastal scrub, valley and foothill grassland. Grassy valleys and hills, often in fallow fields. 25-200m. Blooms April-November.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Hesperolinon congestum Marin western flax	FT/ST/List 1B.1	Chaparral and valley and foothill grassland; associated with serpentinite soils. 30-365 m. Blooms April-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period and no serpentine soils are present.
Hoita strobilina Loma Prieta hoita	--/--/List 1B.1	Chaparral, cismontane woodland, riparian woodland. Serpentine; mesic sites. 30-860 m. Blooms May-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Holocarpha macradenia Santa Cruz tarplant	FT/ SE/List 1B.1	Coastal prairie, coastal scrub, and valley and foothill grassland. Light, sandy soil or sandy clay; often with non-natives. 10-260m. Blooms June-October.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Horkelia cuneata ssp. *sericea* Kellogg's horkelia	--/--/List 1B.1	Closed-cone coniferous forest, maritime chaparral, coastal dunes, and coastal scrub; associated with old dunes, coastal sand hills, openings. 10-200 m. Blooms April-September.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Horkelia tenuiloba thin-lobed horkelia	--/--/List 1B.2	Broadleaved upland forest, Chaparral, Valley and foothill grassland/mesic openings, sandy. 50-500 m. Blooms May-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Isocoma arguta Carquinez goldenbush	--/--/List 1B.1	Valley and foothill grassland. Alkaline soils, flats, lower hills. On low benches near drainages & on tops & sides of mounds in swale habitat. 1-20m. Blooms August-December	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Kopsiopsis hookeri small groundcone	--/--/List 2.3	North Coast coniferous forest. 90-885. Fertile April-August.	None. No suitable habitat and species not observed during focused surveys conducted in Spring 2012 during fertile period.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Lasthenia congugens Contra Costa goldfields	FE/--/List 1B.1	Valley and foothill grassland, vernal pools, cismontane woodland. Extirpated from most of its range; extremely Endangered. Vernal pools, swales, low depressions, in open grassy areas. 1-445m. Blooms April-May.	None. No suitable vernal pool habitat present and species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Lathyrus jepsonii var. *jepsonii* Delta tule pea	--/--/List 1B.2	Freshwater and brackish marshes. Often found w/ *Typha, Aster lentus, Rosa californica, Juncus* spp., *Scirpus*, etc. Usually on marsh and slough edges. 0-4 m. Blooms May-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period. Long Wharf EIR indicates a known occurrence in San Francisco Bay in Montezuma Slough, approx. 20 miles northeast from Project site.
Layia carnosa beach layia	FE/SE/List 1B.1	Coastal dunes on sparsely vegetated, semi-stabilized dunes, usually behind foredunes. Hugely reduced in range along California's north coast dunes. 0-75m. Blooms March-July.	None. No suitable coastal dune habitat present and species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Leptosiphon rosaceus rose leptosiphon	--/--/List 1B.1	Coastal bluff scrub. 0-100 m. Blooms April-July. Blooms March-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Lessingia germanorum San Francisco lessingia	FE/SE/List 1B.1	Coastal scrub; associated with remnant dunes. Open sandy soils relatively free of competing plants. 20-125m. Blooms July-November.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Lessingia hololeuca woolly-headed lessingia	--/--/List 3	Broadleaved upland forest, coastal scrub, lower montane coniferous forest, and valley and foothill grassland; associated with clay and serpentinite soils. 15-305 m June-October	None. Species not observed during focused surveys conducted in Summer 2012 during peak blooming period.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Lessingia micradenia var. *micradenia* Tamalpais lessingia	--/--/List 1B.2	Chaparral, Valley and foothill grassland/usually serpentinite, often roadsides. 100-500 m. Blooms (June) July-October.	None. Species not observed during focused surveys conducted in Summer 2012 during peak blooming period.
Lilaeopsis masonii Mason's lilaeopsis	--/SR/List 1B.1	Freshwater and brackish marshes, riparian scrub. Tidal zones, in muddy or silty soil formed through river deposition or river bank erosion. 0-10 m. Blooms April-November.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Meconella oregana Oregon meconella	--/--/List 1B.1	Coastal prairie, coastal scrub. Open, moist places. 250-500 m. Blooms March-April.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Micropus amphibolus Mt. Diablo cottonweed	--/--/List 3.2	Broadleaved upland forest, chaparral, cismontane woodland, and valley and foothill grassland; associated with rocky soils. 45-825 m. Blooms March-May.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Microseris paludosa marsh microseris	--/--/List 1B.2	Closed-cone coniferous forest, cismontane woodland, coastal scrub, and valley and foothill grassland. 5-300 m. Blooms April-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Navarretia leucocephala ssp. *bakeri* Baker's navarretia	--/--/List 1B.1	Cismontane woodland, Lower montane coniferous forest, Meadows and seeps, Valley and foothill grassland, Vernal pools/mesic. 5-1740 m. Blooms April-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Navarretia rosulata Marin County navarretia	--/--/List 1B.2	Closed-cone coniferous forest, Chaparral/ serpentinite, rocky. 200-635 m. Blooms May-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Pentachaeta bellidiflora white-rayed pentachaeta	FE/SE/List 1B.1	Cismontane woodland and valley and foothill grassland. Often associated with serpentinite soils. 35-620 m. Blooms March-May.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Plagiobothrys chorisianus var. *chorisianus* Choris' popcorn-flower	--/--/List 1B.2	Mesic chaparral, coastal prairie, and coastal scrub. 15-160 m. Blooms March-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Plagiobothrys diffusus San Francisco popcorn-flower	--/SE/List 1B.1	Coastal prairie and valley and foothill grassland. Historically from grassy slopes with marine influence. 60-485M. Blooms March-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Plagiobothrys glaber hairless popcorn-flower	--/--/List 1A	Alkaline meadows and seeps and coastal salt marshes and swamps. 15-180 m. Blooms March-May.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period within potentially suitable coastal salt marsh habitat.
Pleuropogon hooverianus North Coast semaphore grass	--/ST/List 1B.1	Broadleaved upland forest, Meadows and seeps, North Coast coniferous forest/open areas, mesic. 10-671. Blooms April-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Polemonium carneum Oregon polemonium	--/--/List 2.2	Coastal prairie, coastal scrub, and lower montane coniferous forest. 0-1,830 m. Blooms April-September.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Polygonum marinense Marin knotweed	--/--/List 3.1	Coastal salt or brackish marshes and swamps. 0-10 m. Blooms (April) May-August (October).	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Quercus parvula var. *tamalpaisensis* Tamalpais oak	--/--/List 1B.3	Lower montane coniferous forest. 100-750. Blooms March-April.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Sanicula maritima adobe sanicle	--/SR/ List 1B.1	Chaparral, coastal prairie, meadows and seeps, and valley and foothill grassland; associated with clay and ultramafic soils. 30-240 m. Blooms February-May.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Senecio aphanactis chaparral ragwort	--/--/List 2.2	Cismontane woodland, coastal scrub. Drying alkaline flats. 20-575 m. Blooms January-April.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Sidalcea calycosa ssp. *rhizomata* Point Reyes checkerbloom	--/--/List 1B.2	Marshes and swamps (freshwater, near coast). 3-75 m. Blooms April-September.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Sidalcea hickmanii ssp. *viridis* Marin checkerbloom	--/--/List 1B.3	Chaparral. Serpentine or volcanic soils; sometimes appears after burns. 0-430m. Blooms May-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Silene verecunda ssp. *verecunda* San Francisco campion	--/--/List 1B.2	Coastal bluff scrub, chaparral, coastal prairie, coastal scrub, and valley and foothill grassland; associated with sandy soils, one site on serpentine. 30-645 m. Blooms March-June (August).	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Stebbinsoseris decipiens Santa Cruz microseris	--/--/List 1B.2	Broadleaved upland forest, closed-cone coniferous forest, chaparral, coastal prairie, coastal scrub, and valley and foothill grassland; associated with open areas in loose or disturbed soil, usually derived from sandstone, shale or serpentine, on seaward slopes. 10-500 m. Blooms April-May.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Streptanthus albidus ssp. *peramoenus* most beautiful jewel-flower	--/--/List 1B.2	Chaparral, valley and foothill grassland, cismontane woodland. Serpentine outcrops, on ridges and slopes. 120-730m. Blooms April-September.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Streptanthus batrachopus Tamalpais jewel-flower	--/--/List 1B.3	Closed-cone coniferous forest, Chaparral/ serpentinite. 305-650 m. Blooms April-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Streptanthus glandulosus ssp. *niger* Tiburon jewel-flower	FE/SE/List 1B.1	Valley and foothill grassland; associated with shallow, rocky, serpentinite soils. 30-150 m. Blooms May-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Streptanthus glandulosus ssp. *pulchellus* Mount Tamalpais bristly jewel-flower	--/--/List 1B.2	Chaparral, Valley and foothill grassland/serpentinite. 150-800 m. Blooms May-July.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Suaeda californica California seablite	FE/--/List 1B.1	Marshes and swamps. Margins of coastal salt marshes. 0-5 m. Blooms July-October.	None. Species not observed during focused surveys conducted in Summer 2012 during peak blooming period and suitable coastal salt marsh habitat not present.
Symphyotrichum lentum Suisun Marsh aster	--/--/List 1B.2	Brackish and freshwater marshes and swamps. Most often seen along sloughs with *phragmites, scirpus, blackberry, typha*, etc. 0-3 m. Blooms May-November.	None. Species not observed during focused surveys conducted in Summer 2012 during peak blooming period.
Trifolium amoenum showy rancheria clover	FE/--/List 1B.1	Coastal bluff scrub and valley and foothill grassland. Sometimes associated with serpentinite soils. 5-415 m. Blooms April-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Trifolium hydrophilum saline clover	--/--/List 1B.2	Marshes and swamps, valley and foothill grassland, vernal pools. Mesic, alkaline sites. 0-300 m. Blooms April-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Triphysaria floribunda San Francisco owl's-clover	--/--/List 1B.2	Coastal prairie, coastal scrub, and valley and foothill grassland. Can occur on serpentine and non-serpentine substrate (such as at Pt. Reyes). 10-160 m. Blooms April-June.	None. Species not observed during focused surveys conducted in Spring 2012 during peak blooming period.
Triquetrella californica coastal triquetrella (moss)	--/--/List 1B.2	Coastal bluff scrub, coastal scrub, and valley and foothill grasslands. Grows within 30m from the coast in coastal scrub, grasslands and in open gravels on roadsides, hillsides, rocky slopes. 10-100 m	None. Species not observed during focused surveys conducted in Spring 2012.

TABLE 4.4-2 FOCUSED LIST OF SPECIAL-STATUS PLANT SPECIES WITH POTENTIAL TO OCCUR WITHIN MODERNIZATION PROJECT AREA (REFINERY PROCESS AREA AND TANK FARM AREA)

Scientific Name Common Name	Listing Status USFWS/ CDFW/CNPS	General Habitat	Potential To Occur
Sensitive Plant Communities			
Coastal brackish marsh	*		None. Not found in Refinery Process or Tank Farm areas.
Coastal terrace prairie	*		None. Not found in Refinery Process or Tank Farm areas.
Northern coastal salt marsh	*		None. Not found in Refinery Process or Tank Farm areas
Northern maritime chaparral	*		None. Not found in Refinery Process or Tank Farm areas.
Serpentine bunchgrass	*		None. Not found in Refinery Process or Tank Farm areas.
Valley needle grassland	*		None. Not found in Refinery Process or Tank Farm areas.

STATUS KEY:

Federal
FE: Federally listed Endangered
FT: Federally listed Threatened

State
SE: California-listed Endangered
ST: California-listed Threatened
SR: California-listed Rare

CNPS
List 1A: Plants presumed extinct in California.
List 1B: Plants rare and endangered in California and elsewhere.
List 2: Plants rare and endangered in California, but more common elsewhere.
List 3: Taxa about which more information is needed.
List 4: Plants of limited distribution.

Sources: ENVIRON, 2013.

- Low: Limited suitable habitat is present (i.e., few of the habitat components meeting the species requirements are present and/or the majority of habitat is unsuitable or of very low quality). Additionally, there are no or few recent known records of occurrence in the vicinity of the Project site. The species has a low probability of occurrence.
- Moderate. Suitable habitat is present (i.e., some of the habitat components meeting the species requirements are present and/or the majority of the habitat on the Project site is suitable). Additionally, there are few or many recent known records of occurrences in the vicinity. The species has a moderate probability of occurrence.
- High: Highly suitable habitat is present (i.e., all habitat components meeting the species requirements are present and/or all of the habitat is highly suitable or of high quality). Additionally, there are few or many recent known records of occurrences in the immediate vicinity (generally less than 1 mile). This species has a high probability of occurrence.
- Present. Species is confirmed to be present (i.e., species was either observed during recent surveys or has a recorded observation in the CNDDB).

4.4.2.2.2.1 *Special-Status Plants and Wildlife*

A majority of special-status plant and wildlife species documented in the vicinity of the Project site are not likely to occur within the Refinery Process or Tank Farm areas. These determinations were based on: (1) a review of the on-site plant communities in relation to the species' specific habitat requirements; (2) recorded regional occurrence information and published species' ranges; (3) an assessment of the on-site conditions and disturbance, topography, elevation, soils, and surrounding land uses; and 4) review of the Long Wharf EIR (SLC, 2007).

4.4.2.2.2.2 *Special-Status Wildlife Species*

Based on the initial database and background research, 90 wildlife species have been documented in the vicinity of the Project site, which includes 16 invertebrate, 3 amphibian, 2 reptile, 24 bird, and 12 mammal species. Of these species, 48 have "no" or "low" potential to occur due to the absence of essential habitat requirements for the species, the distance to known occurrences and/or the species distributional range, the limited availability of foraging and nesting habitat, and amount of site disturbance from past and present Refinery Operations. None of these species would be affected by the Modernization Project and are not considered in further detail.

The remaining 23 species are considered to have a "moderate" potential for occurrence and include 1 invertebrate, 5 bat, and 3 bird species in the Tank Farm Area. These species are discussed in further detail below.

4.4.2.2.2.2.1 *Invertebrates*

4.4.2.2.2.2.1.1 *Monarch Butterfly (Danaus plexippus)*

The Monarch butterfly is listed by the CNDDB as a sensitive species due to its restricted range in California and rare wintering sites. These orange and black butterflies make massive migrations from August-October, flying thousands of miles south to winter along the California coast and in central Mexico. Along the way, monarchs stop to feed on flower nectar and to roost together at night and can be found in many open habitats including fields, meadows, weedy areas, marshes, and roadsides. Every fall, the monarch flies to the same overwintering sites and frequently to the same trees. At wintering sites, these butterflies roost in trees and form huge aggregations that may have thousands to millions of individuals. In California, these sites are primarily eucalyptus, Monterey pine, or Monterey cypress groves and the butterfly winters at these sites from approximately September through March. According to the CNDDB, the nearest documented monarch winter roost site occurs approximately 3 miles southeast of the Project site at U.C. Berkeley's off-site Richmond Field Station, an engineering research facility located southwest of I-580 (CDFW, 2013). Roost habitat consists of numerous large windrows of eucalyptus in a south-facing, sheltered area, which can be found in the Tank Farm margins. An additional winter roost site has been documented by CNDDB approximately 5 miles north of the Project site within the Point Pinole Regional Shoreline, occurring within a densely planted grove of eucalyptus, that provides the only "permanent and predictable" (forming nearly every year) site in the San Francisco Bay Area (CDFW, 2013). No Monarch butterflies have been observed in the Project site.

4.4.2.2.2.2.2 *Birds*

4.4.2.2.2.2.2.1 *White-tailed kite (Elanus leucurus)*

White-tailed kite is a CDFW Fully Protected Species, meaning that it may not be "taken" or possessed (i.e., kept in captivity) at any time. White-tailed kite occurs in low elevation grassland, agricultural, wetland, riparian zones, and oak woodland and savannah habitats. Nesting by white-tailed kites in California has been reported for the months February through August with peak activity seen in March, April, and May. Preferred nesting habitats are best described as oak woodlands or trees along marsh edges. However, white-tailed kites have been reported to use any suitable tree that is of moderate height, such as eucalyptus, cottonwoods, toyon, and even coyote brush with the nests placed near the tops of these shrubs or trees. Kites primarily feed on small mammals, although, birds,

reptiles, amphibians, and insects are also taken (Dunk, 1995). White-tailed kite has a moderate potential to nest in tree- and shrub-dominated habitats such as coast live oak woodland, Northern coastal scrub, and well-established revegetated areas within the Tank Farm Area.

4.4.2.2.2.2.2.2 *Other Protected Nesting Birds*

Vegetation surrounding the Tank Farm Area supports marginally suitable nesting habitat for some raptors and songbirds that are adapted to current levels of site disturbance from ongoing Refinery Operations. Although no active nests were observed during the field surveys, there is potential for ground-, tree-, and shrub-nesting songbirds (e.g., loggerhead shrike) to establish nests prior to placement of storage tank domes. In addition, there is a possibility that raptor species could establish nests in trees surrounding the Tank Farm Area, including (but not limited to) Red-tailed hawk (*Buteo jamaicensis*), Red-shouldered hawk (*Buteo lineatus*), Cooper's hawk (*Accipiter cooperi*), and American kestrel (*Falco sparverius*). These species are protected under the Federal Migratory Bird Treaty Act (MBTA) and would be protected under the California Fish and Game Code when actively nesting. Nesting season is January 1 through August 31.

4.4.2.2.2.2.3 *Mammals*

The following five bat species may utilize marginally suitable roost habitat in Coast live oak and Monterey Pine stands surrounding the Tank Farm Area.

4.4.2.2.2.2.3.1 *Pallid Bat (Antrozous pallidus)*

The pallid bat is a State species of concern that ranges from western Canada to central Mexico and occurs in open, dry habitats with rocky outcrops, cliffs, caverns, and crevices for roosting. It is most commonly found in deserts, grasslands, and shrublands, in addition to woodlands and forest. Some of this habitat exists within the Tank Farm Area and may provide suitable roosting habitat for this species. Pallid bats feed on insects, such as crickets and scorpions, and are capable of consuming up to half their weight in insects every night. Although they normally catch their prey on the ground, they usually transport their prey to their night roost for consumption.

4.4.2.2.2.2.3.2 *Townsend's Big-Eared Bat (Corynorhinus townsendii)*

This species is a State species of concern primarily found in rural settings in a wide variety of habitats including oak woodlands, mixed coniferous-deciduous forest, and other mesic habitats. It requires caves, mines, tunnels, buildings, or other human-made structures for roosting. Unused buildings and mature oak trees in adjacent oak woodland habitat within the Tank Farm Area may provide suitable roosting habitat for this species.

4.4.2.2.2.3.3 *Western Red Bat (Lasiurus blossevillii)*

Roosting habitat for Western red bat, a State species of concern, includes forests and woodlands from sea level up through mixed conifer forests. It feeds over a wide variety of habitats including grasslands, shrublands, open woodlands and forests, and croplands. It prefers edges or habitat mosaics that have trees for roosting and open areas for foraging. Mature trees may provide suitable roosting habitat for this species in the Tank Farm Area.

4.4.2.2.2.3.4 *Hoary Bat (Lasiurus cinereus)*

The hoary bat is most abundant in the forests and croplands of the plains states and in forests of the Pacific Northwest, and is also found in the forests of the eastern United States and the arid deserts of the Southwest. Diverse woodland habitats with a mixture of forest and small open areas that provide edges seem ideal for this species. This species has been found in Spanish moss, squirrel nests, woodpecker holes, and out in the open on the trunks of trees. Summer tree roosts are typically located along edge habitats close to feeding grounds. Mature trees may provide suitable roosting habitat for this species in the Tank Farm Area.

4.4.2.2.2.3.5 *Silver-haired Bat (Lasionycteris noctivagans)*

The silver-haired bat is a State species of concern. The distribution of the Silver-haired Bat includes coastal and montane forests from the Oregon border south along the coast to San Francisco Bay and along the Sierra Nevada and Great Basin region to Inyo County. It is primarily a forest dweller, feeding over streams, ponds, and open brushy areas. It roosts in hollow trees, snags, buildings, rock crevices, caves, and under bark. Mature trees and unused buildings may provide suitable roosting habitat for this species in the Tank Farm Area.

4.4.2.2.2.3 *Special-Status Plant Species*

None of the special-status plant species documented from the general vicinity of the Project site are expected to occur in the Refinery Process or Tank Farm areas. Many of these species are associated with habitat types that do not occur in the Project site, and are found only on very specific substrates that are not present (e.g., serpentine soils), or occur at elevations outside of the range of elevations in the Project site. Following focused site surveys that included an analysis of the microhabitat conditions associated with all of the species considered, which were conducted during peak blooming periods of all species with potential to be present, it was determined that no special-status plant species are expected to occur in the Refinery Process or Tank Farm areas.

4.4.2.2.3 *Jurisdictional Wetlands and Waters*

The 2008 EIR concluded that the Modernization Project would not adversely impact any wetlands or waters potentially subject to regulation by the U.S. Army Corps of Engineers, Regional Water Quality Control Board (RWQCB), or CDFW. ENVIRON confirmed that there are no federal or State jurisdictional wetlands or waters in the Refinery Process or Tank Farm areas, or in the Staging Area where nearly all of the Modernization Project construction activities would occur.

4.4.2.3 Regulatory Setting

This section briefly describes federal, State and local regulations, permits, and policies pertaining to biological resources and wetlands as they may apply to the Modernization Project.

4.4.2.3.1 *Federal Endangered Species Act*

The Federal Endangered Species Act prohibits the unauthorized "take" of threatened and endangered species, and regulates the modification of habitat that has been designated as critical for such species. Permission to incidentally take such species may be granted by the USFWS or the National Oceanic and Atmospheric Administration National Marine Fisheries Service. There is no critical habitat on the Project site, and no take of federally protected species is sought or needed for the Project.

4.4.2.3.2 *Federal Migratory Bird Treaty Act*

The MBTA (16 United States Code [U.S.C.] Section 703 et seq.), Title 50 Code of Federal Regulations (CFR) Part 10, prohibits the unauthorized "take" of migratory birds, including eggs and nests, absent appropriate authorization from the Department of the Interior. With a few exceptions, most birds are considered migratory under the MBTA. Disturbances that cause nest abandonment and/or loss of reproductive effort or loss of habitat upon which these birds depend would be in violation of the MBTA.

4.4.2.3.3 *Bald and Golden Eagle Protection Act*

The Bald and Golden Eagle Protection Act that was first passed in 1940 regulates take, possession, sale, purchase, barter, transport, import and export of any bald or golden eagle or their parts (e.g., nests, eggs, young) unless allowed by permit (16 U.S.C. 668(a); 50 CFR 22). Take was broadly defined to include shoot, wound, kill, capture, collect, molest, or disturb. In the 1972 amendments, penalties for violations were raised to a maximum fine of $250,000 for an individual or a maximum of two years in prison for a felony conviction, with a doubling for organizations instead of individuals.

4.4.2.3.4 *Marine Mammal Protection Act*

The Marine Mammal Protection Act prohibits the taking (including harassment, disturbance, capture, and death) of any marine mammals except as set forth in the act.

4.4.2.3.5 *Clean Water Act Sections 404 and 401*

The objective of the Clean Water Act is to maintain and restore the chemical, physical, and biological integrity of the Waters of the United States. Section 401 of the Clean Water Act and U.S. Environmental Protection Agency Section 404(b)(1) Guidelines require certification from the RWQCB when a proposed activity may result in discharge into navigable waters. The RWQCB also has jurisdiction over waters of the State not regulated by the U.S. Army Corps of Engineers under the Porter-Cologne Act. Section 404 of the Clean Water Act gives the U.S. Army Corps of Engineers, in consultation with the U.S. Environmental Protection Agency, regulatory and permitting authority regarding discharge of dredge or fill material into such waters. No dredging or filling of jurisdictional waters is proposed as part of the Modernization Project.

4.4.2.3.6 *2013 National Pollutant Discharge Elimination System Vessel General Permit*

The U.S. Environmental Protection Agency regulates, under the 2013 National Pollutant Discharge Elimination System Vessel General Permit, discharges incidental to the normal operation of vessels operating in a capacity as a means of transportation (including petroleum tankers). The Vessel General Permit includes requirements to limit the introduction of invasive species to local waters (including the Bay). Specifically, the Vessel General Permit requires owners/operators to test ballast water for organisms both greater and less than 50 micrometers in dimension. Ballast water cannot be discharged unless tests indicate there are fewer than (1) 10 living organisms per cubic meter for organisms greater than 50 micrometers; and (2) 10 living organisms per milliliter for organisms between 10 and 50 micrometers.

4.4.2.3.7 *California Endangered Species Act*

The California Endangered Species Act, like its federal counterpart, prohibits the unauthorized "take" of species that are listed under the act. No such take is sought or needed as part of the Modernization Project.

4.4.2.3.8 *Natural Community Conservation Planning Act of 1991*

The California Natural Community Conservation Planning (NCCP) Program is an ongoing effort designed to conserve natural communities at the ecosystem scale while accommodating compatible land use. The CDFW is the principal state agency implementing the NCCP Program. Plans developed in accordance with the

NCCP Act provide for comprehensive management and conservation of multiple wildlife species and identify and provide for the regional or area-wide protection and perpetuation of natural wildlife diversity while allowing compatible and appropriate development and growth.

The Project site is located in the Bay Area-Delta Bioregion (as defined by the State's Natural Communities Conservation Program). This Bioregion comprises a variety of sensitive natural communities, including coastal brackish marsh, coastal terrace prairie, Northern coastal salt marsh, Northern maritime chaparral, serpentine bunchgrass, and valley needle grassland. None of these sensitive natural communities are present within the Refinery Process or Tank Farm areas.

4.4.2.3.9 *California Department of Fish and Wildlife Streambed Alteration Agreement*

The CDFW regulates activities that would interfere with the natural flow of, or substantially alter, the channel, bed, or bank of a lake, river, or stream. These activities are regulated under the California Fish and Game Code Sections 1600-1616. Requirements to protect the integrity of biological resources and water quality are often conditions of Lake and Streambed Alteration Agreements. No activities that would affect such waters are part of the Modernization Project.

4.4.2.3.10 *California Native Plant Protection Act*

The California Native Plant Protection Act prohibits the unauthorized take of rare and endangered plants. No such take is expected to occur as a result of the Modernization Project.

4.4.2.3.11 *Fully Protected Species*

The classification of "fully protected" was the CDFW's initial effort to identify and provide additional protection to those animals that were rare or faced possible extinction. Lists were created for fish, amphibians and reptiles, birds, and mammals. Most of the species on these lists have subsequently been listed under CESA and/or FESA. The Fish and Game Code Sections (fish at Section 5515, amphibian and reptiles at Section 5050, birds at Section 3511, and mammals at Section 4700) dealing with "fully protected" species states that these species "…may not be taken or possessed at any time and no provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to take any fully protected species," although take may be authorized for necessary scientific research. This language makes the "fully protected" designation the strongest and most restrictive regarding the "take" of these species (California Fish and Game Code Sections 3503 and 3513).

Section 3503.5 of the California Fish and Game Code prohibits the removal or take of the nest or eggs of any bird except English sparrows (*Passer domesticus*)

and European starlings (*Sturnus vulgaris*). Disturbance that causes nest abandonment and/or loss of reproductive effort is considered take. Section 3513 essentially overlaps with the MTBA, prohibiting the take or possession of any migratory non-game bird. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered "take" by the CDFW.

4.4.2.3.12 *Species of Special Concern*

"Species of special concern" are broadly defined as animals not listed under the Federal or California Endangered Species Act, but which are nonetheless of concern to the CDFW because the species is (1) is extirpated from the State or, in the case of birds, in its primary seasonal or breeding role; (2) is listed as Federally, but not State, threatened or endangered; (3) meets the State definition of threatened or endangered but has not formally been listed; (4) is experiencing population declines or range retractions that, if continued or resumed, could qualify it for State threatened or endangered status; or (5) has naturally small populations with high susceptibility to threats that could lead to declines and qualify it for State threatened or endangered status. Although these species generally have no special legal status, they are given special consideration.

4.4.2.3.13 *Porter-Cologne Water Quality Control Act*

The Porter-Cologne Water Quality Control Act is California's leading water quality protection law, and protects both surface and ground waters through plans, permits, and enforcement actions. Each of the California's nine RWQCBs adopts and periodically updates a "Basin Plan" to assure that water quality is protected for environmental and public health purposes. The RWQCB also participates in the Clean Water Act permitting process for surface water discharges (e.g., from industrial or stormwater treatment systems) through a state certification process. The Facility's stormwater and wastewater treatment processes are operated pursuant to permits issued by the RWQCB, and are subject to federal and state mandates to assure that Facility water discharges do not adversely affect water quality. The Modernization Project does not include any modification to existing Facility's water-related permits, or adversely affect water quality, as discussed in greater detail in *Section 4.9, Hydrology and Water Quality*.

4.4.2.3.14 *Sensitive Vegetation Communities*

Sensitive vegetation communities are natural communities and habitats that are either unique, of relatively limited distribution in the region, or of particularly high wildlife value. No vegetation communities ranked as sensitive by CDFW exist within the Refinery Process or Tank Farm areas.

4.4.2.3.15 *Contra Costa County General Plan*

The Contra Costa General Plan (Contra Costa County, 2005) designates Significant Ecological Areas throughout the County. Significant Ecological Areas (SEAs) are recognized by CDFW as sensitive natural communities.[2] The most significant ecological resource areas in Contra Costa County are defined by three separate categories: (1) areas containing rare, threatened, and endangered species; (2) unique natural areas; and (3) wetlands and marshes. Six of these areas occur in the vicinity of the Project site, outside of the City of Richmond. No Project components are proposed in any of these areas, therefore the Modernization Project would not adversely affect any SEAs.

Point Pinole. Tidal and freshwater marshes, mudflat, grassland, eucalyptus plantation, and fishing pier, which extends ¼ mile into San Pablo Bay. Valuable for migrating waterfowl and shorebirds. Habitat for soft-haired bird's beak (*Cordylanthus mollis* ssp. *mollis*), California clapper rail and salt marsh harvest mouse (*Reithrodontomys raviventris*), possibly for black rail, Samuel's song sparrow (*Melospiza melodia samuelis*), and white-tailed kite (*Elanus leucurus*). The eucalyptus plantation serves as an overwintering site for migrating monarch butterflies (about 5 miles north of the Project site).

San Pablo Creek and Wildcat Creek Marshes. This area of tidal marsh and mudflat is located adjacent to and north of the Project site. Numerous special-status species have been recorded in these marshes (see Special-Status Species discussion below).

Brooks Island. Tidal marsh, scrub/brushland and coastal prairie grassland. Important stop for migrating waterfowl including Canada goose (*Branta canadensis*). It also supports a population of California vole (*Microtus californicus*) with uncommon pelage (hair) color variation (approximately 3 miles south-southeast of the Project site).

Hoffman Marsh. Tidal marsh habitat for migrating waterfowl and shorebirds, possibly for California clapper rail and salt marsh harvest mouse (approximately 4 miles southeast of the Project site).

San Pablo Ridge. The grassland areas on clay and clay loam soils on San Pablo Ridge support a population of Santa Cruz tarweed (*Holocarpha macradenia*) that

[2] While the Project site is entirely within the City of Richmond and not subject to the Contra Costa County General Plan, these designated areas identify important concentrations and/or habitat for special-status species in the Project vicinity. Consideration of the Significant Ecological Areas provides a useful context within which to evaluate potential impacts to biological resources in areas surrounding the Project.

was transplanted from a hillside in Pinole (approximately 4 miles east of the Project site).

Wildcat Creek Canyon. Grassy hillside with riparian woodland along Wildcat Creek. Habitat for ornate shrew (*Sorex ornatus*), western pond turtle (*Clemmys marmorata*), northern brown skink (*Plestiodon "gilberti" placerensis*) and possibly for Alameda whipsnake (*Masticophis lateralis euryxanthus*) (approximately 6 miles east-southeast of the Project site).

4.4.2.3.16 *Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan 2030), including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use, Plans, and Policies* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions.* There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.4.3 Significance Criteria and Methodology

4.4.3.1 Significance Criteria

Based on CEQA Guidelines Appendix G, a project would have a significant adverse impact on the environment if it would:

(A) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status-species in local or regional plans, policies, or regulations, or by the CDFW or USFWS;

(B) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFW or USFWS;

(C) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;

(D) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;

(E) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; or

(F) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

4.4.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of impacts related to biological resources is explained in the context of each impact, as discussed further below. Since the Biological Resources evaluation completed for the 2008 EIR was not found to be deficient, this assessment focused on updating the previous analysis based on the reduced scope of the Modernization Project, the updated list of protected species, and a re-assessment of baseline Project site biological resources with the potential to be adversely affected by the Project.

4.4.3.3 CEQA Guidelines Appendix Topics Not Discussed Further in this EIR

Review and comparison of the Modernization Project to the environmental setting clearly shows that all Project components would be constructed within existing industrial areas of the Project site that are largely unvegetated and have no protected biological resources. Additionally, Modernization Project operational activities—even assuming an increase in Facility utilization of 93% or 100% relative to the baseline utilization level of 89%—would not result in any new significant adverse impacts to any biological resource. The increased shipping activity at the Long Wharf would remain below the 900 vessel calls previously approved for operations. Biological impacts associated with increased shipping activities were previously analyzed by the Chevron Long Wharf EIR (SLC, 2007). The Long Wharf EIR concluded the potential impacts related to vessel traffic to fishes, birds, and mammals were less than significant. In addition, disturbance impacts to benthic habitats due to vessel traffic were also found to be less than significant. Potential impacts related to introduction of invasive species in ballast water were found to be significant and unavoidable, even after all feasible mitigation was applied.[3] Potential impacts related to spills from tankers on all biota were found to be significant and unavoidable, even after all feasible mitigation was applied.

Since the analysis and CEQA review included in the Long Wharf EIR are applicable to the Modernization Project, no new impacts above and beyond those that were

[3] It should be noted that the 2013 Vessel General Permit (described in the *Section 4.4.2.3*) includes more stringent controls on discharge of ballast water (including numeric effluent limitations) than the 2008 Vessel General Permit (the Long Wharf EIR was prepared in 2006, prior to approval of the first Vessel General Permit in 2008). Compliance with the increasingly stringent requirements of the new Vessel General permit would further reduce the severity of this impact.

presented in the Long Wharf EIR would occur. Therefore, biological impacts related to shipping under the Modernization Project are less than significant.

(F) Potential of the Project to conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan

Construction and operation of the Modernization Project would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan. Although the Project site and vicinity is located in the Bay Area-Delta Bioregion which is covered by the State's Natural Community Conservation Planning Act, no impacts to sensitive natural communities comprising the Bay Area-Delta Bioregion would occur during either construction or operational phases of the Project components, as discussed in the Impacts and Mitigations section below. The Project site is not located within any other Habitat Conservation Plan or other local, regional, or State habitat conservation plan areas. Therefore, no impacts are anticipated and no mitigation measures are required or recommended.

The remaining criteria are discussed below in *Section 4.4.4* (under impact statements) and *Section 4.4.5*.

4.4.4 Impacts and Mitigation Measures

Construction and operation of the Modernization Project could affect biological resources within and adjacent to the Project site during both Project construction and Project operation, as discussed below.

4.4.4.1 Operation Impacts

Any operational changes that would occur as a result of the Modernization Project subsequent to Project construction are not expected to directly or indirectly affect sensitive biological species or habitats at the Project site. Habitat with the potential to support nesting birds and/or special-status wildlife would be removed during dome placement in the Tank Farm Area during the construction phase and no further vegetation clearing is proposed during the operation phase. Project components would operate within the existing industrialized Refinery Process Area, which does not contain any special-status species or habitats. There are no location-specific or operation-specific climate change- or emissions-related impacts expected to affect biological resources associated with the Modernization Project (refer to *Section 4.8, Greenhouse Gases*).

As described in more detail in *Chapter 3, Project Description*, the Modernization Project would increase the Facility's sulfur removal capacity, thus enabling it to process crude oils blends and gas oils with higher sulfur levels on a sustained basis. As discussed in *Section 4.9, Hydrology and Water Quality*, the Modernization Project would (1) not be expected to result in significant changes to pollutant load in wastewater; and (2) not result in a net increase in the quantity of wastewater discharged to the Bay under the 93% Utilization Scenario, and with mitigation would not increase the quantity of wastewater discharge under the 100% Utilization Scenario. As a result, the Modernization Project would not adversely affect biological resources in the Bay.

In addition, as discussed in *Section 4.11, Noise,* operation of the Modernization Project is not expected to result in any significant increases in existing ambient noise levels at the Project site. Any wildlife species, including nesting birds, using habitats adjacent to Refinery Process and Tank Farm areas are assumed to already be acclimated to existing industrial noise levels that exceed human tolerance thresholds, independent of any changes that would result from the Modernization Project.

The changes that would occur as a result of the light-emitting diode (LED) lighting also would not impact biological resources as these resources are also acclimated to existing industrial lighting and the change to LED lighting would not be significant. In conclusion, there would be no adverse impacts to special-status species, sensitive natural communities, wetlands, or wildlife movement corridors associated with operation of the proposed Project components or Project Design Features. Therefore, there would be no additional discussion of operation-related impacts in the remainder of this section. All remaining discussion of Modernization Project-related impacts is associated with Project construction activities.

4.4.4.2 Construction Impacts

The Modernization Project would be constructed primarily within the Refinery Process and Tank Farm areas that do not support any special-status plant or animal species. Impacts related to construction are expected to be limited to the Tank Farm Area where storage tank dome placement is proposed. Dome placement would require clearing and grubbing of vegetation within a 50-foot radius surrounding each tank that is done in order to provide access and a work area for necessary heavy machinery and for fire protection. Not all tanks are completely surrounded by vegetation, so actual impacts would vary. Potential impacts related to vegetation clearing around the tanks include impacts to nesting birds protected under the MBTA and the California Fish and Game Code and species associated with woodland habitats including individual special-status bats and monarch butterfly. It should be noted that no active bird nests, no

monarch butterflies, nor any special-status bat species were observed during surveys conducted in suitable habitat on site. Implementation of proposed avoidance, minimization, and mitigation measures would reduce potential construction impacts to these species to less-than-significant levels.

As described above, any wildlife species, including nesting birds, using habitats adjacent to Refinery Process and Tank Farm areas are assumed to already be acclimated to industrial noise levels. However, there is potential for increased noise levels during construction to disrupt nesting activities of special-status bird species, including those protected by the MBTA. With implementation of Mitigation Measure 4.4-1a (see *Section 4.4.4.2.1* below), this indirect impact would be avoided by conducting a nesting bird survey and observing prescribed disturbance buffers (if active nests are found), or by avoiding construction during the nesting season.

4.4.4.2.1 *Special-Status Species*

Impact 4.4-1: Construction of the Modernization Project would not significantly impact any candidate, sensitive or special-status plants but it could potentially impact special-status wildlife species. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

4.4.4.2.1.1 *Plants*

Although several special-status plants have been identified by the CNDDB to occur in the vicinity of the Project site (i.e., greater San Francisco Bay Estuary), the Refinery Process and Tank Farm areas do not support any special-status plant species. The absence of special-status plants was confirmed by conducting focused plant surveys during peak blooming periods of all species that had a potential to occur. Furthermore, the Refinery Process Area does not provide suitable habitat for special-status plants due to the high level of site disturbance, industrialization, and landscaping. The Refinery Process Area does not contain specified soils, moisture regime or other specific habitat elements necessary to support special-status plant species with the potential to occur in the San Francisco Bay Estuary.

4.4.4.2.1.2 *Wildlife*

4.4.4.2.1.2.1 *Nesting Birds*

The Tank Farm Area contains degraded coastal scrub, coast live oak-California bay woodland, revegetated areas, and non-native tree groves along the periphery.

These vegetation types have the potential to provide suitable nesting habitat for white-tailed kite, a CDFW Fully Protected species for which take is not authorized under the State Fish and Game Code. In addition, these communities could provide suitable nesting habitat for raptors and songbirds protected under the State Fish and Game Code and/or the federal MBTA. Construction activities associated with replacement of the storage tank dome Project Design Feature, including vegetation removal, grubbing, noise, and vibration, have a potential to result in direct (i.e., death or physical harm) and indirect (i.e., nest abandonment) adverse impacts to white-tailed kite and other nesting raptors and songbirds. However, implementation of Mitigation Measure 4.4-1a would reduce the potential for inadvertent impacts to white-tailed kite and other nesting birds due to construction of the Modernization Project to a less-than-significant level.

Mitigation Measure 4.4-1a: To avoid construction-related direct impacts (nest removal) or indirect impacts (increased noise levels) on nesting birds (including California Department of Fish and Wildlife (CDFW) Fully Protected Species and Species of Special Concern), one of the following measures shall be implemented:

- Conduct vegetation clearing and grubbing activities from September 1 through January 1, when birds (including raptors) are not likely to be nesting on the site;

OR

- Conduct pre-construction surveys for nesting birds if construction is to take place during the nesting season (January 1 through August 31). A qualified wildlife biologist shall conduct a pre-construction nest survey no more than 5 days prior to initiation of construction activities (including vegetation clearing and grubbing) conducted within 300 feet of any vegetated area to provide confirmation of the presence or absence of active nests on or immediately adjacent to the storage tank dome Project Design Feature within the Tank Farm Area. If active nests are encountered, species-specific measures shall be prepared by a qualified biologist and implemented to prevent abandonment of the active nest. At a minimum, grading in the vicinity of the nest shall be deferred until the young birds have fledged. A minimum exclusion buffer of 50 feet (300 feet or more for raptors) shall be maintained during construction, depending on the species and location. The perimeter of the nest-setback zone shall be fenced or adequately demarcated with staked flagging at 20-foot intervals, and construction personnel and activities would be restricted in the area. A survey report by a qualified biologist verifying that (1) no active nests are present, or (2) the young have fledged, shall

be submitted to the City and CDFW prior to initiation of grading in the nest-setback zone. The qualified biologist shall serve as a construction monitor during those periods when construction activities occur near active nest areas to ensure that no inadvertent impacts to these nests occur.

Implementation of either of the mitigations listed above would reduce the Modernization Project's potential impact to nesting birds to a less-than-significant level.

4.4.4.2.1.2.2 *Special-Status Bats*

Tall trees in eucalyptus or Monterey pine groves within the Tank Farm Area may potentially serve as roost habitat for several special-status bat species. Construction of Modernization Project elements has the potential to cause inadvertent impacts on roosting bats. Implementation of Mitigation Measure 4.4-1b would reduce this impact to a less-than-significant level.

Mitigation Measure 4.4-1b: One of the following mitigation measures shall be implemented to lessen potential impacts on potential roost habitat and bat species:

- Construction activities near bat roost habitat or removal of potential bat roost habitat shall commence between September and October in order to avoid both the bat maternity period and the bat hibernation period;

OR

- If this is not feasible, pre-construction bat roost surveys shall be conducted prior to removal of potential roost habitat. Pre-construction surveys for potential bat roost habitat shall be performed in all trees and buildings subject to removal or demolition for evidence of bat use (guano accumulation, acoustic or visual detections). If evidence is found, then acoustic surveys shall be conducted to determine whether a site is occupied. A minimum of three acoustic surveys shall be conducted in areas containing evidence of bat use between April and November under appropriate conditions using an acoustic detector (WBWG, 2002). If necessary, and with approval from CDFW, exclusion of bats from occupied roosts shall be performed in the fall prior to construction. A qualified wildlife biologist shall be present during exclusion.

Implementation of either of the mitigations listed above would reduce the Modernization Project's potential impact on special-status bats to a less-than-significant level.

4.4.4.2.1.2.3 *Monarch Butterfly*

Because monarch butterfly winter roost sites have been documented approximately 3 miles southeast of the Project site at the U.C. Berkeley off-site Richmond Field Station and 5 miles north of the Project site on the San Pablo Peninsula in habitats similar to those found in the Project site, the non-native trees in the Tank Farm Area have a potential to serve as winter roost habitat for this species. Removal of eucalyptus, Monterey pine, or Monterey cypress trees that have potential to support overwintering Monarch butterflies in the Tank Farm Area could be potentially adversely affected.

Implementation of Mitigation Measure 4.4-1c would reduce the potential for inadvertent impacts on monarch butterfly winter roosts to a less-than-significant level.

Mitigation Measure 4.4-1c: One of the following mitigation measures shall be implemented to lessen potential impacts on potential winter roost habitat for Monarch butterfly:

- Conduct tree removal when Monarch butterflies are not present (typically between March 31 and August 31);

OR

- If conducting tree removal between March 31 and August 31 is not feasible, pre-construction Monarch butterfly roost surveys shall be conducted by a City-approved biologist within 100 feet of the storage tank dome Project Design Feature prior to initiation of any tree removal activities. If any winter roosts are encountered during the survey, construction shall be postponed until the roosting activity has ended. A follow-up survey shall be conducted by an approved biologist prior to construction in order to verify that the roosts have been vacated.

Implementation of either of the mitigations listed above would reduce the impact to a less-than-significant level.

4.4.4.2.2 *Riparian Habitat*

Impact 4.4-2: Construction of the Modernization Project would not have a significant adverse effect on any riparian habitat or other sensitive natural community. This impact would be less than significant and no mitigation is necessary. (LTS)

No sensitive plant communities recognized in the CNDDB (CDFW, 2013) including coastal brackish marsh, coastal terrace prairie, Northern coastal salt

marsh, Northern maritime chaparral, serpentine bunchgrass, or valley needle grassland, or riparian habitat regulated by the CDFW and/or recognized under the NCCP or County General Permit, SEAs are present within the Refinery Process and Tank Farm areas. The salt marsh plain and constructed marsh area northeast of the Refinery Process Area would not be affected by the construction or operation of any Project components due to their physical separation from the Project. Therefore, construction of the Modernization Project would result in no impact on sensitive natural communities.

Mitigation Measure 4.4-2: None required.

4.4.4.2.3 *Protected Wetlands*

Impact 4.4-3: Construction of the Modernization Project would not have a significant adverse effect on federally protected wetlands, San Francisco Bay, or San Pablo Bay. This impact would be less than significant and no mitigation is necessary. (LTS)

No potentially jurisdictional wetlands or other waters occur within the Refinery Process or Tank Farm areas. The Project components are sufficiently separated from the nearest water features by active Refinery Operations, and would not be dredged, filled, or otherwise degraded by activities associated with development, construction, or operation of the Modernization Project. Therefore, no direct impacts to wetlands are expected to occur as a result of the Modernization Project. Drainage from the Refinery Process and Tank Farm areas and surrounding areas is directed into the Facility's stormwater drainage and treatment system. As discussed in *Section 4.9, Hydrology and Water Quality*, the Modernization Project would (1) not be expected to result in significant changes to pollutant load in wastewater; and (2) not result in a net increase in the quantity of wastewater discharged to the Bay under the 93% Utilization Scenario, or under the 100% Utilization Scenario as mitigated. Due to these factors, no significant adverse impacts to any waters or wetlands or associated special-status species in the vicinity of the Project would be caused by construction of the Project. Refer to *Section 4.9, Hydrology and Water Quality*, of this EIR for a comprehensive discussion of the Facility's stormwater and wastewater drainage and treatment systems capacity and compliance with associated National Pollutant Discharge Elimination System regulations, including submittal of a Stormwater Pollution Prevention Plan.

Mitigation Measure 4.4-3: None required.

4.4.4.2.4 *Movement of Fish or Wildlife Species*

Impact 4.4-4: Construction of the Modernization Project would not interfere substantially with the movement of any native resident or migratory fish or

wildlife species or with established native resident or migratory wildlife corridors, or impede the use of a native wildlife nursery site. This impact would be less than significant and no mitigation is necessary. (LTS)

The Refinery Process and Tank Farm areas consists primarily of developed areas, including the existing Refinery Process and Tank Farm areas, and access roads, and are not considered a major wildlife movement corridor or habitat linkage. Furthermore, the Chevron property is fully encompassed by an 8-foot-tall chain link fence topped with barb wire coils that would allow for only the occasional movement of wildlife through holes in the fence, and would preclude the regular passage of larger mammals (i.e., coyote, mule deer). Modernization Project construction would not change the current patterns of wildlife through the Project site and there are no significant linkages between the Project site and larger preserved habitat areas. San Pablo Peninsula is surrounded by open water along the northwestern tip and southern boundary, and considerable urban development exists to the southeast, including Interstate 80 (I-80) to the south and the Richmond Parkway and the City of Richmond to the east, such that the remnant habitats on site have become a virtual island from established movement corridors or habitat linkages.

Although limited wildlife movement may infrequently occur between the Project site and surrounding open space areas including open water habitat and/or marsh complexes, such movement is very unlikely to result in eventual movement of wildlife populations to intact, preserved habitats; therefore, the site does not act as a true wildlife corridor, movement pathway, or linkage of note between larger habitat areas for terrestrial wildlife. Due to the disturbed, limited, and fragmented condition of habitats on site, which would preclude most species from using the site for breeding/nesting, the Project site also does not appear to function as a wildlife nursery site that would contribute disproportionately to a population. Therefore, the Modernization Project would result in a less-than-significant impact to the movement of any native resident or migratory fish and wildlife species and would not impede the use of a native wildlife nursery site.

Mitigation Measure 4.4-4: None required.

4.4.4.2.5 *Local Policies*

Impact 4.4-5: Construction of the Modernization Project would not conflict with any local policies or ordinances protecting biological resources. This impact would be less than significant and no mitigation is necessary. (LTS)

The proposed Modernization Project is consistent with the General Plan 2030 overall goal to preserve and restore natural habitat and protect biological diversity. The Modernization Project would comply with the General Plan 2030

Policy CN 1.1 (Habitat and Biological Resources Protection and Restoration). The Modernization Project would not impact creeks, wetlands, the shoreline of San Pablo Bay or any other natural open space area, and therefore is consistent with Policy CN2.1 (Open Space and Conservation Areas). The surrounding watershed, natural waterways, SEAs, or any other areas important for the maintenance of natural vegetation and wildlife populations would not be adversely affected. In addition, consistency with the General Plan 2030 Policy CN 1.2 (Local Native Plant Species) to promote native species and control the spread of invasive species is achieved through revegetating all areas of ground disturbance with locally propagated native shrub and/or tree species and controlling the spread of invasive exotic plant species that may become established in these areas.

Further, no Project components are proposed in any areas designated as SEAs by the Contra Costa General Plan (Contra Costa County, 2005); therefore, the Modernization Project would not adversely affect such areas and is also consistent with County General Plan provisions.

Mitigation Measure 4.4-5: None required.

4.4.5 Cumulative Impacts

This section addresses cumulative biological resource impacts associated with the proposed Modernization Project. These are impacts to sensitive biological resources that result from combined, incremental impacts of the Modernization Project when added to other closely related past, present, and foreseeable future projects. Cumulative impacts can result from individually minor but collectively significant adverse impacts taking place over a period of time. The following cumulative impact analysis is based on a review of related projects in the vicinity of the Project site (refer to *Section 4.0, Introduction to Chapter and Methodology*) and of existing conditions in the vicinity of the Project through an evaluation of available aerial photographs.

The lists of projects in *Appendix 4.0, Cumulative Projects,* include 32 projects of various land uses, including regional transportation and existing public utility upgrades and residential, commercial, light industrial, and recreational infill projects. In addition, there are several additional Facility and/or Richmond Chevron projects that are proposed independent of the Modernization Project. These projects include storage tank replacement projects that are already underway, maintenance and retrofit of existing Facility Long Wharf infrastructure, construction of a maintenance shop in an existing industrial area of the Project site, various improvement or upgrade projects within the Facility (e.g., sulfur loading rack replacement, sulfur tanks replacement), and major Facility turnaround (e.g., shut down of process areas for maintenance).

These foreseeable projects, located at the Facility or elsewhere in Richmond, El Cerrito, Benicia, San Pablo, and greater Contra Costa County, are in various phases of project approval and review or are currently under construction. A majority of these projects: (1) are proposed in heavily urbanized or industrialized areas, where significant biological resources are absent, as at the Facility; or (2) are "infill" projects, resulting in the removal of existing development and replacement with new development. In the case of these types of projects, the amount and quality of the biological resources at or near the sites are low and significant cumulative impacts to biological resources are not expected to occur.

Construction and operation of the Modernization Project in conjunction with related projects would not result in a regional loss of undeveloped land and associated biological resources, as the Modernization Project would occur in an already-industrialized area. Furthermore, as mentioned above, the majority of the related projects are also located in already-developed areas that generally support few biological resources, particularly resources that are considered sensitive. Although common wildlife species may be displaced or lost as a result of construction activities and grading operations of the proposed and related projects, implementation of such projects would not reduce regional populations of common or special-status wildlife species or sensitive habitats to below self-sustaining levels or otherwise substantially affect these populations.

Lastly, the biological habitats associated with the Tank Farm Area (oak woodlands, marginal nesting habitat for birds, and marginal roosting habitat for bats and monarchs) are too small, fragmented, and/or isolated by surrounding Refinery Operations, the I-580 corridor, and other commercial and/or industrial development to support substantial and viable sensitive biological resources. Species-related impacts would be mitigated by avoidance measures prior to and during construction and would not result in a cumulatively considerable impact in combination with impacts from reasonably foreseeable projects in the region. Therefore, provided the mitigation measures listed above are implemented, the proposed Modernization Project's contribution to significant cumulative biological resources impacts would be less than significant.

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4.5 CULTURAL RESOURCES

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) changes to relevant plans and policies, including the adoption of a new Richmond General Plan. These revisions do not change the 2008 EIR's conclusions that all significant adverse cultural resources impacts for the Modernization Project would be mitigated to less-than-significant levels.

IMPACT SUMMARY

- Construction of the Modernization Project would not cause a substantial adverse change in the significance of a historical resource. Construction of the Project would not cause a significant adverse impact to any significant historical, archeological, or cultural resources. Prior to issuance of the writ, the Project was partially constructed. Most of the subsurface excavation work is complete, and there is no remaining excavation work required to complete the Project in previously undeveloped areas of the Project site. No archeological resources, human remains, or unique paleontological resources were expected to occur on the Project site, and none were discovered during completed Project site excavation and subsurface activities. The construction of the remaining components of the Modernization Project would not cause any substantial adverse change in the significance of an archeological resource, nor would it directly or indirectly destroy a unique paleontological resource or site, or any unique paleontological feature, any human remains, or any other potentially significant cultural resource.
- There is a remote possibility that an unexpected archeological or paleontological resource, or human remains, would be discovered during remaining Modernization Project excavation activities on previously developed portions of the Project site. This significant adverse impact is mitigated to less-than-significant levels through implementation of recommended mitigation measures.
- There would be no impacts to historical resources, unique archaeological resources, unique paleontological resources, unique geologic features, human remains, or any other significant cultural resource, during operation of the Modernization Project.

4.5.1 Introduction

This section establishes the existing conditions and identifies and evaluates potential impacts related to cultural resources that could result from construction and operation of the Modernization Project.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities that could adversely impact cultural resources. For example, as described in *Chapter 3, Project Description, Section 3.3,* construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years. All remaining excavation and subsurface work would occur within the existing, previously developed area of the Project site. No significant archeological resources, unique paleontological resources, or human remains were anticipated to occur on the Project site based on the 2008 EIR. Further, none were discovered during the 2008 Project construction that was completed, nor are any expected to occur during the Modernization Project's remaining subsurface construction activities.

Cultural resources include, but are not limited to, any object, building, structure, site, area, place, record, or manuscript that is historically or archaeologically significant, or is significant in the architectural, engineering, scientific (including paleontological and unique geological features), economic, agricultural, educational, social, political, military, or cultural annals of California (CEQA

Guidelines Section 15064.5). Because archaeological resources can also be considered historical resources under CEQA, the term "cultural resources" encompasses both built, architectural historical resources and historical resources of an archaeological nature, in addition to unique archaeological resources. CEQA also recognizes the significance of unique paleontological resources.

4.5.2 Setting

4.5.2.1 Regional and Project Setting

Although the Project site is urbanized with a history of industrial and maritime uses since the early 20th century, prehistorically it was a biologically rich upland and beach surrounded by intertidal flats and marsh. Natural marshland biotic communities along the edges of bays and channels were the principal source for subsistence and other activities from the middle Holocene until the contact period in the San Francisco Bay region. Efforts to reconstruct prehistoric times into broad cultural stages, (e.g., Early Period, Middle Period), allows researchers to describe a wide number of sites with similar cultural patterns and components during a given period of time, thereby creating a regional chronology.

Many of the original surveys of archaeological sites in the Bay region were conducted between 1906 and 1908 by N.C. Nelson and yielded the initial documentation of nearly 425 "earth mounds and shell heaps" along the littoral zone of the Bay (Nelson, 1909). From these beginnings, the most notable sites in the Bay region were excavated scientifically, like the Emeryville shellmound (ALA-309), the Ellis Landing Site (CCO-295) in Richmond, and the Fernandez Site (CC0-259) in Rodeo Valley (Moratto, 1984). These dense midden sites are vast accumulations of domestic debris, which have been carbon 14 dated to be 2310 +/- 220 years old, such as ALA-309, but other evidence from around the Bay suggests that human occupation in the region is of greater antiquity, or +/-5000 B.C. (Jones, 1992). While many interpretations exist as to the function of the shellmounds, much of the evidence suggests that they served as sociopolitical landmarks on the cultural landscape and may have served as ceremonial features as well.

The Early Period or the so-called "Berkeley Pattern" is characterized by almost exclusive use of cobble mortars and pestles, which is often associated with a heavy reliance on acorns in the economy (Moratto, 1984). Such unusually intensive reliance on one food type indicates that a shift away from the earlier reliance on a broad spectrum of dietary sources to supply demand was needed by around 1,000 B.P. The Late Pleistocene/Early Holocene profusion of food availability along lakeshores and estuaries likely led to an overexploitation of the

resources that led, initially, to population increases, which may explicate the shift toward exploiting a readily available, yet lower ranked resource like acorns or seeds (Jones, 1991). Nevertheless, given the burgeoning size of Early Period settlements, it is probable that the populations were denser and more sedentary, yet continued to exploit a diverse resource base—from woodland to grassland and marshland, to bayshore resources throughout the San Francisco Bay Area (King, 1974). Many of the Berkeley traits diffused throughout the region and spread to the interior areas of central California during this time period.

The population increases and larger, more complex settlements that began in the late-Early Period typify the Middle Period (ca. 500 BC – AD 1000) (Arnold et al., 2004). The sociopolitical landscape also appears to become more elaborate with clear differentiations in wealth. During the Late Period (ca. AD 1000 – 1700), however, new sites start to decline in the record and the large shellmounds were abandoned. The Late Period also showed population declines and concomitant changes in resource use—likely due to human-caused depletions in some terrestrial food sources during the Middle Period (Broughton, 1994). Broughton (1997, 1999) determined that vertebrate fauna discovered in the Emeryville shellmound showed clear changes in the Middle Period from preferred terrestrial species to expensive (or less efficiently pursued prey per unit of energy) marine mammals, and significant changes in body size in both terrestrial and marine animals, which suggests overexploitation.

4.5.2.1.1 *Richmond Area Prehistory*

Large numbers of shell mounds were identified in the vicinity of the area that became Richmond, including a prominent and well-documented archaeological site at Ellis Landing (near Brooks Island in Richmond) by Nelson (1909) and some have been re-evaluated recently (Broughton 1997; 1999). These sites provide diverse collections of artifacts and faunal remains along with human burials with rich grave offerings. Banks & Orlins (1981) conducted an extensive regime of augering throughout the Richmond Harbor, which included the areas that constituted Nelson's shellmound dimensions. The augering revealed that the area had been covered by approximately 2 to 3 meters of compacted fill, followed by 3.5 meters of intact midden, in the case of CA-CCO-295. The dimensions of the shellmound were estimated to be 500 x 330 feet.

Native American archaeological sites located in western Contra Costa County are usually situated near seasonal and perennial freshwater sources and near the historic extent of bay tidal marshland. The Project site is within ½-mile of recorded prehistoric archaeological resources, which are listed in Table 4.5-1. As mentioned, the Ellis Landing Shellmound (CA-CCO-295), located near Brooks

Island (approximately 2 miles east of the Project site), represented one of the largest and most significant shellmounds in the San Francisco Bay region.

Also within the vicinity of the Project site is the Stege Mounds Archaeological District, CA-CCO-297, -298, -299, and -300. Originally recorded by Loud (1924), the Stege Mounds represented another example of long-term occupation of the salt marsh and tidal flats surrounding the Richmond Harbor. Two of the sites were re-evaluated (CA-CCO-297 and -298) by Banks & Orlins (1981), which verified that these sites were mostly intact at about 1 meter depths below landfill. The Stege Mounds are approximately 5 miles east of the Project site.

4.5.2.1.2 *Ethnographic Setting*

Prior to Euro-American contact, the area of present-day Contra Costa County was occupied by the Ohlone (also known by their linguistic group, Costanoan). Politically, the Costanoan were organized into groups called tribelets. A tribelet constituted a sovereign entity that held a defined territory and exercised control over its resources. It was also a unit of linguistic and ethnic differentiation. Richmond, and a large area of the East Bay, is located within the territory of a people that spoke Chochenyo, one of several Costanoan languages.

The Ohlone economy was based on fishing, gathering, and hunting, with the land and waters providing a diversity of resources including acorns, various seeds, salmon, deer, rabbits, insects, and quail. The acorn was the most important dietary staple of the Costanoan, and the acorns were ground to produce a meal that was leached to remove the bitter tannin. Technologically, the Costanoan crafted tule balsa, basketry, lithics (stone tools) such as mortars and metates (a mortar-like flat bowl used for grinding grain), and household utensils. The Costanoan, like many other Native American groups in the Bay Area, likely lived in conical tule thatch houses.

In 1770, the Costanoan-speaking people lived in approximately 50 separate and politically autonomous nations or tribelets, and the number of Chochenyo speakers reached 2,000, substantially more than the typical size of a tribelet, which ranged from 40 to 200 members.

During the Mission Period (1770-1835), native populations, especially along the California coast, where brought—usually by force—to the missions by the Spanish missionaries to provide labor. The missionization caused the Costanoan people to experience cataclysmic changes in almost all areas of their life, particularly a massive decline in population due to introduced diseases and declining birth rate, resulting in large part from colonization by the Spanish missionaries. Following the secularization of the missions by the Mexican

government in the 1830s, most Native Americans gradually left the missions and established rancherias in the surrounding areas.

Native American archaeological sites that could shed light on the Costanoan ways of life in the pre-mission era tend to be situated near the historic extent of the Bay tidal marshland.

4.5.2.1.3 *Historic Setting*

In 1895, Augustin S. Macdonald visited Point Richmond and proposed a transcontinental rail terminal and ferry service, to provide a means for commerce and the transport of goods between Richmond and San Francisco. By 1901, Santa Fe Railroad had moved its shops to Richmond and the Standard Oil Company built its Facility here also in 1901 (City of Richmond, 2012). Point Richmond was Richmond's first center of commerce and its early 1900s buildings and many nearby residences are now listed as a National Register Historic District. Richmond incorporated as a city in 1905.

During the early 20th century, the harbor and major terminal construction began in earnest and, with the advent of World War II, ushered considerable growth for the Kaiser Richmond shipyards. At war's end, the shipyards closed and were subsequently used for the post-war industrialization and production that followed (City of Richmond, 2012).

As industry grew in the area, the most prominent were in warehousing and distribution, and chemical and research facilities. During this phase, Standard Oil, now called Chevron, and its subsidiaries, Chevron Chemical and (later) Chevron Research, were the mainstays in local employment, and they remain so to this day.

4.5.2.2 Research Methods

4.5.2.2.1 *Archival*

The consultant for the 2008 EIR, Environmental Science Associates (ESA), conducted a cultural resources records search of all pertinent survey and site data at the Northwest Information Center, Sonoma State University on July 13, 2005 [File No. 05-40]. ESA accessed the records by utilizing the San Quentin and Richmond U.S. Geological Survey (USGS) 7.5-minute quadrangle maps and included the Project site along with a ¼-mile radius around the Modernization Project construction sites. The records search included a review of the Directory of Properties in the Historic Property Data File for Contra Costa County for information on sites of recognized historical significance within the National Register of Historic Places, the California Register of Historic Resources,

California Inventory of Historical Resources (1976), California Historical Landmarks (1996), and California Points of Historical Interest (1992).

The writ does not identify any legal deficiencies in the cultural resources analysis of the 2008 EIR. Nevertheless, LSA Associates, Inc. (LSA) conducted an updated analysis of cultural resources, including a records search and a renewed notice and consultation process with tribal representatives and historical preservation stakeholders. LSA's November 11, 2012, records search (NWIC File No. 12-0498) was conducted for the Project site and a ¼-mile radius around it. Based on the nature of proposed improvements, this radius was deemed sufficient to analyze the Project's potential for impacts and is consistent with professional archival research standards.

The records search included a review of the Directory of Properties in the Historic Property Data File for Contra Costa County (dated March 5, 2012). Thirteen previously identified cultural resources were revealed during the updated records search; however, none were significant or potentially significant.

4.5.2.2.2 *Field Methods*

As part of the 2008 EIR, a field reconnaissance was conducted by ESA archaeologist, Dean Martorana, RPA, to obtain a general impression of the area's potential to yield significant cultural resource sites and visually inspect the Project site in relation to known archaeological sites. Because the entire Project site is highly modified and developed, standard archaeological survey methods have little to no value due to the lack of visible native ground surface and significant alteration of the topographic setting. As a result, an updated field reconnaissance was not conducted by LSA for this EIR.

4.5.2.2.3 *Native American Heritage Commission and Native American Consultation*

The Native American Heritage Commission (NAHC) was contacted by an ESA archaeologist on October 26, 2005 and requested to provide information on locations of importance to Native Americans and a list of Native Americans that should be contacted. The NAHC sacred lands search did not identify any traditional cultural properties within the Project site. The NAHC provided a list of Native American organizations that should be contacted concerning locations of importance to Native Americans in the vicinity of the Project site. ESA sent a letter to each organization on the NAHC list, providing information about the 2008 Project and requesting information on locations of importance to Native Americans. A copy of the letter sent, and the list of recipients, is included in *Appendix 4.5*. No responses were received.

LSA repeated this consultation process in 2013. The NAHC responded to an LSA letter on November 18, 2013, and letters with Modernization Project information were sent to each individual on the NAHC response list on November 26, 2013. A copy of the letter sent, and the list of recipients, is included in *Appendix 4.5*.

No responses to LSA's letter were received, and on December 10, 2013, LSA made follow-up contact with each individual. Each individual's response is summarized in *Appendix 4.5*.

4.5.2.2.4 *Historical Society Consultation*

On December 7, 2012, LSA sent a letter describing the Modernization Project with maps depicting the Project site area to the Richmond Museum of History and the Contra Costa County Historical Society. No response letters were received.

4.5.2.2.5 *Paleontological Consultation*

Paleontological resources are the fossilized evidence of past life found in the geologic record. Despite the tremendous volume of sedimentary rock deposits preserved worldwide, and the enormous number of organisms that have lived through time, preservation of plant or animal remains as fossils is an extremely rare occurrence. Because of the infrequency of fossil preservation, fossils—particularly vertebrate fossils—are considered to be nonrenewable resources. Because of their rarity, and the scientific information they can provide, fossils are highly significant records of ancient life.

At the request of LSA, the University of California, Berkeley, Museum of Paleontology conducted a fossil locality search on November 21, 2012, and Museum Director Pat Holroyd reported that no fossil localities were identified within the Project site boundaries (Holroyd, 2012). LSA conducted an online fossil locality search on January 2, 2013, using the Museum of Paleontology website. No fossil localities were identified within the Project site.

4.5.2.3 Research Results

The field reconnaissance conducted for the Modernization Project did not result in the identification of any historic resources, including unique archaeological, resources. However, the City of Richmond recently designated the Standard Oil Administration Building, which is located within the Refinery at 841 Chevron Way, a historic resource under the City's historic resource code. The building therefore qualifies as a historical resource under CEQA Guidelines Section 15064.5(a)(2). The archival research revealed that 12 previously identified cultural resources are within a ½-mile radius (cumulative search radius, including records search update) of the Project site (see Table 4.5-1).

TABLE 4.5-1 EXAMPLES OF RECORDED CULTURAL RESOURCE SITES WITHIN ½-MILE OF THE PROJECT SITE

Site Designation	Age	General Location	Description	Comments	Reference
CA-CCo-277	Prehistoric	Refinery Process Area	Shellmound	According to Nelson, the site is "insignificant."	Nelson, 1907
CA-CCo-283	Prehistoric	Near Pt. Molate	Shellmound	Burials noted; site was partially leveled	Nelson, 1907; Bennyhoff et al., 1952; Chavez, 1985
CA-CCo-506H	Historic era	Between Pt. Molate and Castro Pt.	Chinese earthenware; misc. debris		Chavez, 1984
CA-CCo-765H	Historic era	South of toll plaza	Submerged ship hull		W. Self, 2001
CA-CCo-276	Prehistoric	Tank Farm Area	Shellmound	Site was destroyed	Nelson, 1907
CA-CCo-278	Prehistoric	East shoreline of San Pablo Pen.	Shellmound		Nelson, 1907
CA-CCo-281	Prehistoric	Near Pt. Orient	Shellmound	Measured 120 x 240 feet to a depth of 7 feet	Nelson, 1907
CA-CCo-282	Prehistoric	Western shore line; ill-defined	Shellmound		Nelson, 1907
CA-CCo-284	Prehistoric	Near Project site boundary and Western Drive, and north of toll plaza	Shellmound		Nelson, 1907
Standard Oil Administration Building*	Historic era	841 Chevron Way	Building	Designated a Richmond historic resource on March 6, 2012	City of Richmond, 2012
P-07-3119	Historic era	West of Project site adjacent to Western Drive and the toll plaza	Building		Bright, 2011
CA-CCo-423	Prehistoric	Point Molate	Shellmound	Highly disturbed	None given
P-07-001162 Point Richmond Historic District	Historic era	Centered on Washington Ave., West Richmond Avenue, and Park Place	Commercial buildings and residences	Designated a National Register Historic District in 1979	California Department of Parks and Recreation, Office of Historic Preservation, 2012

* Note: On March 6, 2012, the City of Richmond designated the Standard Oil Administration Building a historic resource under the City's historic resource code. The building therefore qualifies as a historical resource under CEQA Guidelines Section 15064.5(a)(2).
Source: References on file at the Northwest Information Center, Rohnert Park, CA.

Two sites—CA-CCo-276 and CA-CCo-277—have been identified within the Project site boundaries; however, these sites are not proximate to the Modernization Project construction areas. Two additional sites—P-07-3119 and CA-CCo-284—have been identified in the vicinity of the Project site, near Western Drive, north of the toll plaza.

Fifteen cultural resource investigations have been conducted within the vicinity of the Project site. Hupman and Chavez (1993) conducted an inventory report that covered the spatial extent of the Project site. No resources were identified during this survey. LSA (1990) conducted an historic resource evaluation of seven potentially historic properties on the Project site that constituted refinery process facilities and found that none qualified for the National Register of Historic Places (or, by default, the California Register of Historical Resources). Many, if not all, of the facilities on the Project site have been subject to infrastructural changes from maintenance and upgrading for over 30 years; therefore, the facilities have lost integrity that would convey their historical significance. The facilities are utilitarian, industrial structures that do not possess architectural elements that would give it distinction, nor contribute to the history of California to be eligible as an historical resource. No structures or facilities appeared to predate the Facility.

In 1978, a portion of the Point Richmond neighborhood in Richmond—located about a ½-mile south of the Project site, across Interstate 580 (I-580)—was listed in the National Register of Historic Places as an historic district, which includes some 300 buildings. The recognition was bestowed because this portion of the Point Richmond neighborhood has largely maintained the historical integrity of a turn-of-the century industrial village. However, given the distance from the Project site, no direct or indirect impacts to this district are expected.

The Project site is underlain by artificial fill deposits of considerable disturbance due to the extensive excavation conducted for the construction of the Facility and its ongoing operations (Helley & Graymer, 1997). Further, the 1899 USGS San Francisco Quadrangle indicates that the Project site lies within areas that were inundated by the San Pablo Bay prior to development. Consequently, the areas that are proposed for construction would not likely affect intact archaeological deposits.

4.5.2.4 Regulatory Setting

4.5.2.4.1 *California Environmental Quality Act*

CEQA requires that public or private projects financed or approved by public agencies must assess the impacts of the project on cultural resources. CEQA also applies to impacts on archaeological sites, which may be included among

"historical resources" as defined by CEQA Guidelines Section 15064.5, subdivision (a), or, in the alternative, may be subject to the provisions of Public Resources Code Section 21083.2, which govern review of "unique archaeological resources." Historical resources may generally include buildings, sites, structures, objects or districts, each of which may have historical, architectural, archaeological, cultural, or scientific significance.

Under CEQA, "historical resources" include the following:

- A resource listed in, or determined to be eligible by the State Historical Resources Commission, for listing in the California Register of Historical Resources (Pub. Resources Code, Section 5024.1.)
- A resource included in a local register of historical resources, as defined in Section 5020.1(k) of the Public Resources Code or identified as significant in an historical resource survey meeting the requirements of Section 5024.1(g) of the Public Resources Code, shall be presumed to be historically or culturally significant. Public agencies must treat any such resources as significant unless the preponderance of evidence demonstrates that it is not historically or culturally significant.
- Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California may be considered to be an historical resource, provided the lead agency's determination is supported by substantial evidence in light of the whole record. Generally, a resource shall be considered by the lead agency to be "historically significant" if the resource meets the criteria for listing on the California Register of Historical Resources (Pub. Res. Code, § 5024.1) including the following:

  (A) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

  (B) Is associated with the lives of persons important in our past;

  (C) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

(D) Has yielded, or may be likely to yield, information important in prehistory or history.

1. The fact that a resource is not listed in, or determined to be eligible for listing in the California Register of Historical Resources, not included in a local register of historical resources (pursuant to Section 5020.1(k) of the Public Resources Code), or identified in an historical resources survey (meeting the criteria in Section 5024.1(g) of the Public Resources Code) does not preclude a lead agency from determining that the resource may be an historical resource as defined in Public Resources Code Section 5020.1(j) or 5024.1.

Archaeological resources that are not "historical resources" according to the above definitions may be "unique archaeological resources" as defined in Public Resources Code Section 21083.2, which also generally provides that "non-unique archaeological resources" do not receive any protection under CEQA. If an archaeological resource is neither a "unique archaeological" nor an "historical resource," the impacts of the Modernization Project on those resources shall not be considered a significant impact on the environment. It shall be sufficient that both the resource and the impact on it are noted in the EIR, but they need not be considered further in the CEQA process.

In summary, CEQA requires that if a project results in an impact that may cause a substantial adverse change in the significance of an historical resource, or would cause significant adverse impacts on a unique archaeological resource, then alternative plans or mitigation measures must be considered.

Therefore, prior to the assessment of impacts or the development of mitigation measures, the significance of cultural resources must first be determined. The steps that are normally taken in a cultural resources investigation for CEQA compliance are as follows:

- Identify potential historical resources and unique archaeological resources.
- Evaluate the eligibility of historical resources.
- Evaluate the adverse impacts of a project on all eligible historical resources.

Furthermore, CEQA also defines the significance of discoveries of Native American remains, in particular, and discoveries of human remains, as presented in CEQA Guidelines Section 15064.5, subdivisions (d) and (e), respectively, and describes the procedures to be undertaken in the event of such discoveries.

4.5.2.4.2 *City of Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan 2030), including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.5.3 Significance Criteria and Methodology

4.5.3.1 Significance Criteria

Consistent with Appendix G of the CEQA Guidelines, a significant adverse impact on the environment with respect to cultural resources would occur if the Modernization Project would do any of the following:

(A) Cause a substantial adverse change in the significance of a historical resource that is either listed or eligible for listing on the National Register of Historic Places, the California Register of Historic Resources, or a local register of historic resources;

(B) Cause a substantial adverse change in the significance of a unique archaeological resource;

(C) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature; or

(D) Disturb any human remains, including those interred outside of formal cemeteries.

CEQA provides that a project may cause a significant environmental impact where the project "may cause a *substantial adverse change in the significance of an historical resource*[.]" (Pub. Resources Code, Section 21084.1 (emphasis added).) CEQA Guidelines Section 15064.5 defines a "substantial adverse change in the significance of an historical resource" to mean "physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be *materially impaired*" (CEQA Guidelines, Section 15064.5, subd. (b)(1) (emphasis added)).

CEQA Guidelines, Section 15064.5, subdivision (b)(2), defines "materially impaired" for purposes of the definition of "substantial adverse change…" as follows:

"The significance of an historical resource is materially impaired when a project:

(A) demolishes or materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its inclusion in, or eligibility for, inclusion in the California Register of Historical Resources; or

(B) demolishes or materially alters in an adverse manner those physical characteristics that account for its inclusion in a local register of historical resources pursuant to Section 5020.1(k) of the Public Resources Code or its identification in an historical resources survey meeting the requirements of Section 5024.1(g) of the Public Resources Code, unless the public agency reviewing the effects of the project establishes by a preponderance of evidence that the resource is not historically or culturally significant; or

(C) demolishes or materially alters in an adverse manner those physical characteristics of a historical resource that convey its historical significance and that justify its eligibility for inclusion in the California Register of Historical Resources as determined by a lead agency for purposes of CEQA."

(CEQA Guidelines, Section 15064.5, subd. (b)(2)).

4.5.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of cultural resources impacts is explained in the context of each impact, as discussed further below.

4.5.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

(A) Potential of the Project to cause a substantial adverse change in the significance of an historical resource as defined in Section 15064.5

There are no historical resources as defined in Section 15064.5 located within the Refinery Process and Tank Farm areas or the construction staging areas of the Project site. The infrastructure and buildings within these areas are highly industrialized and thus retain no architectural distinction, nor do they appear to be associated with significant events or persons in California's history.

As discussed above in *Section 4.5.2.3*, the Standard Oil Administration Building, situated outside the Refinery Process and Tank Farm areas and construction staging areas, is a historical resource as defined in CEQA Guidelines Section 15064.5. The construction of the proposed facilities would not directly or

indirectly result in a change to this historical resource or any other historical resources as defined in Section 15064.5.

Potential impacts to archaeological deposits are discussed in the impact and mitigation subsection, below.

4.5.4 Impacts and Mitigation Measures

Impact 4.5-1: Although there are no known unique archaeological resources on the Project site, there is a remote potential that remaining Modernization Project subsurface excavation activities may result in the discovery of, and potential impacts to, a previously unknown archaeological resource. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Two prehistoric archaeological sites are within the Project site and in proximity to areas that would be subject to project-related ground disturbance: CA-CCo-276, located in the Refinery Tank Farm Area; and CA-CCo-277, located in the Refinery Process Area. CA-CCo-276 has been extensively impacted by historical land development to the extent that intact deposits associated with this resource are unlikely to exist. Excavation in the vicinity of CA-CCo-276 is anticipated to be minor, consisting of work in areas that have been previously disturbed. CA-CCo-277 is described as a deposit that is sparse in nature (noted as "insignificant" in historical documentation), and the site is recorded as outside of the active construction proposed for the Refinery Process Area.

The Project site is largely modified and disturbed and the vast majority of Modernization Project-related excavation and subsurface work has already been completed. As noted, remaining excavation work would primarily occur only within previously developed portions of the Project site. The only exception would be potential excavation associated with the 2MW solar project that is included in the menu of Community Greenhouse Reduction Measures. See *Section 4.8, Greenhouse Gases*, for a discussion of potential impacts of greenhouse gas reduction measures located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program, Chevron's participation in Marin Clean Energy for some Chevron facilities. The general Modernization Project vicinity has a considerable level of previously identified prehistoric sites, especially along the margins of the San Pablo Bay. Previously unknown archaeological sites (e.g., shell midden soils, lithic artifacts, historic trash scatters) may occur deeply buried within the Project site. Damage to significant buried archaeological deposits would be a significant adverse impact.

Mitigation Measure 4.5-1: In the event that any prehistoric or historic subsurface cultural resources, such as structural features or unusual amounts of bone or shell, artifacts, human remains, architectural remains (such as bricks or other foundation elements), or historic archaeological artifacts (such as antique glass bottles, ceramics, horseshoes, etc.), are discovered during ground-disturbing activities, all work within 50 feet of the resources shall be halted and Chevron and/or the lead agency shall consult with a qualified archaeologist to assess the significance of the find per CEQA Guidelines Section 15064.5. If any find is determined to be significant, representatives of Chevron and/or the lead agency and the qualified archaeologist shall meet to determine the appropriate avoidance measures or other appropriate mitigation, with the ultimate determination to be made by the lead agency. All significant cultural materials recovered shall be, as necessary and at the discretion of the consulting archaeologist, subject to scientific analysis, professional museum curation, and documented according to current professional standards.

As part of the Mitigation Monitoring and Reporting Program for the EIR, Chevron shall have environmental monitors on-site during Modernization Project actions that involve ground-disturbing construction. The construction workers shall be trained by the monitors on environmental sensitivity and the identification of prehistoric or historic subsurface cultural resources.

In considering any suggested mitigation proposed by the consulting archaeologist to mitigate impacts to historical resources or unique archaeological resources, the lead agency shall determine whether avoidance is necessary and feasible in light of factors such as the nature of the find, Project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) shall be instituted. Work may proceed on other parts of the Project site while mitigation for historical resources or unique archaeological resources is carried out.

Implementation of Mitigation Measure 4.5-1 would reduce the impact to a less-than-significant level.

Impact 4.5-2: Although there are no known unique paleontological or geologic features in the Project site, there is a remote potential that remaining Modernization Project subsurface excavation activities may result in the discovery of, and potential impacts to, a previously-unknown paleontological resource. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

While not anticipated to result from the Modernization Project, unique fossil discoveries can be made even in areas of low likelihood, and could be adversely affected by the remaining excavation activities of the Modernization Project, which could have a significant adverse impact on a paleontological resource.

> Mitigation Measure 4.5-2: In the event of unanticipated paleontological discoveries, such as large deposits of fossil remains, Chevron shall notify a qualified paleontologist who shall document the discovery as needed, evaluate the potential resource, and assess the significance of the find under the criteria set forth in CEQA Guidelines Section 15064.5. In the event of an unanticipated discovery of a brea,[1] true, and/or trace fossil during construction, excavations within 50 feet of the find shall be temporarily halted or diverted until the discovery is examined by a qualified paleontologist per Society of Vertebrate Paleontology standards (SVP, 1995). The paleontologist shall notify the appropriate agencies to determine procedures that would be followed before construction is allowed to resume at the location of the find. If the lead agency determines that avoidance is not feasible, the paleontologist shall prepare an excavation plan for mitigating the impact of the Modernization Project on the qualities that make the resource important, and such plan shall be implemented. The plan shall be submitted to the lead agency for review and approval.
>
> As part of the Mitigation Monitoring and Reporting Program for the EIR, Chevron shall have environmental monitors on-site during Modernization Project actions that involve ground-disturbing construction. The construction workers shall be trained by the monitors on environmental sensitivity and the identification of prehistoric or historic subsurface cultural resources.
>
> Implementation of Mitigation Measure 4.5-2 would reduce the impact to a less-than-significant level.

Impact 4.5-3: There is a remote potential that remaining Modernization Project subsurface excavation activities may result in the discovery of, and potential impacts to, previously-unknown human remains. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

There is no evidence that the Project site has been used for burial purposes in the recent or distant past, nor were any human remains discovered during Modernization Project excavation activity completed prior to issuance of the writ.

[1] A seep of natural petroleum that trapped extinct animals and which preserved and fossilized their remains.

Thus, it is unlikely that human remains would be encountered during Modernization Project construction. However, in the event of the discovery of any human remains, including those interred outside of formal cemeteries, during Modernization Project construction, the following mitigation measure is provided.

> Mitigation Measure 4.5-3: In the event that human skeletal remains are uncovered during construction activities for the Modernization Project, Chevron shall immediately halt work, contact the Contra Costa County Coroner to evaluate the remains, and follow the procedures and protocols pursuant to Section 15064.5 (e)(1) of the CEQA Guidelines. If the County coroner determines that the remains are Native American, Chevron shall contact the NAHC, in accordance with Health and Safety Code Section 7050.5, subdivision (c), and Public Resources Code 5097.98 (as amended by Assembly Bill 2641). Per Public Resources Code 5097.98, the landowner shall ensure that the immediate vicinity, according to generally accepted cultural or archaeological standards or practices, where the Native American human remains are located is not damaged or disturbed by further development activity until the landowner has discussed and conferred, as prescribed in this section (Public Resources Code 5097.98), with the most likely descendants regarding their recommendations, if applicable, taking into account the possibility of multiple human remains.
>
> Implementation of Mitigation Measure 4.5-3 would reduce the impact to a less-than-significant level.

4.5.5 Cumulative Impacts

Consistent with the Richmond General Plan 2030 EIR (General Plan 2030 EIR), this cumulative analysis for impacts on cultural and paleontological resources considers a broad regional system of which the resources are a part. The cumulative context for historical resources is the San Francisco Bay Area, which includes the counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma, where common patterns of historic-era settlement have occurred. The cumulative context for archaeological resources and human remains is the Ohlone tribal territory, which includes the areas around San Francisco Bay, Monterey Bay, and the lower Salinas Valley. The cumulative context for paleontological resources is the San Francisco Bay Area.

The General Plan 2030 EIR acknowledges that urban development that has occurred over the past several decades in the San Francisco Bay Area and Ohlone tribal territory, has resulted in the demolition and alteration of innumerable significant historic, archaeological, and paleontological resources and finds that

it is reasonable to assume that present and future development activities will continue to result in impacts on such resources. The General Plan 2030 EIR concludes that the General Plan 2030 together with cumulative development would result in significant cumulative impacts to cultural resources. The General Plan 2030 EIR also finds that the General Plan 2030 has the potential to adversely affect significant historical, archeological, and paleontological resources and the Modernization Project's incremental contribution to these cumulative impacts would itself be potentially cumulatively considerable, and thus potentially significant.

Although the General Plan 2030 EIR concludes that a cumulative impact could occur, the previous impacts discussion noted that there is a remote possibility the Modernization Project could impact archeological or paleontological resources or human remains. Due to the minimal grading and excavation that has to occur to complete the Modernization Project, such impacts are not anticipated. To account for the remote chance that a resource could be encountered, mitigation measures are recommended to ensure any potential impacts would be reduced to a less-than-significant level. The Modernization Project's potential to impact archeological or paleontological resources or human remains when considered in conjunction with the potential for past, present, existing, pending, and reasonably foreseeable future development to impact such resources in the region could result in a cumulative impact associated with archeological or paleontological resources or human remains. The reason for this is that the mitigation measures contained herein will reduce the severity of potential impacts through either the recovery of scientifically consequential information (e.g., as represented by a significant archaeological deposit) through professional data recovery or respectful treatment in consultation with descendant communities.

Given the low likelihood of encountering the resources discussed in this subsection, the Modernization Project's contribution to this cumulative impact would be less than significant after the implementation of the Project mitigation measures.

4.5.6 References—Cultural Resources

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4.6 ENERGY

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current Baseline; and (3) changes to relevant plans and policies, including the adoption of a new Richmond General Plan. Non-Project energy efficiency measures are addressed in Section 4.8, Greenhouse Gases. These revisions do not change the 2008 EIR's conclusions that there are no significant adverse energy impacts for the Modernization Project.

IMPACT SUMMARY

- Construction and operation of the Modernization Project would increase consumption of energy within the Facility beyond current levels. The Modernization Project's impacts on energy resources would be less than significant, however, and no mitigation measures are required.
- Construction of the Modernization Project would use renewable and nonrenewable energy resources, but the increased demand would not result in substantial use of regional energy sources or require construction of new energy infrastructure.
- Operation of the Modernization Project would increase natural gas consumption by 30% to 40% of the Baseline consumption rates but would not require construction of facilities not already included in the Project.
- The Modernization Project's increased consumption of electricity would be offset by the increased self-generation of electricity at the Facility. The amount of imported electricity is not expected to change. Therefore, construction of new facilities and sources of electricity and distribution infrastructure would not be required.
- Operation of the Modernization Project would require additional energy for transportation of employees, as well as raw materials and product, but this change in energy use would be insubstantial compared to existing Facility consumption.
- The Modernization Project would not cause a cumulatively considerable increase in energy consumption.

4.6.1 Introduction

This section establishes the existing conditions and identifies and evaluates potential impacts related to energy resources that could result from construction and operation of the Modernization Project.

Public Resources Code Section 21100(b)(2) indicates that an EIR must include mitigation measures "to reduce the wasteful, inefficient, and unnecessary consumption of energy." Appendix F of the CEQA Guidelines addresses energy conservation and indicates that an EIR should discuss the significant adverse energy impacts of a project. Pursuant to Part II.C of Appendix F, environmental impacts considered in the EIR may include the project's energy requirements and energy use efficiencies, the impacts of the project on local and regional energy supplies, requirements for additional capacity, impacts on peak demand, the degree to which the project complies with existing energy standards, overall projected transportation use, and use of transportation alternatives.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

The transportation impacts of the Modernization Project are discussed in *Section 4.16, Transportation and Traffic*, of this EIR.

The Chevron Hydrogen and Energy Renewal Project EIR Consolidated Volume (2008 EIR) litigation and writ of mandamus are discussed, and the Modernization Project is described, in *Chapter 3, Project Description*.

4.6.2 Setting

The Facility is located in the western end of the City of Richmond in western Contra Costa County, California. Pacific Gas and Electric Company (PG&E) serves the area where the Modernization Project's changes to the Facility would occur. PG&E would supply a portion of the electricity and all of the natural gas for the Modernization Project.

4.6.2.1 General Setting

4.6.2.1.1 *State and Regional Setting*

4.6.2.1.1.1 *Energy Production and Distribution*

California's energy system provides approximately 12% of the natural gas, 38% of the petroleum, and 71% of the electricity of the state's energy supply. The rest of the state's energy is imported and includes natural gas purchases from Canada (22%) and from the Rocky Mountain States and the Southwest (65%), electricity from the Pacific Northwest (8%) and the Southwest (21%), and crude oil imported from Alaska (12%) and foreign sources (50%) (CEC, 2011). Among the states, California ranks fourth in the nation in production of crude oil, thirteenth in production of natural gas, third in generation of hydroelectric power, and tenth in electricity generation from nuclear power (EIA, 2010b, 2011, 2012b, 2013a).

4.6.2.1.1.1.1 *Transportation Fuels Supply*

Most petroleum fuel refined in California is for use in on-road motor vehicles and is refined within California to meet state-specific formulations required by the California Air Resources Board (CARB). The major categories of petroleum fuels are gasoline and diesel for passenger vehicles, transit, and rail vehicles; and fuel oil for industry and electrical power generation. Other liquid fuels include kerosene, jet fuel, and residual fuel oil for marine vessels.

California's oil fields comprise the fifth-largest petroleum-producing area in the United States, behind federal offshore production, Texas, North Dakota, and Alaska. Crude oil is moved from area to area within California through a network of pipelines that carry it from both onshore and offshore oil wells to the refineries that are located in the San Francisco Bay Area, the Los Angeles area, and the Central Valley. Currently, 16 petroleum refineries operate in California, processing approximately 1.9 million barrels[1] per day of crude oil (EIA, 2012a).

Because demand in California now exceeds the supply, crude oil and refined products must be imported from other producing areas. Imported crude oil must be brought into California through marine facilities because there are no pipelines to bring crude into the state. Imports of gasoline and diesel that meet California's strict regulatory specifications,[23] as well as crude oil imports, are

[1] For crude oil, as for other petroleum products, one barrel contains 42 gallons.

[2] California's reformulated gasoline program set requirements for elimination of lead from gasoline, regulations for deposit control additives and reid vapor pressure, specifications for certain compounds, and elimination of methyl-tertiary-butyl-ether.

expected to grow each year into the foreseeable future. That growth would, in turn, lead to increases in petroleum vessel movements and the need for additional docks, terminals, pipelines, and storage tanks to support them.

Other transportation fuel sources are alternative fuels, such as methanol and denatured ethanol (alcohol mixtures that contain no less than 70% alcohol), natural gas (compressed or liquefied), liquefied petroleum gas (LPG), hydrogen, and fuels derived from biological materials (i.e., biomass).

4.6.2.1.1.1.2 *Electricity and Natural Gas Supply*

The production of electricity requires the combustion, consumption, or conversion of other energy resources, including water, wind, oil, natural gas, coal, solar, geothermal, and nuclear. Of the electricity that is generated within the state, 55% is generated by fossil fuel-fired power plants and 16% by nuclear power plants (EIA, 2010b).[4] Nearly 29% of the in-state total electricity production is supplied by renewable sources, including large hydroelectric generation (16.4%), geothermal (6.2%), solar (0.4%), wind (3%), wood/wood waste (1.7%), municipal solid waste/landfill gas (0.9%), and other biomass (0.3%) (EIA, 2010a).

Natural gas ultimately supplies the largest portion of California's electricity market; natural gas-fired power plants in California meet approximately 36% of the in-state electricity demand (CEC, 2012). In addition to the generation of electricity, natural gas is also widely used for industrial, commercial, and residential heating. Most of the natural gas consumed in California comes from the Southwest, the Rocky Mountains, and Canada, while the remainder is produced in California. Although contractually California can receive natural gas from any producing region in North America, it can only take supplies from the three producing regions due to the current pipeline configuration.

For Contra Costa County, PG&E is the primary supplier of electricity and natural gas to businesses and residents of the area. PG&E's service area extends from Eureka to Bakersfield (north to south), and from the Sierra Nevada to the Pacific Ocean (east to west). On the PG&E system, the installed hydroelectric and renewable capacity is larger than in the rest of the state, and approximately 25% of the electrical generating sources delivering power to the PG&E grid use fossil

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[3] California's diesel fuel program set specifications for aromatic hydrocarbon and sulfur content in diesel fuel and a lubricity standard.

[4] The percentage of generation by nuclear power does not reflect the recent decommissioning of Units 2 and 3 at San Onofre Nuclear Generating Station in June 2013. Updates to the EIA energy profiles that reflects this change are not yet available.

fuels[5] (PG&E, 2013). Electricity production facilities include natural gas-fired, coal-fired, and hydroelectric plants. PG&E obtains its energy supplies from power plants and natural gas fields in northern California and from electricity and natural gas purchased outside its service area and delivered through high-voltage transmission lines of the power grid and through gas pipelines.

Marin Clean Energy also supplies electricity to businesses and residents of Richmond. Marin Clean Energy is a community choice aggregator that procures power from renewable sources of energy and sells it to consumers through PG&E's distribution system. As of October 1, 2013, Marin Clean Energy has served approximately 84% of customers in Richmond, with the remainder served by PG&E and Direct Access. Marin Clean Energy's Light Green product has 58.8% of the portfolio coming from carbon-free or carbon-neutral sources in 2011 (Marin Energy Authority, 2013). Marin Clean Energy's Deep Green product has 100% of the portfolio coming from carbon-free or carbon-neutral sources (Marin Energy Authority, 2013).

4.6.2.1.1.2 *State and Regional Energy Consumption*

With a relatively mild Mediterranean climate and strict energy efficiency and conservation requirements, California has lower energy consumption rates than other parts of the country. California has the lowest annual electrical consumption rate per person; the state ranks 48th in the nation based on total energy consumption per capita and consumes approximately 8.8% of the United States natural gas supply average consumption. Nevertheless, with a population of 37.7 million people, California residents consume approximately 8% of the nation's total energy produced (EIA, 2013a) and the state is the tenth largest consumer of energy in the world (CEC, 2000).

4.6.2.1.1.2.1 *Transportation Sector Fuels Consumption*

The transportation sector is a major end use of energy in California, accounting for approximately 39.6% of total statewide energy consumption in 2010 (EIA, 2013a). In addition, energy is consumed in connection with construction and maintenance of transportation infrastructure, such as streets, highways, freeways, rail lines, and airport runways. California's 30 million vehicles consume more than 16 billion gallons of gasoline and more than 3 billion gallons of diesel each year, making California the second largest consumer of gasoline in the world (CEC, 2008).

[5] An additional 15% of power came from unspecified sources purchased through the wholesale power market that PG&E is not able to trace back to a specific generator.

4.6.2.1.1.2.2 *Non-Transportation Related Electricity and Natural Gas Consumption*

This section covers energy usage (electricity and natural gas) for residential, commercial, industrial, and municipal customers. California has the lowest annual electrical consumption per resident of any state; in 2010, California per capita electricity usage was 6,721 kilowatt hours (kWh), which was 55% of the national average usage of 12,146 kWh (CEC, 2010c). In addition, in 2006, California per capita natural gas consumption was 60 standard cubic feet (scf), which was approximately 12% less than the national average usage of 67.9 scf (CEC, 2006).

Energy consumption from industrial shipments is expected to grow by 4.5% per year on average in the state. At the same time, industrial energy use has declined by an annual rate of about 2.3% due to increases in energy efficiency. Considering the 2.3% decrease in industrial demand due to conservation measures together with the 4.5% increase in industrial shipments, industrial energy use is expected to grow 2.2% annually on average (CEC, 2001).

PG&E supplied its customers in northern California with approximately 900 billion scf of natural gas in 2002. Industrial and commercial customers accounted for approximately two-thirds of this gas.

Contra Costa County is located in a coastal climate zone (Climate Zone 3 in the Title 24 Climate Zone designation mapping) and, with the moderating influence of the bay, requires less energy for heating than other parts of the state.

4.6.2.1.2 *Local Setting*

PG&E supplies electricity and natural gas to the area within the Richmond city limits including the Facility. Marin Clean Energy also supplies electricity to Richmond using the PG&E network for transmission and distribution to approximately 84% of customers. At present, Marin Clean Energy does not supply any of the electricity to the Facility. PG&E supplies electricity to the Facility through two 115-kilovolt lines. Distribution facilities within the Facility, including the six substations, are owned and operated by Chevron.

4.6.2.2 Facility Setting and Baseline

As discussed in other chapters, the baseline period of 2008-2010 was selected as representative of Facility operations. During the baseline period, the Facility Crude Unit operated at an average annual utilization rate of 89%. As discussed in more detail in *Section 4.8, Greenhouse Gas*es, from the end of the baseline period (2010) and before the Project's projected January 2016 commencement of

operations, Chevron would have implemented 13 individual non-Project measures that would improve the Facility's energy efficiency and process performance, thus reducing the Facility's fuel and energy usage. Though these measures are expected to only reduce the Facility's pre-Project energy consumption by less than 5% compared to the 2008-2010 baseline period, the baseline has been adjusted to account for the fact they would be implemented before the Modernization Project commences operations, as authorized by *Neighbors for Smart Rail v. Exposition Metro Line Construction Authority*, (2013) 57 Cal.4th 439.

4.6.2.2.1 *Power Balance*

The Facility produces both electric power and steam for use throughout site processes. Electric power is generated by two gas turbines and one steam turbine generator. Electric power is also produced in small amounts by the fluid catalytic cracker turbine generator. Steam is produced by two heat recovery steam generators (fired by turbine exhaust with or without duct burners) as well as by five fired boilers in the No.1 power plant.[6]

The entire system is operated so as to maximize the amount of steam generated by the heat recovery steam generators, with the caveat that a certain amount of spare capacity is always maintained by firing the duct burners at less than capacity. In practice, this means operating the gas turbines (52-megawatt [MW] capacity, each) at near 100% capacity continuously (averaged 99 MW combined in 2010), with the No. 1 power plant providing additional steam to match plant load. A steam turbine generator (30-MW capacity) is used to generate additional electric power by letting steam down from 800 pounds per square inch gauge (psig) to 500 psig and 150 psig. The 500-psig steam and 150-psig steam are used for heating in the refining process or for direct contact with hydrocarbons during the refining process. Electric production and use are well balanced at the Facility, with the Facility producing approximately 115 MW of power and consuming 117 MW. Electricity is purchased from the grid to make up the 2-MW production shortfall.

Heat in the exhaust from the gas turbines is supplemented by duct burners and recovered by the heat recovery steam generators (one for each turbine). The heat recovery steam generators generate 800-psig, 750 degrees Fahrenheit (°F) superheated steam as well as 360-psig, 560°F superheated steam for reinjection

[6] The five boilers are called the "No. 1 power plant" because the unit was built in 1937 and at the time prodcued both power and steam. Today, the No. 1 power plant consists of boilers only and generates only steam.

into the gas turbines. As mentioned above, 800-psig steam from the heat recovery steam generators is supplemented with 800-psig steam from the No. 1 power plant so that steam production matches steam load. Eight hundred-psig steam is used for heating and for direct contact with hydrocarbons as well as being let down in the steam turbine generator for 500-psig and 150-psig process users.

In addition to the steam generators already described (heat recovery steam generators and boiler plant), steam is also generated by process units throughout the Facility, by using the heat generated in the processes to convert water into steam. Steam generated by process units is important in that Chevron keeps excess steam generating capacity online to cover shortfalls in steam production should one of the process units unexpectedly go offline. The extra online steam generating capacity provides redundant steam generation capacity (referred to as the "steam cushion" by plant staff) that can be brought online in the event of rapid changes in steam demand or steam production in other process units.

4.6.2.2.2 *Electricity*

The Facility currently has the capacity to self-generate 125 MW of electric power. (Chevron Data Transmittal #36I (Rev #2), 2014) The Facility typically purchases a net average of 2 MW from PG&E. Although the Facility self-generates a substantial amount of its own electrical power and can at times sell power back to PG&E based on different Facility unit load conditions, on average the Facility continues to import approximately 2% (on a net basis, taking into account exported power sold to the grid) or 10% (on a gross basis) of its electrical energy from the PG&E grid (Chevron Data Transmittal #36I (Rev #2), 2014).

4.6.2.2.3 *Natural Gas*

The Facility imports natural gas at an approximate rate of 97.1 million cubic feet per day (Chevron Data Transmittal #72 (Rev #2), 2014). Natural gas is a raw material and fuel for the Facility and this annual use rate has remained approximately the same since Chevron implemented its Reformulated Gasoline and Fluid Catalytic Cracker Upgrade Project in 1995.

4.6.2.2.4 *Renewable Energy*

In April 2009, Chevron installed a 55-kilowatt (kW) solar panel system on the roof of the Refinery Tech Center building.

Table 4.6-1 shows the Baseline energy (electricity and natural gas) consumption associated with Facility operations. Transportation fuel consumption is a

TABLE 4.6-1 BASELINE ENERGY (ELECTRICITY AND NATURAL GAS) IMPORTS

Period	Electricity Imports (Gross) (MWh/year)	Electricity Imports (Net) (MWh/year)	Natural Gas (mmscf/year)
Baseline	84,776a	19,016b	35,474c

Notes: MWh = megawatt hours; mmscf = million standard cubic feet

[a] Based on gross imported electricity for 2008 (12 MW), 2009 (7.2 MW), and 2010 (9.8 MW), and multiplying by 8,760 hours for 2009 and 2010 and 8,784 hours for 2008 (Chevron Data Transmittal #36I (Rev #2), 2014).

[b] Based on the gross imported electricity and the average electricity exported to the utility's electrical grid (7.5 MW) (Chevron Data Transmittal #36I (Rev #2), 2014).

[c] Based on daily average natural gas consumption for 2008 (96.0 mmscf/day), 2009 (93.0 mmscf/day), and 2010 (102.3 mmscf/day) and multiplying by 365 days (for 2009 and 2010) or 366 days (for 2008) (Chevron Data Transmittal #72 (Rev #2), 2014).

relatively insignificant portion of the energy impacts associated with the Modernization Project and thus is not quantified in this table.

4.6.2.3 Regulatory Setting

The regulatory setting is considered in evaluating energy impacts for CEQA purposes because legal and regulatory requirements impose limitations on energy consumption and production.

Federal and State agencies regulate energy use and consumption through various programs. Local agencies typically address energy issues through their general plans. Relevant federal, state and local regulatory measures affecting the Facility's energy use and efficiency are described below.[7]

At the federal level, the United States Department of Transportation (DOT), United States Department of Energy, and United States Environmental Protection Agency (EPA) are three agencies with substantial influence over energy policies and programs. Generally, federal agencies influence transportation energy consumption through establishment and enforcement of fuel economy standards for automobiles and light trucks, through funding of energy related research and development projects, and through funding for transportation infrastructure projects.

[7] None of the federal, state, or local regulatory measures described in this *Section 4.6, Energy* are expected to affect the Facility's energy consuption prior to the Modernization Project's commencement of operations in January 2016. According, the Baseline has not been adjusted to reflect these regulatory mechansims.

At the State level, the California Public Utilities Commission (CPUC), California Energy Commission (CEC), and CARB are three agencies with authority over different aspects of energy, including electricity and fuels.

4.6.2.3.1 *Federal Programs*

4.6.2.3.1.1 *Energy Policy and Conservation Act*

The Energy Policy and Conservation Act of 1975 was established in response to the oil crisis of 1973, which increased oil prices due to a shortage of reserves. The Act required that all vehicles sold in the U.S. meet certain fuel economy goals, known as the Corporate Average Fuel Economy standards. The National Highway Traffic Safety Administration (NHTSA) of the DOT administers the Corporate Average Fuel Economy program, and the EPA provides the fuel economy data.

In April 2010, the EPA and NHTSA issued a Final Rulemaking establishing new federal fuel economy standards for model years 2012 to 2016 passenger cars and light-duty trucks. For model year 2012, the fuel economy standards for passenger cars, light trucks, and combined cars and trucks were 33.3 miles per gallon (mpg), 25.4 mpg, and 29.7 mpg, respectively (EPA and DOT, 2010). These standards increase progressively up to 37.8 mpg, 28.8 mpg, and 34.1, respectively, for model year 2016. In subsequent rulemakings the agencies extended the national program of fuel economy standards to passenger vehicles and light-duty trucks of model years 2017-2025, culminating in fuel economy of 54.5 mpg by model year 2025 (EPA and DOT, 2012), as well as to medium- and heavy-duty vehicles of model years 2014-2018, including large pickup trucks and vans, semi-trucks, and all types and sizes of work trucks and buses (EPA and DOT, 2011).

4.6.2.3.1.2 *Energy Policy Act of 2005 and Energy Independence and Security Act of 2007*

Signed by President George W. Bush on August 8, 2005, the Energy Policy Act of 2005 seeks to reduce reliance on non-renewable energy resources and provide incentives to reduce current demand on these resources. For example, under the Energy Policy Act, consumers and businesses can attain federal tax credits for purchasing fuel-efficient appliances and products. Because driving fuel-efficient vehicles and installing energy-efficient appliances can provide many benefits, such as lower energy bills, increased indoor comfort, and reduced air pollution, businesses are eligible for tax credits for buying hybrid vehicles, building energy-efficient buildings, and improving the energy efficiency of commercial

buildings. Additionally, tax credits are given for the installation of qualified fuel cells, stationary microturbine power plants, and solar power equipment.

The Energy Policy Act of 2005 also established the first renewable fuel volume mandate in the United States. The original Renewable Fuel Standard program required 7.5 billion gallons of renewable fuel to be blended into gasoline by 2012. Under the Energy Independence and Security Act of 2007, the Renewable Fuel Standard program was expanded to include diesel and to increase the volume of renewable fuel required to be blended into transportation fuel from 9 billion gallons in 2008 to 36 billion gallons by 2022.

4.6.2.3.1.3 *American Recovery and Reinvestment Act*

On February 17, 2009, President Obama signed the American Recovery and Reinvestment Act of 2009. The American Recovery and Reinvestment Act was passed in response to the economic crisis of the late 2000s, with the primary purpose to maintain existing jobs and create new jobs. Among the secondary objectives of the American Recovery and Reinvestment Act was investment in "green" energy programs, including funding the following through grants, loans, or other funding: private companies developing renewable energy technologies; local and state governments implementing energy efficiency and clean energy programs; research in renewable energy, biofuels, and carbon capture; and development of high efficiency or electric vehicles (EPA, 2009).

4.6.2.3.1.4 *Intermodal Surface Transportation Efficiency Act*

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 promotes the development of inter-modal transportation systems to maximize mobility as well as address national and local interests in air quality and energy. The Intermodal Surface Transportation Efficiency Act contains factors that metropolitan planning organizations, such as the Association of Bay Area Governments, are to address in developing transportation plans and programs, including some energy-related factors. To meet the new Act requirements, metropolitan planning organizations have adopted explicit policies defining the social, economic, energy, and environmental values that guide transportation decisions in their respective metropolitan areas. The planning process for specific projects would then address these policies. Another requirement of the Intermodal Surface Transportation Efficiency Act is to consider the consistency of transportation planning with federal, state, and local energy goals. Through this requirement, energy consumption is expected to be a decision criterion, along with cost and other values to determine the best transportation solution.

4.6.2.3.1.5 *Mobile Source Regulations*

4.6.2.3.1.5.1 *Corporate Average Fuel Economy*

The Corporate Average Fuel Economy standards seek to reduce energy consumption by increasing the fuel economy of passenger cars and light-duty trucks. Additional information on this regulation can be found in *Section 4.8, Greenhouse Gases.*

4.6.2.3.1.5.2 *EPA and NHTSA Joint Rulemaking for Vehicle Standards*

In April 2010, the EPA and NHTSA issued a final rulemaking establishing new federal greenhouse gas and fuel economy standards for model years 2012 to 2016 passenger cars, light-duty trucks, and medium-duty passenger vehicles. In addition, on August 9, 2011, the EPA and NHTSA finalized regulations to reduce greenhouse gas emissions and improve fuel efficiency of medium- and heavy-duty vehicles, including large pickup trucks and vans, semi-trucks, and all types and sizes of work trucks and buses. Additional information on this regulation can be found in *Section 4.8, Greenhouse Gases.*

4.6.2.3.2 *State Programs*

California continues to be the national leader in energy efficiency. While energy use per person in the rest of the nation has increased by 45% over the last 30 years, California's per capita use has remained relatively flat as a result of the State of California's energy efficiency measures.

In the 2010 publication California's Clean Energy Future, prepared by numerous State regulatory bodies,[8] it was concluded that California could save an additional 5,000 to 8,100 MW (on peak) and 800 million therms of natural gas consumption by 2020, in addition to the 2,300 MW (on peak) of committed energy efficiency savings included in a 2009 demand forecast (CEC, 2010a). In 2004, the CPUC established aggressive energy savings goals and authorized a significant increase in energy efficiency funding. Meeting these goals would reduce the utilities' need for additional electricity supplies between 2004 and 2013 by more than half. The passage of Senate Bill (SB) 1037 (Kehoe) Chapter 366, Statutes of 2005, further reinforces the State's energy efficiency policies by requiring all utilities to meet their unmet resource needs first with energy efficiency and demand reduction resources that are cost-effective, reliable, and feasible.

[8] Regulatory bodies include the California Environmental Protection Agency, CARB, CEC, CPUC, and California Independent System Operator.

4.6.2.3.2.1 *Title 24 Building Energy Efficiency Standards*

The State of California regulates energy consumption under Title 24 of the California Code of Regulations (CCR). The Title 24 Building Energy Efficiency Standards were developed by the CEC and apply to energy consumed for heating, cooling, ventilation, water heating, and lighting in new residential and non-residential buildings. The CEC adopted the first Title 24 standards in 1978 and updates them periodically to incorporate new energy efficiency technologies and methods. The 2006 Appliance Efficiency Regulations (20 CCR, Sections 1601–1608), dated December 2006, were adopted by the CEC on October 11, 2006, and approved by the California Office of Administrative Law on December 14, 2006. The regulations include standards for both federally regulated appliances and non-federally regulated appliances. While these regulations are now often seen as "business as usual," they do exceed the standards imposed by any other state and reduce greenhouse gas emissions by reducing energy demand.

On July 17, 2008, the California Building Standards Commission adopted the nation's first green building standards. The California Green Building Standards Code (proposed Part 11 of 24 CCR) was adopted as part of the California Building Standards Code (24 CCR). Part 11 establishes voluntary standards on planning and design for sustainable site development, energy efficiency (in excess of the California Energy Code requirements), water conservation, material conservation, and internal air contaminants. Some of these standards have become mandatory in the 2010 edition of the Part 11 code.

The CEC has opened a public process and rulemaking proceeding to adopt changes to the 2013 Building Energy Efficiency Standards contained in 24 CCR, Part 6 (also known as the California Energy Code), and associated administrative regulations in Part 1 (collectively referred to here as the standards). The proposed amended standards would be adopted in 2014. The 2013 Building Energy Efficiency Standards are 25% more efficient than previous standards for residential construction and 30% better for non-residential construction. The standards, which take effect on January 1, 2014, offer builders better windows, insulation, lighting, ventilation systems and other features that reduce energy consumption in homes and businesses.

4.6.2.3.2.2 *Renewables Portfolio Standard*

Established in 2002 under SB 1078, and accelerated in 2006 under SB 107 and again in 2011 under SB X1-2 (Superior Court of the State of California, 2011), California's Renewables Portfolio Standard requires retail sellers of electric services to increase procurement from eligible renewable energy resources to 33% of total retail sales by 2020. The 33% standard is consistent with the

standard's goal established in the Scoping Plan (CARB, 2008). As interim measures, the Renewables Portfolio Standard requires 20% of retail sales to be sourced from renewable energy by 2013, and 25% by 2016. Initially, the Renewables Portfolio Standard provisions applied to investor-owned utilities, community choice aggregators, and electric service providers. SB X1-2 added, for the first time, publicly owned utilities to the entities subject to the Renewables Portfolio Standard.

4.6.2.3.2.3 *State of California Integrated Energy Policy*

The CEC adopts and transmits to the Governor and Legislature a report of findings biannually. In 2002, the Legislature reconstituted the State's responsibility to develop an integrated energy plan for electricity, natural gas, and transportation fuels. Based on SB 1389 (Bowen) Chapter 568, Statutes of 2002, the CEC is required to prepare integrated energy policy reports every two years, with updates in alternate years.

The most recent full report, the 2013 Integrated Energy Policy Report, was released by the CEC on January 23, 2014 (CEC, 2013). The report contains an assessment of major energy trends and issues facing California's electricity, natural gas, and transportation fuel sectors, and provides policy recommendations for the protection and enhancement of the environment, energy, economy, and public health and safety. In particular, the report identifies the following general categories of issues that the CEC believes California must consider in order to meet statewide energy goals:

- Increase energy efficiency in existing buildings and develop a pathway to include zero-net-energy buildings in California's building standards;
- Address technical, regulatory, and market barriers to demand response;
- Address barriers to the development of renewable sources, such as biomethane, and integrate intermittent renewable resources into the electricity system as a whole to minimize negative impacts on the electricity grid;
- Address challenges to the electricity system in Southern California, including scarcity of offsets due to stringent air quality regulations, permanent closure of one of the state's two nuclear power plants, and seismic safety and spent fuel storage concerns with the remaining nuclear plant;
- Plan, permit, and build appropriate transmission infrastructure to support the 33% by 2020 Renewables Portfolio Standard while delivering reliable electricity services;

- Ensure reliable supplies of natural gas through assessments of future demand, supply, prices, and infrastructure needs, as well as understanding future issues and trends that could affect markets and disruptions in supply;
- Increase investment in the development of alternative and renewable fuel vehicles and fueling infrastructure to achieve the goal of reducing the carbon intensity of California's transportation fuels by at least 10% by 2020.
- Assess and plan for the potential impacts of climate change on the energy sector, such as increased electricity demand, decreased power plant efficiency, and changes in the availability of hydropower because of less precipitation and earlier runoff (CEC, 2013).

A proposed scope for the 2014 Integrated Energy Policy Report Update was issued by the CEC on February 18, 2014 (CEC, 2014). According to the proposed scope, the 2014 update would provide additional information on topics raised in the 2013 report, including implementation of the state's Alternative and Renewable Fuel and Vehicle Technology Program, renewable energy planning, implementation of an energy efficiency program for existing buildings, and the 2014 update of the California Energy Demand Forecast (CEC, 2014).

The 2013 report notes that many of the state's energy projects are funded by the American Recovery and Reinvestment Act of 2009, described above.

4.6.2.3.2.4 *Assembly Bill 1613 (Waste Heat and Carbon Emissions Reduction Act)*

Assembly Bill (AB) 1613 directed the CEC, the CPUC, and CARB to implement the Waste Heat and Carbon Emissions Reduction Act. The Act is designed to encourage the development of new combined heat and power systems in California with a generating capacity of not more than 20 MW. In June 2010, the CEC published modified final guidelines establishing technical criteria for eligibility of combined heat and power systems for programs to be developed by the CPUC and publicly owned utilities (CEC, 2010b). Section 2843 of the Act provides that the CEC's guidelines require that combined heat and power systems:

- Be designed to reduce waste energy.
- Have a minimum efficiency of 60%.
- Have nitrogen oxide (NO_x) emissions of no more than 0.07 pound per megawatt-hour (MWh).
- Be sized to meet the eligible customer generation thermal load.

- Operate continuously in a manner that meets the expected thermal load and optimizes the efficient use of waste heat.
- Be cost effective, technologically feasible, and environmentally beneficial.

As directed by AB 1613, the CPUC also established: (1) a standard tariff for the sale of electricity to electricity corporations for delivery to the electrical grid; and (2) a "pay as you save" pilot program requiring electricity corporations to finance the installation of qualifying combined heat and power systems by non-profit and government entities. A January 2011 decision by an administrative law judge determined that the pilot program would not be established due to lack of customer interest and difficulties in instituting a program that meets California Department of Corporations requirements.

4.6.2.3.2.5 *Energy and Co-Benefits Assessment of Large Industrial Facilities*

In May 2011, CARB adopted the Regulation for Energy Efficiency and Co-Benefits Assessment of Large Industrial Facilities (17 CCR, Subchapter 10, Article 4, Subarticle 9). Stationary sources that emitted greater than 0.5 million metric tons of carbon dioxide equivalents (CO_2e) in 2009 and transportation fuel refineries and cement plants that emitted greater than 0.25 million metric tons of CO_2e in 2009 are subject to this regulation. The regulation required these facilities to conduct a one-time assessment of the facility's fuel and energy consumption and emissions of greenhouse gas, criteria pollutants, and toxic air contaminants. As part of the assessment, facilities were required to identify potential energy efficiency improvement projects for equipment, processes, or systems that cumulatively account for at least 95% of the facility's total greenhouse gas emissions. Assessment reports were due to CARB by December 15, 2011 (CARB, 2013d). The Facility is subject to this regulation (CARB, 2013b) and submitted the assessment report in accordance with the requirements of the regulation.

On June 6, 2013, CARB published the Refinery Sector Public Report summarizing the information received from the assessment reports for all refinery facilities in California (CARB, 2013a). In the report, a total of 76 potential energy efficiency improvement projects were identified for the Facility. These efficiency measures targeted boilers, electrical equipment, engines, and thermal equipment. Of those 76 measures, Chevron has completed or has started implementing 57 measures. Two of the projects were completed in 1992 and 1995, while the remaining projects were implemented between 2006 and 2011. Ten measures have been identified to be scheduled for the future and nine projects are currently under investigation. In total, greenhouse gas emission reductions are estimated to range between 322,300 and 608,600 metric tons CO_2e, reflecting an increase in energy efficiency at the Facility.

CARB intends to prepare a final report with its conclusions and recommendations, based on the sector reports, in 2014.

4.6.2.3.2.6 *Energy Efficiency Metrics*

The refinery industry uses "efficiency metrics" to identify industry performance standards and evaluate the operational efficiency of refineries in terms of energy usage and associated greenhouse gas emissions. More recently, the CARB cap-and-trade regulation used efficiency metrics to determine the allowance allocation for a given refinery, where more efficient refineries are rewarded with more directly allocated allowances (17 CCR, Subchapter 10, Article 5). Efficiency metrics are intended to allow an equitable comparison across refineries, normalizing for differences in crude feed, products, and associated processing energy intensity. Different definitions of efficiency metrics exist, including the "Simple Barrel" method, the Solomon Energy Intensity Index (EII) method, and the Complexity Weighted Barrel (CWB) method. The more sophisticated efficiency metrics allow comparison of refineries of differing complexity without automatically penalizing the more complex refineries that fundamentally require more energy input to create more processed and higher-value products (e.g., gasoline, distillates), as compared to less complex refineries (e.g., topping refineries) that fundamentally require less energy input to create less processed and lower-value products (e.g., naphtha, asphalt). More detailed descriptions of the Simple Barrel, Solomon EII, and CWT methods are as follows:

- **Solomon EII Method.** The Solomon EII is a proprietary method developed by Solomon Associates that compares a refinery's actual energy usage to the "standard" energy usage of a refinery of similar size and configuration. Here, energy efficiency is used as a proxy for greenhouse gas emissions efficiency. The "standard" energy usage value is calculated by Solomon Associates based on information reported by refineries that account for approximately 85% of global refining capacity and 90% of California's refining capacity (CARB, 2011). Established in 1980, the Solomon EII method is considered the industry standard for comparing energy efficiency across refineries, and is used by industry and government entities alike, including the Western States Petroleum Association, EPA Energy Star, and CARB. CARB adopted the Solomon EII method for calculating allowances in the cap-and-trade regulation first compliance period (2013-2014) for all refineries with an EII value. Refineries without an EII value are typically smaller and simpler; for these refineries, the cap-and-trade regulation uses the Simple Barrel method, as described below, to calculate allowances.
- **CWB Method.** The CWB method was initially developed during an Emissions Allocation Study for the Western States Petroleum Association. CARB has

adopted a CWB method for calculating allowances for all refineries in the cap-and-trade regulation second compliance period (2015-2017) and onward. The CWB method is directly based on greenhouse gas intensity rather than an energy intensity proxy. The CWB method evaluates the greenhouse gas efficiency of each refinery process (e.g., vacuum distillation, fluid catalytic cracking, alkylation) and determines the refinery's overall efficiency from the sum of these processes. In this way, the CWB method accounts for differences in greenhouse gas emissions due to differences in refinery configurations, inputs, and outputs. The CWB method is more transparent than the Solomon EII method in that it is not based on a proprietary index; the California Mandatory Reporting Rule requires refineries to report all input and output information needed to perform the cap-and-trade CWB evaluation.

- **Simple Barrel Method.** The Simple Barrel method evaluates refinery efficiency based on total greenhouse gas emissions per barrel of product produced. Here, "total barrels of product" includes all products the refinery produces (e.g., gasoline, diesel, jet fuel, residual fuel oil, asphalt), regardless of the energy intensity needed to produce more sophisticated and higher-value products. CARB adopted the Simple Barrel method for calculating allowances in the cap-and-trade regulation first compliance period (2013-2014) for all refineries without a Solomon EII value. The refinery's total greenhouse gas emissions are obtained from reports required by the EPA and California Mandatory Reporting Rule (17 CCR, Subchapter 10, Article 2), and the total barrels of product produced are obtained from information reported to the EPA and the CEC. While the Simple Barrel method is indeed simple and relatively transparent, CARB noted that the method may disadvantage more complex refineries that produce more complex and higher-value products when compared to simpler refineries that produce simpler and lower-value products (CARB, 2010).

A related efficiency metric is one that evaluates refinery efficiency based on total greenhouse gas emissions per barrel of crude oil refined. A recent study (Karras, 2011) by Communities for a Better Environment commissioned by the Union of Concerned Scientists reported that California refineries on average emit 19 to 33% more greenhouse gases per barrel of crude oil refined than refineries in any other major U.S. refining region. Proponents of this efficiency metric argue that California's greater greenhouse gas emissions can be attributed to California refineries processing denser crude of higher sulfur content, which require more energy input per barrel in order to refine into desirable products (Karras, 2010, 2011). The study notes that the declining availability of "cleaner" California and Alaska crude oils has resulted in California refineries importing "lower quality" foreign crude, with the trend expected to continue and increase in the future.

Similar to the Simple Barrel method, this method disadvantages more complex refineries as compared to simpler refineries.

4.6.2.3.2.7 *Mobile Source Regulations*

4.6.2.3.2.7.1 *Low Carbon Fuel Standard*

The low carbon fuel standard would reduce greenhouse gas emissions by reducing the carbon intensity of transportation fuels used in California by at least 10% by 2020. The requirements for this regulation are described in more detail in *Section 4.8, Greenhouse Gases.*

4.6.2.3.2.7.2 *Clean Cars*

In January 2012, CARB approved the Advanced Clean Cars Program, which established an emissions control program for cars and light-duty trucks (such as SUVs, pickup trucks, and minivans) of model years 2017-2025. When the program is fully implemented, new vehicles would emit 75% less smog-forming pollutants than the average new car sold today, and greenhouse gas emissions would be reduced by nearly 35%. The requirements for this regulation are described in more detail in *Section 4.8, Greenhouse Gases.*

4.6.2.3.2.7.3 *SmartWay Truck Efficiency Regulation*

The SmartWay Truck Efficiency Regulation, approved by CARB in December 2008, requires heavy-duty long-haul tractors and box-type trailers to be equipped with technologies that reduce greenhouse gas emissions by improving fuel economy. The requirements for this regulation are described in more detail in *Section 4.8, Greenhouse Gases.*

4.6.2.3.2.7.4 *CARB Measures to Reduce Emissions from Goods Movement Activities*

The Goods Movement Emission Reduction Program (CARB, 2013c) and the 2006 Emission Reduction Plan for Ports and Goods Movement (Plan) in California (CARB, 2006) establish measures that reduce emissions (NO_x, particulate matter, and greenhouse gas) from the main sources associated with port cargo handling activities, including ships, harbor craft, terminal equipment, trucks, and locomotives. These measures reduce emissions, including greenhouse gas emissions, by requiring cleaner technologies and upgrades, low-carbon fuels, and/or programs that reduce fuel consumption through reduction of vehicle use or vehicle miles traveled.

In addition, the California Environmental Protection Agency (CARB's parent agency) has partnered with the California Business, Transportation and Housing

Agency to prepare the Goods Movement Action Plan (Caltrans, 2007). This plan guides statewide policy and planning for freight transport, trade corridors, and related air quality issues, as well as guides project selection for the allocation of funds under the Trade Corridors Improvement Fund Program, a statewide fund used for infrastructure improvements along federally designated trade corridors of national significance (State of California, 2007).

Additional details are described in *Section 4.8, Greenhouse Gases.*

4.6.2.3.2.7.5 *CARB Vessel Speed Reduction for Ocean-Going Vessels*

CARB is in the process of evaluating a statewide vessel speed reduction program for ocean-going vessels. This program would require vessels within a certain distance of a port to slow to a specified speed. Reducing vessel speeds to an optimal value minimizes fuel consumption on a per-distance basis and translates into reduced greenhouse gas emissions (CARB, 2009b). Voluntary vessel speed reduction programs are already in place at several ports including the Port of Long Beach, the Port of Los Angeles, and the Port of San Diego.

4.6.2.3.2.7.6 *Regulation of Trains*

In response to the goals of AB 32, Measure T-6 "Freight Transport Efficiency" of CARB's Scoping Plan is intended to address greenhouse gas emissions from the freight transport sector by achieving at least 3.5 million metric tons of CO_2e reduction in greenhouse gas emissions from the sector by 2020. In May 2009, CARB held a workshop (CARB, 2009a) to outline objectives and research topics for further investigation; as of October 2013, however, CARB has not yet implemented any regulations or issued any formal regulatory documents for this measure.

4.6.2.3.3 *Local Plans*

4.6.2.3.3.1 *Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan, 2030), including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions.* There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.6.3 Significance Criteria and Methodology

4.6.3.1 Significance Criteria

While no thresholds related to energy are included in CEQA Guidelines Appendix G, Part I of Appendix F of the CEQA Guidelines states as follows:

> "The goal of conserving energy implies the wise and efficient use of energy. The means of achieving this goal include:
>
> - (1) decreasing overall per capita energy consumption,
> - (2) decreasing reliance on natural gas and oil, and
> - (3) increasing reliance on renewable energy resources."

Appendix F states that an EIR should discuss the general energy impacts of a project, with particular emphasis on these three criteria.

Because the Modernization Project involves changes to the Facility, application of these basic criteria to the Modernization Project, as further explained in Part II.C of Appendix F, would suggest that the EIR should discuss whether the Modernization Project would:

(A) Substantially increase the consumption of electricity, natural gas, gasoline, diesel, or other nonrenewable energy types;

(B) Result in a reduction or interruption of existing electrical or natural gas services due to construction or operation of Modernization Project features;

(C) Use substantial amounts of electricity and natural gas, thereby resulting in the construction of new facilities and sources of energy or major improvements to local infrastructure;

(D) Conflict with existing energy standards, including standards for energy conservation; or

(E) Cause a cumulatively considerable increase in energy consumption and associated environmental impacts.

4.6.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of the Modernization Project's energy-related impacts is explained in the context of each impact, as discussed further in *Section 4.6.4* below.

4.6.3.3 CEQA Guidelines Appendix F Topics Not Discussed Further in this EIR

Review and comparison of the Modernization Project to the Baseline clearly shows that the Project would create no impacts related to the following environmental topics listed in CEQA Guidelines Appendix F.

(B) Potential of the Project to result in a reduction or interruption of existing electrical or natural gas services due to construction or operation of Project features

There are no aspects of the Modernization Project that would result in a reduction or interruption of existing electrical or natural gas services.

4.6.4 Impacts and Mitigation Measures

This analysis addresses the changes in energy use that would result from the construction and operation of the Modernization Project. The Modernization Project would require the use of energy to construct the Project and the use of additional energy to increase Facility utilization to 93% and hydrogen plant utilization to 100% (93% Utilization Scenario). This analysis also analyzes the impact of increasing Facility utilization beyond 93% to 100% (100% Utilization Scenario). The additional energy required would be provided from the Cogeneration Plant and the Hydrogen Plant Replacement, as well as from refinery fuel gases that are a byproduct of processing.

Although the Modernization Project would be an energy infrastructure project, the Modernization Project would be relatively neutral in that it would have only a minimal direct impact on the three main criteria for CEQA's goal of conserving energy, as stated in *Section 4.6.3*, above.

The Modernization Project would not increase reliance on renewable energy resources and also would not decrease reliance on natural gas and oil, except to improve the efficiency with which useful products would be extracted from crude oil and gas oils at the Facility.

The Hydrogen Plant Replacement is designed to meet the Modernization Project objectives of producing more hydrogen and higher-purity hydrogen in a more energy-efficient manner. The Hydrogen Plant Replacement would use pressure swing adsorption technology to recover hydrogen from Facility gas streams and produce higher-purity hydrogen in the production process. Thus, more hydrogen could be produced with less energy and natural gas.

Also, Chevron plans to implement many energy and fuel efficiency projects at the Facility, although these are not part of the Modernization Project. From 2008 to

2016, Chevron would have implemented 13 individual measures that are designed to increase energy efficiency and process performance, thus reducing fuel and electricity usage. Further discussion of these specific measures is included in *Section 4.8, Greenhouse Gases* of this EIR.

4.6.4.1 Construction Impacts

Impact 4.6-1: Construction of the Modernization Project would use non-renewable energy resources, primarily in the form of fuels for vehicles and equipment, and would use electrical energy from renewable and non-renewable sources for tools and lighting. The energy required is readily available, and the increased demand would not result in a substantial use of regional energy sources, nor would it require new energy infrastructure to be constructed. This impact would be less than significant and no mitigation is necessary. (LTS)

Energy expenditures to construct the Modernization Project include combustion of the refined petroleum products needed to operate construction equipment. While construction energy would be consumed only during the construction period, it would be a relatively small but finite consumption of natural energy resources.

Construction of the 2008 Project commenced following its approval. This construction included work on Facility components that are also part of the revised and down-sized Modernization Project (e.g. the Hydrogen Plant Replacement). The 2008 Project construction lasted for approximately 15 months until the third quarter of 2009 when the Contra Costa Superior Court issued an injunction halting further construction. Upon approval of the Modernization Project, the additional construction is expected to occur over a 24-month period. Construction energy use is expected to be the highest during construction of the major Modernization Project components, during the first quarter of construction. Construction would consume fuel and electricity. Based on estimates of construction emissions reported in *Section 4.3, Air Quality* and *Section 4.8, Greenhouse Gases*, construction-related equipment and vehicles on site are expected to consume a maximum of about 42,000 gallons of fuel per day, or about 5,800 million British thermal units per day. This is a conservative "worst-case" calculation, based on the maximum quantities of equipment working on site on a single day during the construction period. Actual average fuel consumption would be less than this estimate, because not all equipment would be used continuously for the entire duration of construction.

As discussed in *Section 4.8, Greenhouse Gases*, Chevron has proposed to implement Bay Area Air Quality Management District (BAAQMD) Basic

Construction Mitigation Measures (BAAQMD, 2011), BAAQMD Additional Construction Mitigation Measures (BAAQMD, 2011), BAAQMD construction best management practices (BAAQMD, 2011), and project-level climate change mitigation measures presented by the California Attorney General's Office (2010). These measures would also result in reduced fuel consumption during construction.

Electricity would be used by construction-related equipment, such as welding machines and power tools. A portion of the electricity consumed would likely be obtained from the on-site Cogeneration Plant, but a portion would be obtained from PG&E. Peak day electrical energy demand for construction during the Modernization Project could be in the range of 100 to 500 kW.

Since the completed construction for the 2008 Project did not require that PG&E construct new facilities or infrastructure for electricity supply, it is not anticipated that future construction for the Modernization Project would require new facilities or electricity infrastructure. Similarly, the completed construction for the 2008 Project did not require construction of facilities or infrastructure for production of additional fuel required for future construction. Therefore, it is not anticipated that construction for the Modernization Project would require new facilities or infrastructure for production of additional fuel.

Given that the Modernization Project objectives are to improve the efficiency of operation of the Facility and given current construction practices, construction of the Modernization Project would not be considered a wasteful use of energy. Construction-related energy consumption would be limited to the construction period. The energy used during construction would primarily be in the form of petroleum-based fuels, and electricity use would not have a significant adverse impact on PG&E's energy resources. Energy consumed by Project construction activities, therefore, would not be a significant adverse environmental impact.

Mitigation Measure 4.6-1: None required.

4.6.4.2 Operational Impacts

Impact 4.6-2: Operation of the Modernization Project and its components would increase long-term consumption of natural gas and increase production of electricity and hydrogen at the Facility. The increased consumption would not result in substantial use of regional energy resources, and neither the increased consumption nor the increased production would require construction of facilities not already included in the Modernization Project. This impact would be less than significant and no mitigation is necessary. (LTS)

Natural gas consumption after construction and operation of the Modernization Project is expected to increase by about 30% to 40% over Baseline levels for both the 93% Utilization Scenario and 100% Utilization Scenario (Chevron Data Transmittal #72 (Rev #2), 2014). The natural gas demand can fluctuate depending on multiple different operating parameters that are independent of the Modernization Project (i.e., maintenance activity) making it difficult to precisely estimate future demand. The primary reason for this increase is that the Hydrogen Plant Replacement would use natural gas as a supplemental feedstock and furnace fuel to produce up to a permitted 294 million standard cubic feet (mmscf) per day of hydrogen with hydrogen recovery. The increase in capacity from Baseline is needed to provide the Facility with the flexibility to remove larger quantities and higher concentrations of sulfur in feedstocks, as well as allow for the potential to export hydrogen. Natural gas consumption for the Baseline and the Modernization Project are shown in Table 4-6.2.

TABLE 4.6-2 NATURAL GAS CONSUMPTION—BASELINE AND PROJECT

	Baseline (mmscf/year)	Project (93% and 100% Utilization Scenarios) (mmscf/year)
Natural Gas	35,474a	46,116 - 49,663b

[a] Based on daily average natural gas consumption for 2008 (96.0 mmscf/day), 2009 (93.0 mmscf/day), and 2010 (102.3 mmscf/day) and multiplying by 365 days (for 2009 and 2010) or 366 days (for 2008).

[b] Based on estimated increase in natural gas consumption by 30 to 40%.

Source: Chevron Data Transmittal #72 (Rev #2), 2014.

This increase in natural gas is within the demonstrated capability of the utility to supply natural gas to the Facility, and therefore the Modernization Project would not require the construction of new facilities or infrastructure for natural gas supply (Chevron Data Transmittal #72 (Rev #2), 2014). Chevron's estimates, based on discussions with PG&E, confirm that the existing pipeline infrastructure would be capable of delivering the necessary flow rates required for operation of the Modernization Project (Chevron, 2007). Thus, this increase in consumption would be considered less than significant.

Construction and operation of the Modernization Project would also increase the production of finished products, hydrogen, and refinery fuel gas from the various crude oils and gas oils that are now imported to the Facility, as described in *Chapter 3, Project Description*. Production yield increases due to the increase in utilization from the Baseline Period to both the 93% and 100% Utilization Scenarios also incorporates more efficient use of those crude oils and gas oils

than is now possible. The additional process gas that would be manufactured would be used as a feedstock in the Hydrogen Plant Replacement or be combined with natural gas to provide fuel gas for furnaces.

Mitigation Measure 4.6-2: None required.

Impact 4.6-3: Operation of the Modernization Project and its components would increase long-term generation and consumption of electrical energy at the Facility. The increased consumption would not result in substantial use of regional energy resources, and neither the increased consumption nor the increased generation would require construction of facilities not already included in the Modernization Project. This impact would be less than significant and no mitigation is necessary. (LTS)

The increase in Facility utilization to both the 93% and 100% Utilization Scenarios would result in increased consumption of electricity. The increased demand for electricity would be satisfied by additional electricity generation capacity from components of the Modernization Project.

The increase in electricity consumption would be met by new electricity generation capacity at the Facility. The new steam turbine generator at the Hydrogen Plant Replacement would generate 17 MW net of electrical energy. In addition, high-pressure steam from the Hydrogen Plant Replacement would generate an additional 6 MW of electrical energy in the cogeneration unit steam turbine generator. Thus, the net change associated with the Modernization Project would be an increase of 23 MW in electricity generation at the Facility compared to the Baseline of 125 MW. The demand for imported electricity from the utility would not change with the Modernization Project in both the 93% and 100% Utilization Scenarios (Chevron Data Transmittal #36I (Rev #2), 2014). Table 4.6-3 shows both gross and net electricity imports for the Baseline and the Modernization Project at 93% utilization (hydrogen plant at 100% utilization).

TABLE 4.6-3 ELECTRICITY IMPORTS FROM UTILITY—BASELINE AND PROJECT

	Baseline (MW)	Project (93% and 100% Utilization Scenarios) (MW)
Electricity Imported (Gross)	9.7	9.7
Electricity Imported (Net)	2.2	2.2

Source: Chevron Data Transmittal #36I (Rev #2), 2014.

Other processes included in the Modernization Project would require additional electricity to operate, and would consume portions of the increased generation capacity of the Facility resulting from the Modernization Project. Even accounting for the increased consumption of the Project components and 2 MW that the Facility currently net imports from PG&E, the increased generation capacity of the Modernization Project would enable the Facility to self-generate all of the electricity needed for normal operations and at times be a modest exporter (a few MW) to PG&E's grid.

Since the Modernization Project would not change the amount of net electricity imported from PG&E, the Project would not require the construction of electricity generation or distribution infrastructure facilities.

As discussed in *Section 4.8, Greenhouse Gases,* and further in Impact 4.8-5, Chevron would commit to a Project Design Feature of participating in Marin Clean Energy for obtaining a portion of its imported electricity from renewable sources of electricity, which would be implemented as a mitigation measure. Thus, with the Modernization Project, less imported electricity would be sourced from non-renewable sources of electricity.

Mitigation Measure 4.6-3: None required.

Impact 4.6-4: Operation of the Modernization Project would require additional energy for transportation of employees, as well as raw materials and product (crude oil, additives, refined products, and byproducts). The change in energy use for transportation and production of product would be insubstantial compared to existing Facility consumption. This impact would be less than significant and no mitigation is necessary. (LTS)

In general, an increase in Facility utilization to 93% would require an overall proportional increase in transportation of raw materials and products by shipping, rail and trucks. Table 4.6-4 shows the quantity of fuel required for transportation of raw materials and product for the Baseline and the Project (93% and 100% Utilization Scenarios).

The Modernization Project would result in an additional 29 employees and would thus result in increased energy consumption for their transportation to and from the Facility. Taken together, the Modernization Project's increase in energy consumption related to the transportation of raw materials, products, and employees over Baseline levels is insignificant and does not amount to a significant adverse impact.

TABLE 4.6-4 FUEL CONSUMPTION FOR SHIPPING, RAIL, AND ON-ROAD VEHICLES (93% UTILIZATION SCENARIO)

	Baseline (Gallons/Year)	Project (93% Utilization Scenario) (Gallons/Year)	Project (100% Utilization Scenario) (Gallons/Year)
Shipping[a]	11,955,987	13,076,036	14,047,121
Rail[b]	102,952	110,333	118,735
On-Road Vehicles[c]	879,000	1,089,000	1,179,000

[a] Shipping fuel consumption estimates based on carbon dioxide emissions and the ratio of fuel consumption to carbon dioxide emissions for ships (0.314) and tugs and barges (0.314). Both 93% and 100% Utilization Scenario Project cases are for the cases with Project Design Features as a conservative measure. Fuel consumption for cases with Project Design Features is only less than 2% greater compared to the cases without Project Design Features.

[b] Rail fuel estimates are from *Appendix 4.3-TRANS*.

[c] Fuel consumption based on carbon dioxide emission factors for gasoline and diesel.

Mitigation Measure 4.6-4: None required.

Impact 4.6-5: Operation of the Modernization Project would result in increased overall energy efficiency. This impact would be less than significant and no mitigation is necessary. (LTS)

The Modernization Project has a number of components that are designed to increase energy efficiency.

4.6.4.2.1 *Hydrogen Plant Replacement*

As described in *Chapter 3*, *Project Description,* the Hydrogen Plant Replacement would employ pressure swing adsorption technology for the purification stage of hydrogen production. Hydrogen produced from the steam reforming process would go through a pressure swing adsorption unit, consisting of a series of vessels, which selectively adsorbs the hydrocarbons in the gas stream and allows the hydrogen to pass through. The vessel is periodically regenerated by removing the adsorbed impurities, like carbon dioxide and unconverted methane, by depressurizing and purging the vessel. The pressure swing adsorption technology would use about 20% less fuel to produce the same amount of hydrogen, compared to the existing hydrogen plant. This reduction comes from the more efficient pressure swing adsorption technology, which allows for the less energy-intensive processing of hydrogen, avoids the need for

energy-intensive conversions to eliminate impurities in the hydrogen stream, and instead utilizes these impurities as fuel in the process

In addition the new steam turbine generator at the Hydrogen Plant Replacement would process high-pressure steam generated at the Hydrogen Plant Replacement, generating up to 17 MW of electrical energy. This energy would be able to supply the entire Hydrogen Plant Replacement and hydrogen recovery equipment, and the balance can be sent to other parts of the Facility.

Another portion of the high-pressure steam generated at the Hydrogen Plant Replacement would be let down to lower pressures across the Facility's cogeneration unit steam turbine generator, producing up to an additional 6 MW of electricity.

Additionally, the hydrogen compressors at the Facility would be upgraded to accommodate the higher purity hydrogen. The upgraded hydrogen compressors would result in reduced external electricity demand.

4.6.4.2.2 *Sulfur Removal Improvements*

As part of the Sulfur Removal Improvements, a power recovery turbine would be installed to generate power to operate equipment at the Facility. The recovery of the energy from elsewhere in the Facility would contribute to avoiding additional greenhouse gas emissions and reducing fuel use.

4.6.4.2.3 *Air Quality and Greenhouse Gas Project Design Features*

As described in *Section 4.8, Greenhouse Gases*, one of the greenhouse gas Project Design Features that Chevron has committed to is participation in Marin Clean Energy for Chevron accounts at or co-located to the Facility. Marin Clean Energy is a Community Choice Aggregator under California law that provides lower-carbon dioxide source electricity to area residents and business within their service area. Marin Clean Energy delivers power via PG&E, which continues to maintain the power transmission and distribution infrastructure, deliver electricity and handle billing. The electricity Marin Clean Energy customers receive is deemed 50% to 100% renewable energy. By offering a much higher percentage of renewable energy than is available from PG&E, Marin Clean Energy lowers customers' greenhouse gas emissions associated with electricity generation.

Chevron's participation in Marin Clean Energy would be inclusive of its commercial accounts at Richmond, and conversion of industrial accounts will be considered to the extent Marin Clean Energy can reasonably accommodate the

variations in the Facility's generation/consumption operating scenarios (Chevron Data Transmittal #47B, Rev #3; Weisz, 2014). Commercial accounts provide less than 100 MWh per year of electricity to Chevron facilities. Industrial accounts provide approximately 85,000 MWh per year of electricity to Chevron facilities. This participation in Marin Clean Energy would result in reduced overall consumption of non-renewable energy resources.

Another Project Design Feature that Chevron has committed to are two Facility water reuse projects, which would reduce East Bay Municipal Utility District water consumption and wastewater discharge, to be implemented as mitigation measures. In aggregate, they are estimated to reduce East Bay Municipal Utility District water consumption by as much as 95 million gallons per year. One project would reuse stripped sour water from the sour water concentrator at the existing sulfur recovery unit for use in the distillation and reforming area. The other project would reuse stripped sour water from the stripping plants (8 and 18 plants) for use in the South Isomax process water system. The reuse of water would result in reduced water consumption from the local water utility, thereby reducing the energy (electricity) needed to source, treat, and distribute water.

The third Project Design Feature that Chevron has committed to, and which would be implemented as a mitigation measure, is the upgrade of approximately 6,000 lighting fixtures with more efficient light-emitting diode (LED) lighting, with expected energy reductions of 2,000 MWh per year. The use of LEDs is a more efficient use of energy to create lighting for the Facility.

A fourth Project Design Feature that Chevron has committed to, and which would be implemented as a mitigation measure, is upgrading the motors that drive the 14 cooling fans in the fluid catalytic cracker cooling water tower to adjustable speed, direct drive motors. Current motors are driven by single-speed induction motors (i.e., the motor is either on or off) through right angle gearboxes. Since the cooling water tower typically operates at a fraction of its design capacity, electricity can be saved by using adjustable speed motors. The use of direct drive systems also improves energy efficiency by eliminating the losses in the mechanical translation of energy in the existing right angle gearbox assemblies. The Project Design Feature is estimated to reduce electricity consumption by 3,400 MWh per year.

In addition, increased utilization leads to increased efficiency on a "per barrel" basis. Most refining processes operate at elevated temperatures. Some of the heat used in refining processes is used to heat the process vessel to operating temperatures and to maintain the vessel at operating temperatures. Some of the heat in refining processes is used to heat the material to the operating

temperatures. Finally, for processes that consume heat (which is known as an "endothermic" process), heat is used in the process itself. The heat that is used to heat the process vessel and maintain the process vessel at temperature is the same regardless of throughput. In fact, the heat required to maintain the vessel at process temperatures decreases slightly with increased throughput (as the more hot material is going through the vessel). Therefore, the energy required per barrel to heat the process vessel decreases and therefore, process efficiency increases.

Mitigation Measure 4.6-5: None required.

4.6.5 Cumulative Impacts

CEQA Guidelines Section 15130(a) indicates that an EIR shall discuss cumulative impacts of a project when the project's incremental impact is cumulatively considerable. Where a lead agency is examining a project with an incremental impact that is not cumulatively considerable, a lead agency need not consider the impact significant, but must briefly describe the basis for concluding that the incremental impact is not cumulatively considerable.

The cumulative context for electricity and natural gas resources is the service area for PG&E, which services most of Northern California with electricity and natural gas. The cumulative context for transportation-related energy would be California, which produces CARB-approved transportation fuel (i.e., gasoline and diesel.) No significant adverse energy impacts were identified for the Modernization Project.

4.6.5.1 Cumulative Construction Impacts

The construction energy impacts analysis in *Section 4.6.4.1* showed that construction of the Modernization Project would have a less-than-significant impact to energy resources. Energy impacts from the Modernization Project during construction and startup of the Project would require short-term use of some existing energy sources. The energy consumed by future construction of the Modernization Project would take place over a period of approximately 24 months. Construction equipment and haul trucks would consume fuel and construction-related equipment such as welding machines and power tools would consume electricity. The energy consumption for construction would not represent a cumulatively considerable contribution to cumulative energy impacts because construction activities would not result in long-term depletion of nonrenewable energy resources and would not permanently increase reliance on energy resources that are not renewable. The incremental impact on energy resources would therefore not be cumulatively considerable.

4.6.5.2 Cumulative Operational Impacts

4.6.5.2.1 *Cumulative Electricity Consumption and need for New Electricity Facilities or Infrastructure*

As discussed in Impact 4.6-3, the Modernization Project would not result in substantial use of regional energy resources nor require the construction of facilities not already included in the Project. The increase in electricity consumption would be met by new electricity generation capacity at the Facility and would not lead to an increase in imported electricity. Therefore, the Project would not cause a cumulatively considerable contribution to cumulative electricity consumption nor require construction of new facilities or infrastructure to serve cumulative demand.

4.6.5.2.2 *Cumulative Natural Gas Consumption*

The Modernization Project would not change overall global consumption of natural gas. Petroleum products are produced globally in response to market demand. One of the objectives of the Modernization Project is to allow the Facility to process crude oil blends and externally sourced gas oils containing higher levels of sulfur than those currently being processed, enabling Chevron to continue producing transportation fuels and lubricant base oils in compliance with low-sulfur state and federal standards. High sulfur crude requires more energy-intensive processes in order to remove the sulfur.

Market demand for transportation fuels is not expected to decrease in the future. The use of liquid fuels for transportation would increase by an average of 1.1% per year. From 2010 to 2040 the increase is projected to be 38% (EIA, 2013b). If the Modernization Project were not to occur, then the processing of higher sulfur crude blends would remain with other refineries, or potentially move to new refineries, that can handle higher sulfur crude blends in order to meet the same demand for transportation fuels. The additional energy consumption would also shift to those other refineries in a commensurate fashion. Hence, on balance, there would be no cumulative increase in consumption of energy from the approval of the Modernization Project.

The United States Department of State recently followed a similar line of analysis in its consideration of the environmental impacts associated with the Keystone XL Pipeline. In the Final Supplemental Environmental Impact Statement (Final SEIS) for this pipeline project, the finding is made that “approval or denial of any one crude oil transport project, including the proposed [Keystone XL Pipeline], is unlikely to significantly impact the rate of extraction in the oil sands, or the continued demand for heavy crude oil at refineries in the United States (based on expected oil prices, oil-sands supply costs, transport costs, and supply demand

scenarios)" (State Department, 2014). Because the demand for crude and refining capabilities is global, the Final SEIS concluded that if the cross-border pipeline were not constructed, a trans-Canada pipeline, if constructed, would be "heavily utilized to export oil sands crude due to relatively low shipping costs to reach growing Asian markets. If new east-west and cross-border pipelines were both completely constrained, oil sands crude could reach U.S. and Canadian refineries by rail" (State Department, 2014). Therefore, the oil sands would be developed and brought to market with or without the Keystone XL Pipeline.

Following the same logic, if the Modernization Project were not constructed higher sulfur crude blends would continue to be refined elsewhere. Additionally analogous is the concept of "crude shuffling," which is also discussed in the Final SEIS for the Keystone XL Pipeline. Crude shuffling describes the potential for a refiner or supplier to "shuffle-out" of one jurisdiction a proscribed crude or refined product and "shuffle-in" a regulatory preferred product. In such an instance, there would be no change in the level of either product's use; rather, only the location where each product is used would change.[9]

In the context of low carbon fuel standards, for example, the objective is to reduce emissions of greenhouse gases by placing a standard on the carbon content of fuel production and processing lifecycle. Research, which is referenced in the Keystone Pipeline Final SEIS, suggests that the implementation of a low carbon fuel standard would not actually result in any net change in greenhouse gas emissions (Sperling and Yeh, 2009) and that the policy measure may actually result in a slight increase in greenhouse gas emissions (Barr, 2010). The reason behind this is that a producer of low carbon fuel may shuffle-in the product to markets that require low carbon fuel and shuffle-out its high carbon fuel to other jurisdictions either in the United States or elsewhere with no net change. However, if it takes additional transportation energy to move the fuels further distances, the policy would result in greater greenhouse gas emissions.

The parallel concept to the low carbon fuel standard is the No Project Alternative in which the Modernization Project is not approved. The market demand for transportation fuels would not diminish because of decision not to approve the Project, so the demand for processing higher sulfur fuels would not decrease. Thus, the higher sulfur fuels that cannot be processed by the Facility would be processed, as they are now, at other refineries.

[9] See discussion on Low Carbon Fuel Standards in Section 4.14.1.4, Greenhouse Gas Regulatory Requirements and Standards in the Final Supplemental Environmental Impact Statement for the Keystone XL Project (State Department, 2014).

Hence, the overall global consumption of energy would not be any different (and may be somewhat less) were the Modernization Project to be approved. Therefore, the Project would not result in a cumulative increase in natural gas consumption.

4.6.5.2.3 *Cumulative Need for Construction of New Natural Gas Facilities or Infrastructure*

Natural gas demand from the Modernization Project, in conjunction with reasonably foreseeable projects and regional growth, would not require construction of new facilities or infrastructure.

The 2013 Integrated Energy Policy Report estimates that the natural gas demand in California will slightly decrease by 2% overall (or 99 mmscf per day) from 2011 to 2025 in its Reference Case (CEC, 2013). While there is an expected increase in population in California, the reduced demand for natural gas can be attributed to the Renewables Portfolio Standard, which requires generation of electricity from 33% renewables by 2020, and higher overall energy efficiency within California. The increase in natural gas savings alone from renewable generation and energy efficiency programs from 2012 to 2015 is approximately 173 mmscf per day, which more than exceeds additional natural gas demand of the Modernization Project (The California Gas and Electric Utilities, 2012).

The expected increase in natural gas demand from the Facility is up to 14,189 mmscf per year (or 39 mmscf per day). Thus, the Project's increased fuel consumption would be more than offset by the overall decrease in natural gas demand and would therefore not be a cumulatively considerable contribution to overall regional demand for natural gas.

For most of California, the natural gas capacity is sufficient to meet estimated demand. In Southern California, however, there could be temporary supply constraints because of the increased natural gas demand from the closure of the San Onofre Nuclear Generating Station in 2012. However, this is not expected to impact supply in Northern California because Northern California has different primary sources of natural gas (Gas Transmission Northwest) compared to Southern California (El Paso, Transwestern, and Kern River) (CPUC, 2010).

Spare pipeline and storage capacity in California also provides a degree of flexibility to the gas system that will allow it to better respond to the changing power generation needs of the state (CEC, 2013). Thus, the demand for additional natural gas from the Modernization Project in conjunction with the forecasted demand for natural gas in California would not require construction of new facilities or infrastructure.

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4.7 GEOLOGY, SOILS, SEISMICITY, AND MINERAL RESOURCES

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) changes to relevant plans and policies, including the adoption of a new Richmond General Plan. These revisions do not change the 2008 EIR's conclusions that there are no significant adverse geology, soils, seismicity, and mineral resources impacts for the Modernization Project after compliance with applicable codes and regulations.

IMPACT SUMMARY

- The Modernization Project could expose people or structures to potential substantial adverse impacts involving seismic shaking, ground failure, or landslides, but potential impacts would be reduced to less-than-significant levels by standard regulatory controls.
- The Modernization Project would not result in substantial soil erosion or the loss of topsoil.
- The Modernization Project could be located on a geologic unit or soil that is unstable, or would become unstable, but potential impacts would be reduced to less-than-significant levels by standard regulatory controls.
- The Modernization Project could be located on expansive soil, creating substantial risks to life or property, but potential impacts would be reduced to less-than-significant levels by standard regulatory controls.
- The Modernization Project would not require the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.
- The Modernization Project would not result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State.
- The Modernization Project would not result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

4.7.1 Introduction

This section establishes the existing conditions and identifies and evaluates potential impacts related to geology, soils, seismicity, and mineral resources that could result from construction and operation of the Modernization Project. This

section establishes the existing conditions are described based on the regional geology and seismicity; considers the soils, geologic units, earthquake faults, and potential seismic hazards at the Project site; and discusses the regulatory framework that pertains to the geologic hazards, seismic hazards, and protection of soil resources. The impact analysis determines the geologic impacts based on the significance criteria and when necessary, presents appropriate measures to mitigate adverse impacts of the Modernization Project.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities that could potentially affect geology, soils, seismicity, or mineral resources. For example, as described in *Chapter 3, Project Description*, *Section 3.3,* construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

4.7.2 Setting

4.7.2.1 Regional and Project Setting

4.7.2.1.1 *Geology*

The Project site is located on the San Pablo Peninsula, which contains a steep-sided, northwest-trending ridge about 3 miles long, separating the San Francisco and San Pablo Bays. Elevations range from just over 300 feet above mean sea level at the ridge crest to at or near sea level at the San Francisco and San Pablo

Bay margin. Most of the Facility's processing operations are situated on the southeast side of the peninsula on former tidal and slough lands, much of which was filled through the 1900s for bay reclamation. These flat lying areas are generally at elevations less than 20 feet above mean sea level. The Modernization Project's remaining construction would be built mostly within the Refinery Process Area.

The Project site lies within the geologically complex region of California, which is composed of old volcanic rocks and rocks originating from an ancient sea floor that was buried and then uplifted over time to form the Coast Ranges. The San Francisco Bay lies within a broad depression within the Coast Range created from an east-west expansion between the San Andreas and the Hayward faults. Sand, silt and clay deposits, estuarine (tidal marsh), artificial fill (placed by humans for bay reclamation), underlie the bay margins. These deposits are associated with prehistoric changes in sea levels, surface water processes, and historic man-made activities.

The bedrock of the San Pablo Peninsula is sandstone with interbedded shale (Blake, et al, 1974). This rock unit is severely sheared and deformed but as evidenced by the topography, forms a resistant basement rock. To the east of the peninsula, where the Refinery Process Area is located, lies a trough with a thick sequence of alternating estuarine and alluvial sedimentary deposits. The sequence reflects the successive rise and fall of sea levels in response to glacial stage melting cycles. The most recent estuarine deposit is known as Young Bay Mud. Young Bay Mud is an unconsolidated, highly plastic, highly compressible, soft, and saturated silty clay. The upper few feet of the mud contain scattered deposits of peat. The mud mantles a northeastwardly sloping buried topography into which several steep-sided ravines have been eroded, accounting for thicknesses of Bay Mud between 5 feet and 100 feet on the eastern portions of the Project site.

Older alluvial and estuarine deposits underlie the mud. They are variable in composition, including gravels, sands, silts, and clays. They represent alluvial fans, which originate from the eastern lying hills, as well as stream-channel and marine deposits.

Beginning about the turn of the century, earth fill was used to reclaim portions of old tidal marsh land for Facility development. The fill is largely hydraulic sandy fill and rocky sandy clay.

4.7.2.1.2 *Soils*

According to the Natural Resources Conservation Service, the Project site consists of Conejo clay loam, Reyes silty clays, Millsholm loam, and Urban land (fill) (USDA, 1977). The Conejo loams consist of clay loams that originate from sedimentary rock and have a slight erosion potential. The Reyes silty clays are associated with bayland margins and have no hazard of erosion. The steeper upland areas of the Project site are mapped as Millsholm loams which can also include softer bedrock but overall have a high erosion hazard. Areas mapped as Urban land include areas filled with crushed rock adjacent to railroad yards and docks.

The Project site and vicinity are underlain by a relatively steep northeast-sloping bedrock surface, over which considerable thicknesses of clay and silt have been deposited by stream and active marine processes. Young Bay Mud has been spread over the clays, infilling the former topography. Portions of this tidal flat area have been reclaimed by filling during the growth and development of the Facility.

4.7.2.1.3 *Seismicity*

The Modernization Project lies within a region of California that contains many active and potentially active faults and is considered an area of high seismic activity (Figure 4.7-1).[1] In April 2008, scientists and engineers released a new earthquake forecast for the State of California called the Uniform California Earthquake Rupture Forecast that evaluated the probability of one or more earthquakes of Richter magnitude 6.7 or higher occurring in the San Francisco Bay Area within the next 30 years. The result of the evaluation indicated a 63% likelihood that such an earthquake event will occur in the Bay Area between 2008 and 2038 (USGS, 2008b).

Richter magnitude is a measure of the size of an earthquake as recorded by a seismograph, a standard instrument that records ground shaking at the location of the instrument. The reported Richter magnitude for an earthquake represents the highest amplitude measured by the seismograph at a distance of 100 kilometers from the epicenter. Richter magnitudes vary logarithmically with each whole number step representing a tenfold increase in the amplitude of the recorded seismic waves. Earthquake magnitudes are also measured by their moment magnitude[2] which is related to the physical characteristics of a fault

[1] See the definitions for fault activity levels under "Regional Faults" following.

[2] Moment magnitude is related to the physical size of a fault rupture and movement across a fault. Moment magnitude provides a physically meaningful measure of the size of a faulting event (CGS, 2002). The Maximum Moment Magnitude Earthquake, derived from

including the rigidity of the rock, the size of fault rupture, and movement or displacement across a fault (CGS, 2002).

Ground movement during an earthquake can vary depending on the overall magnitude, distance to the fault, focus of earthquake energy, and type of geologic material. The composition of underlying soils, even those relatively distant from faults, can intensify ground shaking. For this reason, earthquake intensities are also measured in terms of their observed impacts at a given locality. The Modified Mercalli intensity (MMI) scale (see Table 4.7-1) is commonly used to measure earthquake damage due to ground shaking. The Modified Mercalli values for intensity range from I (earthquake not felt) to XII (damage nearly total), and intensities ranging from IV to X could cause moderate to significant structural damage.[3] The intensities of an earthquake will vary over the region of a fault and generally decrease with distance from the epicenter of the earthquake.

4.7.2.1.3.1 *Regional Faults*

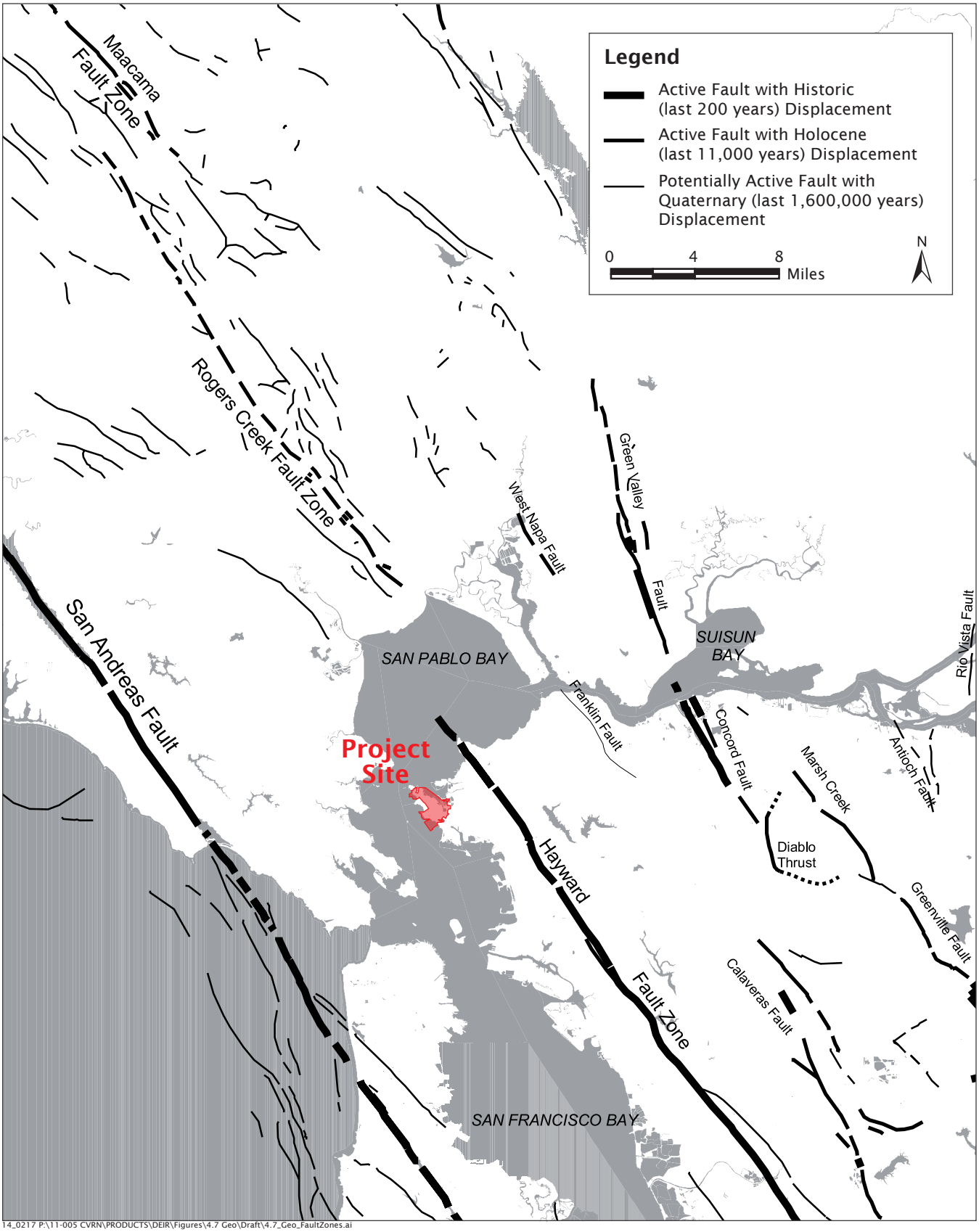
The San Francisco Bay Area is transected by a series of subparallel faults that together accommodate the relative motion between the Pacific and North American plates. The San Andreas Fault and five other significant fault zones are present in the Bay Area: the Calaveras, Concord-Green Valley, Marsh Creek – Greenville Fault, Hayward, and Rodgers Creek. Details of these significant fault zones are presented in Table 4.7-2. For the entire California region, the fault with the highest probability of generating at least one magnitude 6.7 or larger earthquake is the southern San Andreas (59% in the next 30 years). For northern California, the most likely source of such a quake is the Hayward-Rodgers Creek Fault (31% in next 30 years) (USGS, 2008b).

An "active" fault is defined by the State of California as a fault that has had surface displacement within approximately the last 11,000 years. A "potentially active" fault is defined as a fault that has shown evidence of surface displacement during the last 1.6 million years, unless direct geologic evidence demonstrates inactivity for the last 11,000 years or longer. This definition does not, of course, mean that faults lacking evidence of surface displacement are necessarily inactive. "Sufficiently active" is also used to describe a fault if there is some evidence that displacement occurred in the last 11,000 years on one or

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the joint California Geological Survey/United States Geological Survey Probabilistic Seismic Hazard Assessment for the State of California, 1996. (Peterson, et al., 1996).

[3] The damage level represents the estimated overall level of damage that will occur for various Modified Mercalli intensity levels. The damage, however, will not be uniform. Not all buildings perform identically in an earthquake. The age, material, type, method of construction, size, and shape of a building all affect its performance.



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Source: California Department of Conservation, Geological Survey (Jennings, 1994) and Chevron (T38r1)

Figure 4.7-1
Chevron Refinery Modernization Project EIR
Active and Potentially Active Bay Area Faults

TABLE 4.7-1 MODIFIED MERCALLI INTENSITY SCALE

Intensity Value	Intensity Description	Average Peak Acceleration[a] (% of gravity)
I	Not felt except by a very few persons under especially favorable circumstances.	< 0.17
II	Felt only by a few persons at rest, especially on upper floors on buildings.	0.17 – 1.4
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.	0.17 – 1.4
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	1.4 – 3.9
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.	3.5 – 9.2
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.	9.2 – 18
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken	18 – 34
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.	34 – 65
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.	65 – 124
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.	> 124
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.	> 124
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.	> 124

[a] gravity = a force equivalent to an acceleration of 980 centimeters per second squared. For example, 1.0 g of acceleration is a rate of increase in speed equivalent to a car accelerating uniformly from rest and traveling 328 feet in 4.5 seconds.

Source: USGS, 2013b.

more of its segments or branches. These faults are considered either active or potentially active. Inactive faults are those that have not shown evidence of displacement in more than 1.6 million years (Hart, 1997).

TABLE 4.7-2 ACTIVE FAULTS IN THE PROJECT SITE VICINITY

Fault	Location and Direction from Project Site	Recency of Movement	Fault Classification[a]	Historical Seismicity[b]	Maximum Moment Magnitude Earthquake[c]
Hayward	4 miles east-northeast	Pre-Historic (possible 1836; 1868 ruptures) Holocene	Active	M6.8, 1868 Many <M4.5	7.1
Concord–Green Valley	20 miles northeast	Historic (1955) Holocene	Active	Historic active creep	6.9
Rodgers Creek	15 miles north	Historic Holocene	Active	M6.7, 1898 M5.6, 5.7, 1969	7.0
San Andreas	15 miles west	Historic (1906; 1989 ruptures)	Active	M7.1, 1989 M8.25, 1906 M7.0, 1838 Many <M6	7.9
Calaveras (northern)	30 miles southeast	Historic (1861 rupture) Holocene	Active	M5.6-M6.4, 1861 M4 to M4.5 swarms 1970, 1990	6.8
Marsh Creek-Greenville	25 miles east	Historic (1980 rupture) Holocene	Active	M5.6 1980	6.9

[a] An "active" fault is defined by the State of California as a fault that has had surface displacement within approximately the last 11,000 years.

[b] Richter magnitude and year for recent and/or large events. The Richter magnitude scale reflects the maximum amplitude of a particular type of seismic wave.

[c] Moment magnitude is related to the physical size of a fault rupture and movement across a fault. Moment magnitude provides a physically meaningful measure of the size of a faulting event (CGS, 2002). The Maximum Moment Magnitude Earthquake, derived from the joint California Geological Survey/United States Geological Survey Probabilistic Seismic Hazard Assessment for the State of California, 1996. (Peterson, et al., 1996).

Sources: Jennings, 1994; Hart, 1997.

4.7.2.1.3.1.1 *San Andreas Fault*

The main trace of the San Andreas fault trends northwest through the Bay Area from the Santa Cruz Mountains and runs to the eastern side of the San Francisco Peninsula. As the principal strike-slip boundary between the Pacific plate to the west and the North American plate to the east, the San Andreas fault is often a highly visible topographic feature, such as between Pacifica and San Mateo,

where Crystal Springs Reservoir and San Andreas Lake clearly mark the rupture zone. Near San Francisco, the San Andreas fault trace is located immediately off-shore near Daly City and continues northwest through the Pacific Ocean approximately 15 miles from the Project site and 6 miles due west of the Golden Gate Bridge.

In the San Francisco Bay Area, the San Andreas Fault Zone was the source of the two major seismic events in recent history that affected the San Francisco Bay region. The 1906 San Francisco earthquake was estimated at moment magnitude 7.9 and resulted in approximately 290 miles of surface fault rupture, the longest of any known continental strike slip fault. Horizontal displacement along the fault approached 17 feet near the epicenter. The more recent 1989 Loma Prieta earthquake, with a moment magnitude of 6.9, resulted in widespread damage throughout the Bay Area.

4.7.2.1.3.1.2 *Hayward Fault*

The Hayward Fault Zone, located 4 miles east-northeast from the Project site, is the southern extension of a fracture zone that includes the Rodgers Creek Fault (north of San Pablo Bay), the Healdsburg fault (Sonoma County), and the Maacama fault (Mendocino County). The Hayward fault trends to the northwest within the East Bay, extending 60 miles from San Pablo Bay in Richmond to San Jose. The Hayward fault in San Jose converges with the Calaveras fault, a similar type fault that extends north to Suisun Bay. The Hayward fault is designated by the Alquist-Priolo Earthquake Fault Zoning Act as an active fault.

Historically, the Hayward fault generated one sizable earthquake in the 1800s.[4] In 1868, a moment magnitude 7.1earthquake on the southern segment of the Hayward Fault ruptured the ground for a distance of about 30 miles. Recent analysis of geodetic data indicates surface deformation may have extended as far north as Berkeley. Lateral ground surface displacement during these events was at least 3 feet.

A characteristic feature of the Hayward fault is its well-expressed and relatively consistent fault creep. Although large earthquakes on the Hayward fault have been rare since 1868, slow fault creep has continued to occur and has caused measurable offset. Fault creep on the East Bay segment of the Hayward fault is estimated at 9 millimeters per year (Peterson, et al., 1996). However, a large earthquake could occur on the Hayward fault with an estimated moment

[4] Prior to the early 1990s, it was thought that a Richter magnitude 7 earthquake occurred on the northern section of the Hayward Fault in 1836. However, a study of historical documents by the California Geological Survey concluded that the 1836 earthquake was not on the Hayward Fault (Bryant and Cluett, 2000).

magnitude of about 7.1 (Table 4.7-2). The United States Geological Survey (USGS) Working Group on California Earthquake Probabilities includes the Hayward–Rodgers Creek Fault Systems in the list of those faults that have the highest probability of generating earthquakes of magnitude 6.7 or greater in the Bay Area (USGS, 2008b).

4.7.2.1.3.1.3 *Calaveras Fault*

The Calaveras fault is a major right-lateral strike-slip fault that has been active during the last 11,000 years. The Calaveras fault has been the source of numerous moderate magnitude earthquakes and the probability of a large earthquake (greater than magnitude 6.7) in the next 30 years is 7% (USGS, 2008a). However, this fault is considered capable of generating earthquakes with upper bound magnitudes ranging from moment magnitude 6.6 to 6.8. The Calaveras fault is located 30 miles southeast of the Project site.

4.7.2.1.3.1.4 *Rodgers Creek Fault*

The Rodgers Creek Fault Zone is the southern segment of a fracture zone that includes the Rodgers Creek fault (north of San Pablo Bay) and the Healdsburg fault (northern Sonoma County). The southernmost portion of the Rodgers Creek fault is located 15 miles north of the Project site. The most recent significant earthquakes on the Rodgers Creek Fault Zone both occurred near Santa Rosa on October 1, 1969 (the epicenters of these earthquakes were located less than one mile northwest of the current downtown Santa Rosa area). On this date, two earthquakes of Richter magnitude 5.6 and 5.7 occurred within an 83-minute period. The highest moment magnitude of these earthquakes was 7.0. Buildings in Santa Rosa sustained serious damage during these quakes. Prior to these events, the last major earthquake (estimated Richter magnitude 6.7) was generated in 1898 with an epicenter near Mare Island at the north margin of San Pablo Bay. The California Geological Survey (CGS) estimates that the Rodgers Creek Fault Zone is capable of generating a moment magnitude 7.0 earthquake.

4.7.2.1.3.2 *Project Site Vicinity Faults*

There are no known active faults beneath the Project site. The San Pablo fault runs parallel to and along the east side of the San Pablo Peninsula but has shown no evidence of displacement in the last 1.6 million years. A trace of the inactive San Pablo fault is present on the Project site along the east edge of San Pablo Peninsula (Blake, et al, 1974); units of the Franciscan Complex rock formation are offset by the fault. The San Pablo fault runs northwesterly and its location has not been clearly defined. The nearest active fault is the Hayward fault, 4 miles to the east-northeast (see Table 4.7-2 and Figure 4.7-1 for the location of active Bay Area faults relative to the Project site). The San Pablo fault is an

inactive fault. Inactive faults with a long period of inactivity do not provide any guarantee that a considerable seismic event could not occur. Occasionally, faults classified as inactive can exhibit secondary movement during a major event on another active fault. However, it is generally accepted that inactive faults present a low potential for activity.

4.7.2.1.4 *Seismic Hazards*

4.7.2.1.4.1 *Surface Fault Rupture*

Seismically induced ground rupture is defined as the physical displacement of surface deposits in response to an earthquake's seismic waves. The magnitude, sense, and nature of fault rupture can vary for different faults or even along different strands of the same fault. Ground rupture is considered more likely along active faults, which are referenced in Table 4.7-2.

The site is not within an Alquist-Priolo Fault Rupture Hazard Zone, as designated by the Alquist-Priolo Earthquake Fault Zoning Act, and no mapped active faults are known to pass through the immediate region of the Project site. The risk of ground rupture at the Project site is low due to the absence of zoned, active fault traces at the Project site.

4.7.2.1.4.2 *Ground Shaking*

Strong ground shaking from a major earthquake could affect Richmond during the next 30 years. Earthquakes on the active faults listed in Table 4.7-2 could produce a range of ground shaking intensities at the Project site. Ground shaking may affect areas hundreds of miles distant from the earthquake's epicenter. Historic earthquakes have caused strong ground shaking and damage in the San Francisco Bay Area, the most recent being the moment magnitude 6.9 Loma Prieta earthquake in October 1989. This earthquake caused strong ground shaking for about 20 seconds and resulted in varying degrees of structural damage throughout the Bay Area, even at locations of up to 50 miles away from the epicenter.

The 1906 San Francisco earthquake, with an estimated moment magnitude of 7.9, produced moderate (MMI VII) to violent (MMI IX) shaking intensities at the Project site (ABAG, 2005a). The 1989 Loma Prieta earthquake, with a moment magnitude of 6.9, produced light (MMI V) to very strong (VIII) shaking intensities in the location of the Project site (ABAG, 2005b). According to the earthquake hazard shaking maps prepared by the Association of Bay Area Governments (ABAG), the strongest shaking at the Project site would result from an event on the North Hayward and Rogers Creek combined segments. A potential magnitude

7.1 earthquake from these combined segments would likely cause strong (MMI VII) to very violent (MMI X) shaking at the Project site (ABAG, 2014).

The common way to describe ground motion during an earthquake is with the motion parameters of acceleration and velocity in addition to the duration of the shaking. A common measure of ground motion is the peak ground acceleration. The peak ground acceleration for a given component of motion is the largest value of horizontal acceleration obtained from a seismograph. Peak ground acceleration is expressed as the percentage of the acceleration due to gravity, which is approximately 980 centimeters per second squared. In terms of automobile accelerations, one "gravity" of acceleration is a rate of increase in speed equivalent to a car accelerating uniformly from rest and traveling a total of 328 feet in 4.5 seconds. For comparison purposes, the maximum peak acceleration value recorded during the Loma Prieta earthquake was in the vicinity of the epicenter, near Santa Cruz, at 0.64 gravity. The highest value measured in the East Bay was 0.29 gravity, recorded at the Oakland Wharf near the Naval Supply Center where the soils are artificial fill overlying Bay Mud. Measurements closest to the Project site were recorded at 0.12 and 0.13 gravity (CDMG, 1990). The lowest values recorded were 0.06 gravity in the bedrock on Yerba Buena Island. However, an earthquake on the nearby Hayward fault would likely produce far more severe ground shaking at the site than was observed during the Loma Prieta earthquake.

The 2008 USGS National Seismic Hazard Maps indicate that peak ground acceleration in the Richmond area, including the Project site, could range from 0.40 to 0.60 gravity (USGS, 2008c).[5]

4.7.2.1.4.3 *Liquefaction*

Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits.

[5] The 2008 USGS National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes. (USGS, 2013a) The maps are typically expressed in terms of probability of exceeding a certain ground motion in a specified interval of time. These particular maps depict a 10% probability of being exceeded in 50 years, which is also a 90% chance that these ground motions will not be exceeded during that time. This probability level allows engineers to design buildings for larger ground motions than seismologists think will occur during a 50-year interval, making buildings safer than if they were only designed for the ground motions that are expected to occur in the 50 years.

Soil liquefaction causes ground failure that can damage roads, pipelines, underground cables, and buildings with shallow foundations. Liquefaction can occur in areas characterized by water-saturated, cohesionless, granular materials at depths less than 40 feet. In addition, liquefaction can occur in unconsolidated or artificial fill sediments located at the Project site and other reclaimed areas along the margin of San Francisco Bay. The depth to groundwater influences the potential for liquefaction in this area, in that sediments need to be saturated to have a potential for liquefaction (Helley and LaJoie, 1979).

Hazard maps produced by ABAG depict liquefaction hazards for the entire Bay Area in the event of a significant seismic event (ABAG, 2013). According to these maps, the Project site is in an area expected to have a very low to very high potential to experience liquefaction. The very low potential liquefaction corresponds to the presence of bedrock materials in the upland areas of the Project site and the very high potential to the lowland areas of the Project site with estuarine deposits and fill materials. Because of this, liquefaction related ground failure is discussed in the impacts and mitigation measures section of this chapter.

4.7.2.1.4.4 *Earthquake-Induced Settlement*

Settlement of the ground surface can be accelerated and accentuated by earthquakes. During an earthquake, settlement can occur as a result of the relatively rapid compaction and settling of subsurface materials (particularly loose, uncompacted, and variable sandy sediments above the water table) due to the rearrangement of soil particles during prolonged ground shaking. Settlement can occur both uniformly and differentially (i.e., where adjoining areas settle at different amounts). Areas underlain by artificial fill are generally susceptible to differential settlement due to their heterogeneous nature. Given the geologic setting, the Project site could be subjected to earthquake-induced settlement.

4.7.2.1.5 *Geologic Hazards*

4.7.2.1.5.1 *Expansive Soil*

Expansive soils possess a “shrink-swell” behavior. Shrink-swell is the cyclic change in volume (expansion and contraction) that occurs in fine-grained clay sediments from the process of wetting and drying. Structural damage may result over an extended period of time, usually the result of inadequate soil and foundation engineering or the placement of structures directly on expansive soils. Typically, soils that exhibit expansive characteristics comprise the upper 5 feet of the surface. The impacts of expansive soils could damage foundations of above-ground structures, paved roads and streets, and concrete slabs. Expansion and contraction of soils, depending on the season and the amount of

surface water infiltration, could exert enough pressure on structures to result in cracking, settlement, and uplift. The soils that comprise the Project site have some expansive characteristics. The Project site consists of Conejo clay loam, Reyes silty clay, Millsholm loam, and Urban land (fill), Conejo clay loam has moderate shrink-swell potential, Reyes silty clay has high shrink-swell potential, Millsholm loam has low shrink-swell potential, and Urban land is engineered to achieve uniform grade. Engineered fill has been imported to the hydrogen plant site and the sulfur removal sites.

4.7.2.1.5.2 *Landslides*

Ground failure is dependent on the slope and geology as well as the amount of rainfall, excavation, and seismic activities. A slope failure is a mass of rock, soil, and debris displaced down slope by sliding, flowing, or falling. Steep slopes and downslope creep of surface materials characterize landslide-susceptible areas. Debris flows consist of a loose mass of rocks and other granular material that, if present on a steep slope and saturated, can move down slope. The Modernization Project would be primarily located in the Refinery Process Area, which has a landslide potential of Category 3 Generally Stable to Marginally Stable. This category is areas of greater than 15% slope that are underlain by bedrock units susceptible to landsliding but not underlain by landslide deposits (City of Richmond, 2012a).

4.7.2.1.5.3 *Settlement*

Settlement can occur from immediate settlement, consolidation, shrinkage of expansive soil, and liquefaction (discussed above). Immediate settlement occurs when a load from a structure or placement of new fill material is applied, causing distortion in the underlying materials. This settlement occurs quickly and is typically complete after placement of the final load. Consolidation settlement occurs in saturated clay from the volume change caused by squeezing out water from the pore spaces. Consolidation occurs over a period of time and is followed by secondary compression, which is a continued change in void ratio under the continued application of the load.

Natural settlement typically occurs in unconsolidated deposits, such as artificial fill and Bay Mud, over time as a result of increased foundation loads and vibrations from overlying structures. Natural settlement may affect foundations, slabs and pavements. Soils tend to settle at different rates and by varying amounts depending on the load weight or changes in properties over an area, which is referred to as differential settlement. Typically, development around the bay margin where soft compressible soils are present, like those at the Project site, requires specific engineering design to account for potential settlement.

4.7.2.1.6 *Mineral Resources*

The CGS (formerly the California Division of Mines and Geology) has classified lands within the San Francisco Bay Region into Mineral Resource Zones (MRZs). The classification of MRZs is based on guidelines adopted by the California State Mining and Geology Board, as mandated by the Surface Mining and Reclamation Act of 1975 (Stinson et al., 1983). The Project site is mapped by the CGS as containing both an MRZ-1 zone, an area where no mineral deposits are present, and an MRZ-2 zone, an area where significant mineral deposits are present (Stinson et al., 1983). In general the MRZ-2 zone is limited to the upland areas of exposed bedrock while the MRZ-1 zone covers the lowland areas covered by alluvium.

4.7.2.2 Regulatory Setting

4.7.2.2.1 *Alquist-Priolo Earthquake Fault Zoning Act*

Alquist-Priolo Earthquake Fault Zoning Act (formerly the Alquist-Priolo Special Studies Zone Act) of 1972 (revised in 1994) is the State law that addresses hazards from earthquake fault zones. The purpose of this law is to mitigate the hazard of surface fault rupture by regulating development near active faults. As required by the Act, the State has delineated Earthquake Fault Zones (formerly Special Studies Zones) along known active faults in California. The Project site is not located within or near an Alquist-Priolo Earthquake Fault Zone.[6]

4.7.2.2.2 *California Building Code*

The State regulations protecting human-occupied structures from geo-seismic hazards are contained in California Code of Regulations, Title 24, Part 2 (the California Building Code [CBC]). These regulations apply to public buildings and a large percentage of private buildings in the state. All projects submitted for permit application on or after January 1, 2014 will need to show complete compliance with the 2013 CBC. City and county codes are permitted to be more stringent than the CBC, but are required to be no less stringent. The City of Richmond Building Code currently consists of the 2012 International Building Code, as amended by the 2013 CBC, and as further modified by City of Richmond amendments designed to be used in conjunction with the 2013 CBC and the 2013 California Green Building Standards Code. Applicable building codes are described further in *Section 4.13, Public Safety*.

[6] Per CEQA Guidelines, a known earthquake fault is one that has been delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42.

The following CBC chapters include provisions relevant to the Modernization Project:

- Chapter 16 of the CBC (Structural Design) deals with structural design requirements governing seismically resistant construction (Section 1604), including (but not limited to) factors and coefficients used to establish seismic site class and seismic occupancy category for the soil/rock at the building location and the proposed building design (Sections 1613 through 1615.4).
- Chapter 18 of the CBC (Soils and Foundations) includes (but is not limited to) the requirements for foundation and soil investigations (Section 1803); excavation, grading, and fill (Section 1804); allowable load-bearing values of soils (Section 1806); and the design of footings, foundations, and slope clearances (Sections 1808 and 1809), retaining walls (Section 1807), and pier, pile, driven, and cast-in-place foundation support systems (Section 1810).
- Chapter 33 of the CBC (Safeguards during Construction) includes (but is not limited to) requirements for safeguards at work sites to ensure stable excavations and cut or fill slopes (Section 3304). Section 3304.1 of the CBC includes (but is not limited to) grading requirements for the design of excavations and fills (Sections J106 and J107 of the 2013 CBC) and for erosion control (Sections J109 and J110 of the 2013 CBC) (City of Richmond, 2012b).

The 2013 amendments to the CBC and California Green Building Code went into effect January 1, 2014.

4.7.2.2.3 *Other Design Standards*

In addition to regulatory code requirements and building code standards, the Facility adheres to various industry design standards in the construction of its facilities. These standards are further described in *Section 4.13, Public Safety* and in *Appendix 4.13-PS-DET*.

4.7.2.2.4 *Seismic Hazards Mapping Act*

The Seismic Hazards Mapping Act was developed to protect the public from the impacts of strong ground shaking, liquefaction, landslides, or other ground failure, and from other hazards caused by earthquakes. This act requires the State Geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within these zones. Before a development permit is granted for a site within a Seismic Hazard Zone, a geotechnical investigation of the site must be conducted and appropriate mitigation measures incorporated into the Project

design. The Project site has not yet been evaluated by the CGS for possible designation as a Seismic Hazard Zone (CDC, 2014).

4.7.2.2.5 *City of Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan 2030), including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use, Plans, and Policies* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.7.2.2.6 *City of Richmond Municipal Code*

The City of Richmond Municipal Code Section 12.44 contains provisions for excavation and grading that require measures to control erosion. Any project that involves disturbing more than 50 cubic yards of soil is required to obtain a grading permit pursuant to the City of Richmond's grading ordinance. The permit requires the preparation of an erosion control plan.

4.7.3 Significance Criteria and Methodology

4.7.3.1 Significance Criteria

Consistent with Appendix G of the CEQA Guidelines, a project may be deemed to have a significant adverse impact on the environment with respect to geology, soils, seismicity, or mineral resources if it would:

(A) Expose people or structures to potential substantial adverse impacts, including the risk of loss, injury, or death involving:

  i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map[7] issued by the State Geologist for the area or based on other substantial evidence of a known fault;

  ii) Strong seismic ground shaking;

  iii) Seismic-related ground failure, including liquefaction; or

  iv) Landslides;

(B) Result in substantial soil erosion or the loss of topsoil;

(C) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;

[7] Refer to Division of Mines and Geology Special Publication 42.

(D) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property;

(E) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater;

(F) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state; or

(G) Result in the loss of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

4.7.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of geology, soils, seismicity, and mineral resources impacts is explained in the context of each impact, as discussed further below.

4.7.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

Review and comparison of the Modernization Project to the environmental setting clearly shows that the Project would create no impacts related to the following environmental topics listed in CEQA Guidelines Appendix G.

(B) Potential of the Project to result in substantial soil erosion or the loss of topsoil.

As stated above in the Setting section, the erosion potential for soils is variable throughout the Project site, and most of the construction for the Modernization Project, including most of the soil disturbance activity, is already complete. Typically, the soil erosion potential is reduced once the soil is graded and covered with concrete, structures, asphalt, or vegetation. Since this is the condition of the Refinery Process Area of the site, where most of the remaining construction of most of the Modernization Project would occur, erosion impacts are not anticipated.

(E) Potential of the Project to have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

The Facility is served by its own wastewater system and there would be no net increase in wastewater. There would be no septic tanks used. There would be no impact.

(F) Potential of the Project to result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

The Facility, which is considered a heavy industrial use, has operated on this site for over 100 years. Despite some potential for mineral resources to be present beneath the site, the existing Facility processing units and operations preclude access to any potential resources, and no mineral resources were identified during the construction activity that occurred prior to the 2009 court decision halting construction. The Modernization Project components would be located primarily within the Refinery Process and Tank Farm areas, that is, on land where access to mineral resources is already precluded. Additionally, the Modernization Project would not infringe upon nor deny accessibility to the potential resources of the MRZ-2 zone. Thus, the Modernization Project would have no impact on the availability of any known mineral resource that would be of value to the region and the residents of the State.

(G) Potential of the Project to result in the loss of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

The Project site is not delineated by the General Plan 2030 as a locally important mineral resource area. As stated above, the Refinery Process and Tank Farm areas of the Project site, where nearly all of the remaining construction for the Modernization Project would be completed is already dedicated to Refinery Operations. Thus, construction and operation of the Modernization Project would not result in the loss of a locally important mineral resource recovery site.

4.7.4 Impacts and Mitigation Measures

Impact 4.7-1: In the event of a major earthquake in the region, seismic ground shaking could potentially injure persons at the Project site due to structural damage of Facility structures. Ground shaking could potentially expose persons and property to seismic-related hazards, including localized liquefaction and seismically induced settlement. This impact would be less than significant due to compliance with applicable codes and regulations, and no mitigation is necessary. (LTS)

The Richmond area, including the Project site, would likely experience at least one major earthquake (greater than Richter magnitude 6.7) within the next 30 years. The intensity of such an event would depend on the causative fault and the distance to the epicenter, the moment magnitude, and the duration of shaking. The Facility is the closest Bay Area refinery to the Hayward fault. Potential damage at the Facility from a significant earthquake on the Hayward

fault could include broken piping, piping supports, ruptured tanks, and stressed support bolts, but the overall direct damage has been predicted to be minimal (CDMG, 1987). Damage from a significant earthquake on the Rodgers Creek fault is considered to be similar to that from the Hayward fault, with only modest direct damage considering the vast number of structures, tanks, and pipelines (CDMG, 1994).

Refineries are complex facilities and are, in general, conservatively designed and constructed. They consist not only of conventional buildings but also structures that are unique to the petroleum refining process. Over time, refineries undergo modifications and additions. Each phase of modification may be constructed by different groups and may occur over many years. Because seismic design standards have changed considerably over the last several decades, the seismic resistance of a given refinery may vary with the age of construction, with the newest structures and process equipment expected to perform best.

Foundation and structural designs that can withstand the level of ground shaking that could occur at the Project site are in common use today. In accordance with the CBC, every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the impacts of earthquake motions in accordance with its standards. With foundation and structural design in accordance with the current CBC standards, seismic shaking should not result in significant structural damage to Modernization Project equipment. Seismic design consistent with current professional engineering and refinery industry standards would be employed in the proposed construction for resistance to strong ground shaking, especially for lateral forces. At a minimum, the CBC requirements would be followed during design and construction of all elements of the Modernization Project. In the course of the final Facility design, the Project engineering geologist or geotechnical engineer may provide additional foundation design recommendations based on the ground conditions at the Project site. These recommendations would become part of the Modernization Project specifications.

Appropriate grading and design, in accordance with the CBC requirements and local planning department requirements, would be used to reduce the secondary impacts of ground shaking on structures and infrastructure. At the site for the new hydrogen plant, approximately 142,000 tons of soil was previously excavated to “bath tub” the site to a depth of approximately 6 feet. Then, approximately 150,000 tons of clean soil was used to uniformly refill the site. At Sulfur Removal Improvement sites (i.e., 6H2S, pipe racks, tie-ins), approximately 7,351 tons of soil was previously excavated. At the 6H2S site, approximately

7,000 tons of clean soil was then used to refill the excavation. At these sites, the new fill was compacted and engineered as directed by the Project California certified engineering geologist/geotechnical engineer. With the Modernization Project, small quantities of clean soil would be excavated to a maximum depth of 2 feet in several locations for the construction of plant equipment foundations and footings.

Between 2008 and 2009, approximately 150,453 tons of soil was excavated from the hydrogen plant and sulfur removal sites. With the Modernization Project, the total remaining volume of soil requiring excavation is estimated to be approximately 815 tons (Chevron Data Transmittal #32, 2012). (See also *Section 4.9, Hydrology and Water Quality*, for a discussion of contaminated soil associated with the Modernization Project.) New fill would be appropriately compacted and engineered as directed by the Project California certified engineering geologist or geotechnical engineer (Chevron Data Transmittal #36B, 2012).

As with the previously completed construction for the Modernization Project, a design-level geotechnical investigation would be performed for any remaining construction in each Project element site area. The Modernization Project applicant would be required to submit the design-level geotechnical report to the City of Richmond in order to obtain all required grading or construction permits. Each investigation would include an analysis of expected ground motions at the site from known active faults. The analyses would be in accordance with applicable City of Richmond ordinances and policies and consistent with the most recent version of the CBC, which requires structural design that can accommodate ground accelerations expected from known active faults. The investigations would determine final design parameters for the earthwork, foundations, foundation slabs, and any surrounding related improvements (utilities, roadways, parking lots and sidewalks). The investigations for the remaining construction would be reviewed and approved by a registered geotechnical engineer.

Mitigation Measure 4.7-1: None required.

Impact 4.7-2: Proposed construction could experience damage from expansive soils and natural and/or differential settlement or be located on geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. This impact would be less than significant due to compliance with applicable codes and regulations, and no mitigation is necessary. (LTS)

Over time, natural settlement typically occurs in unconsolidated deposits, as a result of increased foundation loads from overlying structures. Differential settlement would be a concern in areas that have been filled with non-engineered fill or are underlain by unstable soils. As discussed above, engineered fill has been imported to the new hydrogen plant site and the Sulfur Removal Improvement sites to achieve uniform grade. Therefore, the potential for natural settlement and differential settlement has been reduced with the placement of engineered fill on the new hydrogen plant site and the Sulfur Removal Improvement sites. Work in the Tank Farm Area would not involve grading, excavation, or construction of new structures and therefore would not result in natural or differential settlement, or cause unstable soils.

Proper compaction of subsurface materials and installation of an adequate foundation can minimize potential foundation or structural damage associated with settlement. As earlier discussed, the Modernization Project applicant would be required to submit a design-level geotechnical report to the City of Richmond in order to obtain all required grading or construction permits for remaining construction on the Project. This report would include estimated excavation and fill volumes, compaction standards and methods, and foundation specifications. Compliance with ASTM International soil compaction standards, the City of Richmond grading ordinance, and a structural foundation design that incorporates modern engineering standards and that is compliant with the CBC, would reduce potential settlement hazards to a less-than-significant level.

The impacts of expansive and/or unstable soils, if present, could damage foundations of aboveground structures. Surface structures with foundations constructed in expansive soils could experience expansion and contraction depending on the season and the amount of surface water infiltration. The expansion and contraction could exert enough pressure on a structure to result in cracking, settlement, and uplift. Construction in areas of unstable soils could cause or result in landslides, lateral spreading, subsidence, liquefaction, or collapse. As stated above, each Project element associated with construction would receive a site-specific geotechnical investigation. Geotechnical investigations would use standard current engineering practices and, would evaluate each site for potential expansive and unstable soils. The final geotechnical report for each site would include recommendations to mitigate any potential hazards associated with expansive and/or unstable soils, if any.

Mitigation Measure 4.7-2: None required.

4.7.5 Cumulative Impacts

The geographic area considered for the geology, soils, seismicity, and mineral resources cumulative impact analysis is the City of Richmond.

Impacts related to geology, soils, and seismicity tend to be localized and generally could not result in regionally cumulative impacts. To the extent that the proposed new facilities would be more resistant to seismic damage, the ability of the Facility to continue operation after an earthquake would be improved. As described above, the Modernization Project would not result in any significant adverse impacts related to geology, soils, and seismicity. The Richmond General Plan 2030 EIR (General Plan 2030 EIR) concludes that implementation of the General Plan 2030 would not result in any cumulative adverse impacts related to geology, soils, and seismicity, as such impacts are site-specific and generally do not combine with similar impacts that could occur with other projects in the City of Richmond or elsewhere. The General Plan 2030 EIR states that implementation of the provisions of the City of Richmond's Building Code, the National Pollutant Discharge Elimination System permit requirements, and the General Plan 2030 Safety Policies would ensure that potential site-specific geotechnical conditions and soil conditions would be addressed fully in the design of future development and that potential impacts would be maintained at less-than-significant levels (City of Richmond, 2012b). For these same reasons, the Modernization Project together with past, present, existing, pending, and reasonably foreseeable future projects, would not result in significant adverse cumulative impacts related to geology, soils, and seismicity. As a result, the Modernization Project would not contribute to any significant adverse cumulative impacts related to geology, soils, or seismicity.

Additionally, given that the Modernization Project would have no adverse impacts related to mineral resources under the Appendix G CEQA thresholds, the Modernization Project would have no cumulatively considerable impact on such resources.

See *Section 4.0, Introduction to Chapter and Methodology,* for a detailed discussion of the approach and methods of the cumulative analysis.

4.7.6 References—Geology, Soils, Seismicity, and Mineral Resources

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4.8 GREENHOUSE GASES

The Greenhouse Gases analysis in the 2008 EIR was challenged in court and is a subject of the peremptory writ issued on March 14, 2011. This Greenhouse Gases section consists of new analysis and text, and replaces the entirety of the Greenhouse Gas subsection included in the Air Quality section of the 2008 EIR.

IMPACT SUMMARY

- Construction and operation of the Modernization Project would result in increased emissions of greenhouse gases.
- Greenhouse gas emissions associated with the Modernization Project would have a significant adverse impact on the environment without implementation of Project Design Features and mitigation measures.
- With implementation of Project Design Features and mitigation measures, the Project's greenhouse gas emissions impact would achieve Chevron's objective of "no net increase" of greenhouse gases, and would be less than significant under applicable Bay Area Air Quality Management District greenhouse gas emission thresholds.
- The greenhouse gas emissions impact associated with the Modernization Project would not conflict with any adopted greenhouse gas reduction plans and policies.
- The Modernization Project, as mitigated, is therefore considered to have a less-than-significant adverse impact with respect to climate change.
- If the Modernization Project is approved, the City would achieve a net reduction in greenhouse gas emissions relative to what would be required under existing applicable laws if the Project is not approved.

4.8.1 Introduction

This section evaluates the potential impacts of the Modernization Project on climate change from both stationary and mobile sources of greenhouse gas emissions. Development of this section was based on a review of existing documentation of global, U.S., and California greenhouse gas emissions inventories, climate change regulations from the U.S. Environmental Protection Agency (EPA), the California Air Resources Board (CARB), and the Bay Area Air Quality Management District (BAAQMD), and information provided by Chevron in association with the Project.

The Modernization Project includes new equipment and modifications of existing equipment which would primarily be developed on the Project site within the

Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section, 4.3 Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Sections 4.8.4.1.2.3.1 Chevron Facility Greenhouse Gas Reductions* and *4.8.4.1.2.3.2 Funding for Community-Based Greenhouse Gas Reduction Programs*.

The 2008 EIR litigation and the writ of mandamus (Writ) and a description of the Modernization Project are discussed in *Section 3.0, Project Description* of this EIR.

4.8.1.1 General Approach

This section provides a description of the affected environment, including a discussion of the state of climate change science and the regulatory setting; identifies impacts of the Modernization Project; and recommends mitigation measures to address the impacts. The methods of emissions analysis for short-term construction and long-term operations are consistent with the current recommendations of the BAAQMD and CARB, and were developed based on extensive consultation with the BAAQMD. The Modernization Project includes Design Features, which in combination with compliance with Assembly Bill (AB) 32, assures that the Project does not exceed greenhouse gas emission levels during the 2008-2010 period, reduced by greenhouse gas adjustments scheduled to take effect prior to Project operations in 2016. These Project Design Features and mitigation measures would achieve this "no net increase" (NNI) in greenhouse gas emissions, identified by Chevron as a Project objective, assuming that the facility's utilization increases from the 89% 2008-2010 period level to the 93% Utilization Scenario. If the facility is operated at full permitted capacity (100% utilization), this EIR includes Mitigation Measures requiring Chevron to continue to achieve this NNI objective. The Modernization Project therefore has a less-than-significant impact relative to climate change.

This EIR's calculation of Baseline and Project greenhouse gas emissions includes Refinery Operations and Facility-related transportation sector (shipping, rail and trucking) activities. Because existing greenhouse gas reduction regulatory mandates separately regulate Refinery and transportation sector operations, and

do not require offsetting greenhouse gas reductions from transportation sector activities, this EIR establishes (and Chevron has agreed to) greenhouse gas reduction mandates that are more stringent than those required by existing federal and state standards.

Additionally, since Facility and Project-related activities would continue to be subject to stringent air quality and other environmental protection mandates, and products such as gasoline and diesel produced by the Facility would be used primarily for the California market, and for California cars and trucks that are among the cleanest and most energy efficient in the world, to the extent that the Modernization Project achieves its increase in facility utilization and production levels, these products would likely reduce demand for California to import petroleum products refined in areas that have less stringent greenhouse gas reduction and other environmental protection mandates. Refined products produced outside of California must also be shipped to serve the California market, and this shipping results in still more greenhouse gas emissions. Because oil extraction, refinery, and shipping activities occur in a global market, and because the Modernization Project is not expected to have any material effect on demand for petroleum products in California or other states, approval of the Modernization Project would result in the production of petroleum products resulting in lower greenhouse gas emissions than those produced in other states or nations and shipped to California.

4.8.1.2 Relationship to Air Quality Analysis

Section 4.3, Air Quality, of this EIR evaluates Project impacts on localized and regional environmental quality. Greenhouse gases differ from CAPs in that greenhouse gas emissions do not cause direct adverse human health impacts. Rather, the direct environmental impact of greenhouse gas emissions is the increase in global temperatures, which in turn has numerous indirect impacts on the environment and humans. For example, some observed climate-related changes include shrinking glaciers, thawing permafrost, later freezing, and earlier break-up of ice on rivers and lakes, a lengthened growing season, shifts in plant and animal ranges, and earlier flowering of trees (IPCC, 2001). Other, longer-term environmental impacts of global warming include sea level rise, changing weather patterns with increases in the severity of storms and droughts, changes to local and regional ecosystems including the potential loss of species, and a significant reduction in winter snow pack (for example, estimates include a 30–90% reduction in snowpack in the Sierra Nevada mountains). Current data suggest that, in the next 25 years, California would experience unprecedented heat, longer and more extreme heat waves, greater intensity and frequency of heat waves, and longer dry periods (CNRA, 2009a). This is likely to increase the risk of mortality and morbidity due to heat-related illness for the elderly;

individuals with chronic conditions such as heart and lung disease, diabetes, and mental illnesses; infants; the socially or economically disadvantaged; and those who work outdoors. The expected increase in temperatures and resulting increases in ultraviolet radiation due to climate change is likely to exacerbate existing air quality problems unless measures are taken to reduce greenhouse gases as well as air pollutants and their precursors. Many of the plans, policies, and regulations identified in *Section 4.8.2.2,* below, are directed at reducing these impacts.

This section of the EIR parallels the *Section 4.3, Air Quality,* in two respects.

First, the methodologies used to calculate greenhouse gas emissions from Project-related activities are based on the same analytical building blocks used in *Section 4.3, Air Quality*. Specifically, Project emissions are estimated by scaling Baseline emissions based on outputs of the Unit Rate Model (URM), described in *Section 4.3, Air Quality*. There are three exceptions that are specific to greenhouse gases, each made in accordance with direction from BAAQMD:

- The new hydrogen plant emissions are estimated using methodologies presented in the American Petroleum Institute (API) Greenhouse Gases Compendium (API, 2009)[1] and the combustion greenhouse gas emission methodologies required under the EPA's Mandatory Reporting Rule.
- The Baseline is based on Chevron's mandatory reporting of greenhouse gas emissions to CARB using CARB-specified methodologies, rather than the BAAQMD Emissions Inventory (EI) greenhouse gas estimates. CARB's greenhouse gas emission reports are subject to a verification process by an independent, certified auditor and are thus currently considered more accurate than the greenhouse gas emission estimation formula used in the BAAQMD EI.
- Project sources of greenhouse gas emissions are only a subset of CAP and toxic air contaminant (TAC) emissions sources. Greenhouse gases are generated primarily from fuel combustion, process sources, and fugitive emissions, whereas CAPs and TACs are generated from those sources as well as many others, as described further in *Section 4.3, Air Quality*. In short, fewer sources are included in greenhouse gas emission estimates.

Second, the vast majority of Project greenhouse gas emissions are associated with Facility activities, followed by shipping activities. Emissions from

[1] The API Greenhouse Gas Compendium is used because the BAAQMD Engineering Evaluation does not include an evaluation of greenhouse gases for the hydrogen plant.

construction activities and non-shipping transportation activities (i.e., trucks and rail transporting materials to and from the facility, respectively) are also quantified in this section, but are nominal in relation to Facility and shipping-related greenhouse gas emissions.

4.8.2 Setting

This section describes an overview of the status of global science on climate change and the scientific consensus regarding the role of anthropogenic greenhouse gas emissions in contributing to climate change and global warming. This section also describes the facility's potential contributions to global climate change within the context of global, national, state, regional, and local existing and projected greenhouse gas emissions inventories.

4.8.2.1 General Setting

This section describes climate change on a global and local scale in relation to climate change science, and climate change impacts, and greenhouse gas emissions. Additional detail can be found in *Appendix 4.8-SET*.

There is international scientific consensus that anthropogenic emissions of greenhouse gases[2]—carbon dioxide, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—have and will continue to contribute to changes in the global climate. Although there is uncertainty concerning the magnitude, rate, and ultimate impacts of this change, it is generally accepted that climate change will result in a number of substantial adverse environmental impacts.

Greenhouse gases absorb the earth's infrared radiation and re-emit a portion of the radiation back toward earth, trapping the heat in the atmosphere. The "greenhouse effect" has been occurring for as long as greenhouse gases have been present in the atmosphere and have played a key role in keeping the earth's temperature hospitable to life. Without greenhouse gases, the earth's temperature would be too cold for life to exist.

While the greenhouse effect is a natural process, there is a general scientific consensus that the current magnitude of the greenhouse effect is the result of human activity on the planet (IPCC, 2007a). This human-made, or anthropogenic,

[2] For the purposes of this analysis, the term "greenhouse gases" refers to CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—i.e., the gases regulated under AB 32 and the Kyoto Protocol of the United Nations Framework Convention on Climate Change. Although the State of California also declared nitrogen trifluoride a greenhouse gas, no nitrogen trifluoride is associated with this project; therefore, nitrogen trifluoride will not be further considered.

warming is primarily caused by increased emissions of greenhouse gases that keep the earth's surface warm. As human industrial activity has increased, atmospheric concentrations of certain greenhouse gases have grown dramatically, so more infrared radiation is re-radiated back toward the earth, causing surface heating. The Intergovernmental Panel on Climate Change's Fourth Assessment Report states that the global increase in greenhouse gases since 1750 are mainly due to human activities such as fossil fuel use, land use change (e.g., deforestation), and agriculture. While other greenhouse gases are much more potent on a pound-for-pound basis, carbon dioxide (CO_2) accounts for 85% of the global warming potential of all the greenhouse gases emitted by the United States (EPA, 2008).

Global climate change is not only expected to increase earth's surface temperature, but also increase the frequency of heat extremes, heat waves, heavy precipitation events, the areas affected by drought and by floods, tropical cyclone activity, and wildfires. Other direct impacts of global climate change are sea level rise, recession of polar ice caps, and changes in water reliability. The Intergovernmental Panel on Climate Change states that, although some people will gain and some will lose because of global climate change, the overall change will be one of social and economic losses (IPCC, 2007b).

The California Natural Resources Agency (CNRA) (CNRA, 2009a, 2009b) prepared a document that discusses the impacts of climate change upon California. The document described new projections by Massachusetts Institute of Technology modelers predicting a median probability of surface warming of 5.2 degrees (º) Celsius by the year 2100. The CNRA also emphasized "tipping elements," which bring about "abrupt changes that could push natural systems past thresholds beyond which they could not recover." These were rapid arctic sea ice melt, irreversible melting of the Greenland Ice Sheet, irreversible melting of the West Antarctic Ice Sheet, Amazon forest die-back, and intensification of El Niño southern oscillation cycles. The CNRA reported the potential impacts in California to be extreme natural events, precipitation changes, sea level rise, water supply issues, low sea ice levels, oceanic chemistry, and socio-economic.

Greenhouse gas emissions in the United States have increased by an annual average rate of 0.4% since 1990. U.S. emissions were 6.7 gigatonnes of carbon dioxide equivalent (CO_2e) in 2011 (EPA, 2013a), second only to China, whose emissions were 11.1 gigatonnes CO_2e (Joint Research Centre, European Commission, 2013). In 2011, California emitted approximately 448 million metric tonnes (MMT) of CO_2e. This is about 6.7% of the total U.S. emissions, while California is over 12% of U.S. population. CARB forecasts California's greenhouse gas emissions will reach approximately 507 MMT CO_2e by 2020 if no measures are taken to mitigate or decrease emissions (CARB, 2013a).

Total greenhouse gas emissions within the Bay Area Basin in 2007 were estimated by BAAQMD to be 95.8 MMT CO_2e. Fossil fuel combustion from transportation and the industrial/commercial sector contributed approximately 36.4%, each (BAAQMD, 2010). The BAAQMD projects that greenhouse gas emissions will increase by approximately 1.4% per year if current trends continue without mitigation (BAAQMD, 2010).

The City of Richmond's greenhouse gas inventory for 2005 estimated total greenhouse gas emissions in the City to be 5.8 MMT CO_2e. The City reported that the Facility contributed 60% of these emissions (City of Richmond, 2009).

4.8.2.2 Regulatory Setting

Climate change has relatively recently become widely recognized as a threat to the global climate, economy, and population. As a result, the climate change regulatory setting is complex and evolving. This section identifies key legislation, executive orders, and court cases related to climate change that are germane to the Project greenhouse gas emissions. The regulatory setting is described in further detail in *Appendix 4.8-REG*.

Legal and regulatory requirements, as well as other policies and initiatives, restrict greenhouse gas emissions and reduce them gradually over time. This evolving regulatory context factors into the analysis of the Baseline against which Project impacts are evaluated to make a significance determination under CEQA.

4.8.2.2.1 *Federal Regulatory Activity and Policies*

The EPA has undertaken several recent actions impacting stationary and mobile sources of greenhouse gases. The background and basis for these rulemaking activities are described in *Appendix 4.8-REG*.

Stationary sources are sources of pollutants that do not move from one location such as power plants, incinerators, and boilers. The Facility is a stationary source. Recent EPA actions pertaining to stationary sources include the Mandatory Reporting Rule and the Tailoring Rule. The U.S. Supreme Court is currently reviewing the statutory basis for the EPA's regulation of stationary sources. A decision is expected in summer of 2014. In addition, President Obama issued a Climate Action Plan in June 2013. In September 2013, the EPA issued a proposal for the first carbon pollution standards for new power plants.

Mobile sources include vehicles that operate on roads and highways (such as cars and trucks) as well as non-road vehicles, engines, and equipment (such as locomotives and construction equipment). Federal regulatory activity pertaining to mobile sources is focused on increased fuel economy through the Corporate

Average Fuel Economy standards, and harmonized reduction of greenhouse gas emissions and improved fuel economy through the EPA and National Highway Traffic Safety Administration coordinated rulemaking efforts in response to the U.S. Presidential Memorandum Regarding Fuel Efficiency Standards, dated May 21, 2010 (NHTSA, 2013).

In addition to the rules and regulations developed with respect to stationary and mobile sources, other federal developments aim to reduce greenhouse gases from other sources, including land use activities. These efforts focus on additional renewable fuel and fuel efficiency requirements, heating and cooling equipment efficiency, funding and support of green jobs and green technology, and National Environmental Policy Act analyses of greenhouse gas emissions from federal actions. The vehicles for these efforts are described in *Appendix 4.8-REG* and include the Energy Independence and Security Act of 2007, the American Recovery and Reinvestment Act of 2009[3], the Renewable Fuels Standards, and the Council on Environmental Quality Guidelines of Greenhouse Gases (Sutley, 2010).

There are also several voluntary programs developed by the EPA that provide opportunities for industry, the EPA, and other organizations in both the public and private sectors to work together to reduce greenhouse gas emissions (EPA, 2013b).

4.8.2.2.2 *State of California Provisions*

California has adopted various administrative initiatives and also enacted a variety of legislation relating to climate change, much of which sets aggressive goals for greenhouse gas emissions reductions within the state. However, no state agency has promulgated binding regulations for analyzing greenhouse gas emissions, determining their significance, or mitigating any significant adverse impacts in CEQA documents. Instead, the CEQA Guidelines amendments continue to rely on lead agencies to choose methodologies and make significance determinations based on substantial evidence (CNRA, 2009c).

The following primary regulatory acts have driven greenhouse gas regulation in California:

Executive Order S-3-05 establishes the goal of reducing greenhouse gas emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by 2050.

[3] http://www.recovery.gov/arra/About/Pages/The_Act.aspx.

Assembly Bill 32 directed CARB to set a statewide greenhouse gas emission limit based on 1990 levels, to be achieved by 2020 and set a timeline for adopting a scoping plan for achieving greenhouse gas reductions in a technologically and economically feasible manner. Based on pre-recession data, California must reduce greenhouse gas emissions by approximately 28.5% below business-as-usual predictions of year 2020 greenhouse gas emissions to achieve this goal. AB 32 milestones and key elements of the 2008 Scoping Plan are summarized in *Appendix 4.8-REG*.

In 2009, a coalition of environmental groups brought a challenge to the 2008 Scoping Plan alleging that it violated AB 32 and that the environmental review document violated CEQA. The details of the challenges and their outcome are discussed in *Appendix 4.8-REG*. During the resolution of the litigation, CARB revised its business-as-usual greenhouse gas emission estimate for 2020 to account for the recession and revised its 2020 baseline to account for mitigation measures incorporated into the inventory. As a result, achieving the 1990 emission level would now require a reduction of greenhouse gas emissions of 80 MMT CO_2e or a reduction by approximately 16% to achieve in 2020 emissions levels in the business-as-usual condition (CARB, 2011a, 2011b).

Specific measures discussed in the 2008 Scoping Plan that are relevant to the Project are listed below and discussed in detail in *Appendix 4.8-REG*:

- Cap-and-trade
- Renewable portfolio standard
- Low carbon fuel standard
- Advanced clean cars
- Heavy duty truck greenhouse gas regulation (Smartway)
- Goods movement
- Vessel speed reduction
- Freight transport efficiency
- Energy efficiency and co-benefits assessment for large industrial sources
- Refinery flare recovery process improvements
- Removal of methane exemption from existing refinery regulations

The cap-and-trade regulation imposes a decreasing cap on the total greenhouse gas emissions from covered entities in the state to help California reach its statewide goal of greenhouse gas emissions to 1990 levels by 2020. Regulated entities will be required to surrender a number of allowances equivalent to their greenhouse gas emissions in metric tons (MT) CO_2e. In general, the overall number of allowances either freely distributed or auctioned by CARB decreases through 2020, thus establishing the cap. The free allocation to refineries is determined using efficiency metrics, which allows for comparison of refineries of

differing complexity. In 2013, CARB adopted the complexity weighted barrel efficiency metric for refineries. This and other metrics are described in further detail in *Appendix 4.8-REG*.

4.8.2.2.2.1 *Other Source Specific Regulations*

State efforts to regulate greenhouse gas emissions from energy related sources are implemented through the Renewables Portfolio standard and Senate Bill (SB) 1368. The Renewables Portfolio standard requires retail sellers of electric services to increase procurement from eligible renewable energy resources to 33% of total retail sales by 2020 (CARB, 2008a).

Several state provisions address the greenhouse gas emission reduction targets set by CARB for mobile sources, including trucks, passenger vehicles, trains and ships. These measures include:

- SB 375 (Land Use Planning)
- Mobile Source Reductions (Pavley) (AB 1493)
- Low Carbon Fuel Standard (Executive Order S-01-07)
- Advanced Clean Cars Program
- SmartWay Truck Efficiency Regulation

SB 375 provides for a new planning process including Sustainable Communities Strategy in regional transportation plans (State of California, 2008). The Sustainable Communities Strategy for the San Francisco Bay Area is discussed in the Regional Provisions section below. The Low Carbon Fuel Standard will reduce greenhouse gas emissions by reducing the carbon intensity of transportation fuels used in California by at least 10% by 2020. The Low Carbon Fuel Standard applies to fuel producers, importers, and distributers, including refineries like the Facility. There are several federal lawsuits challenging the Low Carbon Fuel Standard. The status and details of these lawsuits are described in *Appendix 4.8-REG*.

Several measures address reduction of emissions from the main sources associated with port cargo handling activities, including ships, harbor craft, terminal equipment, trucks, and locomotives. These include:

- The Goods Movement Emission Reduction Program (CARB, 2013b)
- 2006 Emission Reduction Plan for Ports and Goods Movement in California (CARB, 2006)
- Goods Movement Action Plan (Caltrans, 2007).
- CARB Vessel Speed Reduction for Ocean-Going Vessels (CARB, 2009).
- Scoping Plan Measure T-6 “Freight Transport Efficiency”

4.8.2.2.2.2 *CEQA Guidelines Amendments (SB 97)*

In 2009 CEQA Guidelines amendments were adopted pursuant to SB 97. The guidelines state in Section 15064.4(a) that lead agencies should "make a good faith effort, to the extent possible on scientific and factual data, to describe, calculate or estimate" greenhouse gas emissions. Similarly, the revision to Appendix G, Environmental Checklist Form does not prescribe specific thresholds. The CEQA Guidelines amendments do not prescribe specific methodologies for performing an assessment, do not establish specific thresholds of significance, and do not mandate specific mitigation measures. The language used in the CEQA Guidelines amendments indicates that the determination of what is a significant impact on the environment should be left to the lead agency. The CEQA Guidelines amendments further indicate that lead agencies should consider feasible means, supported by substantial evidence and subject to monitoring and reporting, of mitigating the significant impacts of greenhouse gas emissions. Mitigation measures pertinent to the project are described in *Appendix 4.8-REG*. Additionally, the CEQA Guidelines amendments continue to make clear that the significance of greenhouse gas emissions is most appropriately considered on a cumulative level (CNRA, 2009d).

4.8.2.2.3 *Regional Provisions*

4.8.2.2.3.1 *BAAQMD CEQA Guidelines*

The BAAQMD is the primary agency responsible for comprehensive air pollution control in the entire San Francisco Bay Area Air Basin. The BAAQMD adopted its CEQA significance thresholds for greenhouse gas emissions on June 2, 2010, and presents these thresholds along with methods for evaluating compliance in its guidance document entitled *California Environmental Quality Act Air Quality Guidelines* (updated May 2011) (BAAQMD, 2011).

Permitted stationary source emissions of greenhouse gases are subject to a 10,000-MT-per-year significance threshold. This is based upon a determination that approximately 95% of all greenhouse gas emissions from new permit applications for stationary sources in the San Francisco Bay Area would be captured by this threshold.

The BAAQMD's 2011 CEQA Air Quality Guidelines were challenged in the case *California Building Industry Association v. Bay Area Air Quality Management District* (2012). In 2012, the Alameda County Superior Court ruled that the BAAQMD's adoption of thresholds of significance was a project under CEQA, and ordered the BAAQMD to set aside the thresholds until it complied with CEQA requirements. The BAAQMD appealed the Alameda County Superior Court's decision and, in August 2013, California's First District Court of Appeal reversed

the Superior Court decision, upholding the BAAQMD's adoption of the significance thresholds. On September 20, 2013, the California Building Industry Association filed a petition with the California Supreme Court for review of the appellate court's decision. On November 26, 2013, the California Supreme Court granted the petition for review limited to the narrow issue of the circumstances under which CEQA requires an analysis of how existing environmental conditions will impact future residents or users (receptors) of a proposed project, which does not include greenhouse gas impacts. The California Supreme Court's limitation of review to this narrow issue effectively allowed the significance thresholds for greenhouse gases to stand as upheld by the appellate court. Although lead agencies are not required to follow the BAAQMD CEQA Guidelines, most do. The City of Richmond believes the BAAQMD significance thresholds are supported by substantial evidence, and it has elected to apply the 2010 BAAQMD CEQA Guidelines and significance thresholds for purposes of the Project. The BAAQMD significance thresholds are discussed in more detail in *Section 4.8.3.2*.

4.8.2.2.3.1.1 *Stationary Source Threshold of Significance*

As described above, the 2010 BAAQMD CEQA threshold of significance for permitted stationary sources (including industrial sources such as the Chevron Facility) is 10,000 MT CO_2e per year.

4.8.2.2.3.1.2 *Cumulative Threshold of Significance*

Greenhouse gases contribute to global climate change on a cumulative basis. There is no separate BAAQMD cumulative threshold of significance for greenhouse gases; rather, if a project exceeds the above-described thresholds, it would be considered to contribute substantially to a cumulative impact and would therefore be considered to have a significant adverse impact.

4.8.2.2.4 *City Programs*

4.8.2.2.4.1 *Richmond General Plan 2030*

The City of Richmond is one of the first cities in the U.S. to include an Energy and Climate Change Element in the General Plan 2030 update. This element provides policy direction for the City to promote mitigation, sustainability, and adaptation in response to climate change. The element addresses energy conservation, reduction of climate change impacts, renewable energy production and use, responsible community revitalization, and sustainable business development (City of Richmond, 2012b). To better understand existing conditions and help develop mitigation measures tailored to the City's needs, the City prepared a citywide greenhouse gas EI, described in *Appendix 4.8-SET*. The findings and recommendations made based on the results of the inventory are incorporated into the Energy and Climate Change Element of the General Plan 2030.

Consistency with the Richmond General Plan 2030, including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.8.2.2.4.2 *Other Applicable City Regulations and Policies*

4.8.2.2.4.2.1 *City of Richmond*

The City of Richmond has taken several steps to address climate change at the local level:

- In January 2007, the City of Richmond signed onto the U.S. Mayor's Climate Protection Agreement committing to reducing greenhouse gas emissions to meet or surpass the Kyoto Protocol targets of a 7% reduction from 1990 levels by 2012 (City of Richmond, 2013a).
- On September 17, 2007, the Richmond City Council directed staff to develop a comprehensive policy to lead by example in the fight against global warming (City of Richmond, 2013a).
- On September 16, 2008, the Richmond City Council passed a resolution committing to the greenhouse gas emissions targets established by AB 32 (City of Richmond, 2008).
- In February 2009, the City of Richmond reported its first citywide greenhouse gas EI, described in *Appendix 4.8-SET*.
- The City is currently in the process of preparing a Climate Action Plan (City of Richmond, 2013b), which will outline the City's strategies and goals for reducing communitywide greenhouse gas emissions and preparing for and adapting to the impacts of climate change. The preparation of the Climate Action Plan has commenced, but has yet to be fully funded.

4.8.2.3 Facility Setting and Baseline

The major sources of emissions of greenhouse gases from Refinery Operations are stationary sources, such as furnaces and process units used to heat, chemically modify, and separate crude oil and purchased gas oils feedstock into marketable products such as gasoline, diesel, jet fuel, and lubricants. Refinery Operations also generate fugitive emissions from tanks. Emissions are also generated from combustion sources involved in the transportation of feedstocks brought into and marketable products transported from the Facility. Transportation-related combustion air emissions sources include vessels associated with marine shipping, locomotives associated with rail transport and trucks associated with roadway conveyance.

For purposes of this EIR, the Facility's greenhouse gas EI submitted to CARB under the California Mandatory Reporting Rule for Greenhouse Gas Emissions were determined to provide the most comprehensive ongoing framework for understanding emissions from Refinery Operations. The BAAQMD EI, which was used for baseline CAP and TAC emissions in *Section 4.3, Air Quality,* also includes greenhouse gas emissions. However, it was determined that the CARB EI was the most comprehensive since it was calculated using approved methodologies and was verified by an accredited third party. A detailed discussion of the use of the data from the CARB reports to estimate refinery operation emissions are included in *Appendix 4.8-BASE*. The CARB report does not include emissions of indirect greenhouse gas emissions from electricity and water use. Information on how these emissions were estimated is also found in *Appendix 4.8-BASE*.

This EIR also includes emission estimates for Facility transportation related to marine shipping, trucking, and rail activities. Emissions for shipping, trucking and rail activities were not included or analyzed in the 2008 EIR because the Modernization Project—either as originally proposed (Chevron Hydrogen and Energy Renewal Project [2008 Project]) or as currently proposed (Modernization Project)—does not include any changes to the Facility's shipping, trucking, or rail transport conveyance capabilities. Because the Writ required an assessment of potential changes to Facility throughput and variations in potential crude oil blends, this EIR includes a comprehensive analysis of transportation-related air emissions that could vary with Facility utilization levels. In general, higher Facility utilization levels generate a higher level of shipping, trucking and rail activity and associated air emissions (i.e., more transportation, and hence more transportation emissions, occur with 100% Facility utilization than 93% Facility utilization). Certain transportation levels, particularly related to shipping, also vary in accordance with the quantities of crude and purchased gas oils shipped to and processed in the Facility (see the discussion of the URM in *Appendix 4.3-URM*).

As discussed below, air emissions from Refinery Operations, marine shipping, and truck and rail activity are estimated using different data sources and analysis methods. Emissions from Refinery Operations include emissions from process unit furnaces and units, catalytic reforming, the fluid catalytic cracker, storage tanks, electricity and steam generation, and flares. The data sources and estimation methods used for estimating refinery operational emissions are summarized in more detail in *Appendices 4.3-OP* and *4.8-GOP*. Shipping emissions include emissions from combustion sources (e.g., marine and wharf equipment engines) required to deliver crude oil, gas oil and other feedstocks to and to convey products from the Facility by sea. The data sources and estimation

methods used for estimating shipping emissions are summarized in more detail in *Appendix 4.3-SHP*. Rail and truck emissions are relatively minor in scope and include emissions from combustion sources (e.g., truck and locomotive engines) required to deliver materials to and to convey products from the Facility by train and surface roads. The data sources and estimation methods used for estimating trucking and rail emissions are summarized in more detail in *Appendix 4.3-TRANS*. Baseline and Project emission levels are separately calculated and analyzed in this EIR. The Facility's total emissions, however, consist of the sum of all emissions from Refinery Operations, shipping, and truck and rail activity.

The location of the Facility is described in *Section 3.0, Project Description*.

4.8.2.3.1 *Definition of 2008-2010 Period and Baseline*

As discussed in *Section 4.3, Air Quality*, the Facility filed a revised application for the Modernization early in 2011, and the City filed its Notice of Preparation for this EIR in May of 2011.The City selected the 3 years preceding the Notice of Preparation (2008-2010) as the baseline period, rather than a single year, based on a variety of considerations, which are discussed in detail in *Appendix 4.8-BASE* and *Section 4.3, Air Quality*.

The average annual emissions during 2008-2010 were further evaluated. Consistent with the California Supreme Court in Neighbors for Smart Rail v. Exposition Metro Line Construction Authority (2013) 57 Cal.4th 439 (Smart Rail), when planned or adopted air pollution reduction legal mandates and scheduled and funded facility improvements will result in lower facility emissions in the foreseeable future, it is appropriate for an EIR to compare project impacts against the reduced emissions that will occur in the future for the facility, and not simply compare a project with what would soon become unrepresentative existing levels. As discussed in *Appendices 4.8-OP*, *4.3-SHP*, and *4.3-TRANS*, regulatory mandates and equipment changes will occur by the anticipated Modernization Project start date in January 2016 that would reduce emissions from certain Refinery Operations, marine shipping-related combustion activity, and from rail and truck use. This adjustment to the 2008-2010 emissions is considered the greenhouse gas emissions Baseline for purposes of this EIR.

This adjustment to 2008-2010 emissions is described in more detail below and in *Appendix 4.8-GOP* for Refinery Operations, *Appendix 4.3-SHP* for shipping, and *Appendix 4.3-TRANS* for rail and trucking. The following sections explain the development of Baseline greenhouse gas emissions. Additional detail is provided in *Appendix 4.8-SET*.

4.8.2.3.2 *Existing Setting: Actual Emissions During 2008-2010 Period*

This section describes Facility emissions during 2008-2010 from Refinery Operations, shipping, rail and trucking activities.

4.8.2.3.2.1 *2008-2010 Refinery Operation Emissions*

The list below summarizes the types of emissions from the main types of stationary process units and other stationary equipment at the Facility. Additional details regarding each step in the refining process are provided in *Appendix 3, Overview of Oil Refining Process*.

Most of the process equipment is fueled by refinery fuel gas and is a collection of light gases created within the Facility in various processing units and blended with natural gas. Consumption of refinery fuel gas in the process units results in greenhouse gas emissions. Certain industrial processes produce greenhouse gas emissions through chemical reactions that do not involve combustion, which are known as process emissions. The sources of greenhouse gases are:

1. Stationary combustion of natural gas and fuel gas (furnaces, turbines, thermal oxidizers, flares, etc.)
2. Process emissions
   a. Fluid catalytic cracker
   b. Hydrogen plant
   c. Catalyst regeneration
   d. Sulfur recovery unit
3. Tank emissions
4. Fugitive emissions

4.8.2.3.2.1.1 *The CARB Emissions Inventory*

The Facility reports its greenhouse gas emissions to CARB under the Mandatory Reporting Rule, which requires that certain large industrial facilities report their greenhouse gas emissions on an annual basis. Each reporting entity must certify under the penalty of perjury that the emissions statements are accurate. All CARB reports for facilities emitting greater than 25,000 MT CO_2e must also be verified by an independent third party.[4] Chevron's CARB reports for 2008-2010 are included in *Appendix 4.8-CEI*. CARB reports do not include indirect sources,

[4] While 2008 emissions were not required by CARB to undergo third-party verification, Chevron's CARB report for 2008 was verified. Third-party verification is a rigorous process that is closely monitored by CARB. Verifiers must undergo training and accreditation through CARB. Conflicts of interest between the verification body and the reporting entity must be cleared before any verification activities may commence.

shipping and other transportation emissions which are addressed in the next few sections. Additional details on estimating refinery emissions are provided in *Appendix 4.8-GOP*.

4.8.2.3.2.1.2 *2008-2010 Indirect Emissions*

Part of Facility operations are indirect emissions from water and electricity usage. These are "indirect" because the greenhouse gases are emitted elsewhere, but are a result of the operations at the Facility. Greenhouse gases associated with electricity usage are emitted at the power plants that generate electricity for the Facility. Greenhouse gases associated with water usage are also emitted at the power plants which supply electricity to facilities that pump, distribute, and treat water. The emissions estimation methodology for indirect emissions is provided in *Appendix 4.8-GOP*.

4.8.2.3.2.2 *2008-2010 Shipping Emissions*

The Facility imports crude oil, gas oil and smaller amounts of additional blendstocks and exports a portion of manufactured transportation fuels and blendstocks, via ships and barges. Similar to the air quality analysis and in consultation with BAAQMD, standardized methods for estimating shipping-related emissions were used to develop an emission inventory for shipping activities related to Chevron's Long Wharf in 2008-2010. This methodology is described in detail in *Appendix 4.3-SHP* and in a report prepared by Chevron's contractor ICF (Chevron Data Transmittal #26F, 2014).

4.8.2.3.2.3 *2008-2010 Rail and Truck Mobile Sources*

Rail and truck emissions sources comprise a small fraction of Facility emissions relative to Refinery Operations and shipping. For example, trucking and rail combined contributes less than 1% of total 2008-2010 greenhouse gas emissions. The estimation of baseline rail and trucking greenhouse gas emissions are further discussed in *Appendix 4.3-TRANS*.

4.8.2.3.3 *Baseline: Emission Estimate Adjustments as of Modernization Project Anticipated Operational Start (2016)*

As discussed above and in *Section 4.3, Air Quality*, emissions based on the CARB greenhouse gas report for Refinery Operations, and estimated from shipping, trucking and rail activity during 2008-2010, were adjusted to reflect new regulations and equipment changes scheduled to be implemented before the January 2016 anticipated start date for the Modernization Project consistent with the Supreme Court decision in Smart Rail. The adjusted 2008-2010 emissions are considered the Baseline.

As discussed in *Appendices 4.3-SHP* and *4.3-TRANS*, new regulations and equipment changes scheduled to be implemented before the January 2016 anticipated start date for the Modernization Project affect refinery operational emissions and emissions from ship, truck and rail combustion activities. For shipping, this includes Chevron's confirmed upgrades to certain ships used by the Facility. For rail, no adjustment is made because there is no change in greenhouse gas emission factors or modification to the locomotive fleet mix. Baseline trucking emission estimates reflect CARB's 2016 fleet year mix (the mix of older and newer trucks assumed to be on the road in 2016) and corresponding emission factors. These factors are further described in *Appendix 4.3-TRANS*. The factors described above ensure that emissions data for 2008-2010 accurately reflect the level of Facility Baseline emissions against which Modernization Project air quality impacts are assessed.

2008-2010 and Baseline greenhouse gas emissions for Refinery Operations, shipping, rail, and truck activities and the entire Facility are shown in Table 4.8-1.

TABLE 4.8-1 2008-2010 PERIOD AND BASELINE GREENHOUSE GAS EMISSIONS

Year	2008-2010 Period (MT CO_2e/Year)	Baseline (2016) (MT CO_2e/Year)
Facility	4,610,849	4,536,239
Electricity Usage	21,618	14,371
Water Usage	3,062	1,793
Shipping	41,333	40,910
Rail and On-Road Mobile	9,969	9,634
Total	**4,686,831**	**4,602,947**

Source: *Appendices 4.8-GOP* and *4.3-SHP*.

4.8.3 Significance Criteria and Methodology

4.8.3.1 Significance Criteria

4.8.3.1.1 *State CEQA Guidelines Appendix G Thresholds*

As described above in *Section 4.8.2.2*, the 2009 amendments to the state CEQA Guidelines do not establish specific thresholds of significance for greenhouse gas impacts. Rather, the CEQA Guidelines emphasize the lead agency's discretion to determine the appropriate methodologies and thresholds of significance consistent with the manner in which other impact areas are handled in CEQA

(CNRA, 2009c). Appendix G of the CEQA Guidelines, the Environmental Checklist Form, is often used as a basis for lead agencies' selection of significance thresholds, but it does not prescribe specific thresholds. Rather, Appendix G requires evaluating whether a project would:

(A) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant adverse impact on the environment; or

(B) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

The City of Richmond has adopted these two criteria as the significance thresholds against which the Project is evaluated. For the first criterion, the City identifies a significant adverse impact from the BAAQMD CEQA Guidelines threshold of 10,000 MT per year from a stationary source of emissions. The rationale for this threshold is further described below. For the second criterion, the City evaluated the Project against the following plans, policies, and regulations: AB 32, the CARB Scoping Plan, the state cap-and-trade program, the region's Sustainable Communities Strategy/Regional Transportation Plan (Plan Bay Area), the General Plan 2030, the City of Richmond Climate Action Plan (in development), and Executive Order S-3-05. For the Project, Chevron's Project objective is to have NNI in greenhouse gas emissions above the Baseline. Fulfilling this objective would result in a less-than-significant impact relative to both thresholds. These evaluations and statements of impacts are described in *Section 4.8.4,* below.

In addition, Section 15064.7(c) of the CEQA Guidelines amendments specifies that "[w]hen adopting thresholds of significance, a lead agency may consider thresholds of significance previously adopted or recommended by other public agencies, or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence" (CNRA, 2009c). In the case of the Project, the BAAQMD (the San Francisco Bay Area's local air pollution control agency) has established CEQA significance criteria that the City may consider when determining the significance of the Project's air emissions under the CEQA Appendix G thresholds. The BAAQMD significance criteria are described in the next section.

4.8.3.1.2 *BAAQMD Significance Thresholds*

As explained above and in *Section 4.3, Air Quality,* Appendix G of the CEQA Guidelines encourages lead agencies to rely on the specialized air quality expertise of regional air agencies such as the BAAQMD. The BAAQMD presents its thresholds of significance along with methods for evaluating compliance in its guidance document entitled California Environmental Quality Act Air Quality

Guidelines (updated May 2011) (BAAQMD, 2011). The BAAQMD's threshold of significance for evaluating the significance of greenhouse gases from industrial sources is quantitative:

- Will the project result in more than 10,000 MT CO_2e per year?

This is based upon a determination that approximately 95% of all greenhouse gas emissions from new permit applications for stationary sources in the San Francisco Bay Area would be captured by this threshold. BAAQMD determined that project emissions below this level "would not be expected to substantially conflict with existing California legislation adopted to reduce statewide greenhouse gas emissions needed to move us towards climate stabilization."

The BAAQMD does not provide a quantitative significance threshold for greenhouse gas emissions from construction. The BAAQMD recommends that the determination of significance be based on meeting AB 32 reduction goals. It also identifies specific Best Management Practices (BMPs), including: using alternative fueled (e.g., biodiesel, electric) construction vehicles/equipment of at least 15% of the fleet; using local building materials of at least 10%; and recycling or reusing at least 50% of construction waste or demolition materials. BAAQMD also identifies that sources of construction-related greenhouse gas emissions include exhaust, and recommends that the same exhaust-related measures provided for criteria air pollutants should be followed to reduce construction related greenhouse gas emissions. These measures principally include: reduced consumption of diesel fuel (i.e., reduced idling times) and reduction of construction waste (i.e., recycling or reusing construction waste and demolition materials).

The measures identified by BAAQMD are consistent with AB 32 Scoping Plan measures to reduce greenhouse gas emissions. Moreover, in the absence of a quantitative significance threshold for construction, the significance threshold for annual operational greenhouse gas emissions for stationary sources, 10,000 MT CO_2e per year, is also applied to assess the significance of annual construction greenhouse gas emissions. Unlike operational emissions, construction emissions do not occur continuously over the lifetime of a project. Rather, construction emissions are temporary emissions that are spread over the construction period. Thus, the application of the operational greenhouse gas emissions significance threshold for construction emissions is conservative because they are limited in duration. For the purposes of this EIR, Project construction emissions are presented along with the annual operational emissions in *Section 4.8.4.1,* below. The BMPs are presented as mitigation measures, below.

4.8.3.2 Impact Assessment Methodology

Greenhouse gases would be emitted as the result of Project construction activities, direct and indirect operational sources, and mobile emissions associated with the trips generated by the Project. Emissions from sources such as construction equipment, vehicles, operational refinery equipment, energy and water consumption, and water treatment are inventoried and discussed quantitatively and qualitatively. The principal greenhouse gases generated directly and indirectly by the Project are CO_2, CH_4, and N_2O. CO_2 is considered to be the most important greenhouse gas, due primarily to the large quantity of emissions produced by fossil fuel combustion, especially for the generation of electricity and powering of motor vehicles. CH_4 and N_2O are also emitted by fossil fuel combustion, though their emissions are much less significant than CO_2. CH_4 is also emitted from the biodegradation of organic wastes that can be found in typical municipal solid waste, and from industrial and agricultural sources. Details of the methods used to evaluate these emissions are described in the following sections.

4.8.3.2.1 *Approach to Analysis*

This analysis was prepared based upon a literature review that included advice for preparing CEQA climate change analyses released by the California Office of Planning and Research (OPR, 2008) as well as approaches prepared by a number of professional associations and agencies that have published suggested approaches and strategies for complying with CEQA's environmental disclosure requirements. Such organizations include the California Attorney General's Office, the United Nations and World Meteorological Organization's Intergovernmental Panel on Climate Change, CARB, the BAAQMD, the California Climate Action Team, and the Association of Environmental Professionals.

4.8.3.2.2 *Scope of Assessment*

The Project proposes certain improvements to the Facility that would enhance its flexibility to process certain fungible input commodities (i.e., higher sulfur crude oil and gas oil feedstock) that are sourced from a global market to produce other fungible output commodities that are consumed throughout California and the Western United States (e.g., gasoline, jet fuel, lubricating oils). The production and consumption of the Project's input and output commodities result in greenhouse gas emissions. For example, upstream activities associated with the exploration for, and extraction of, crude oil consumes energy that results in greenhouse gas emissions. Likewise, greenhouse gas emissions would be generated downstream from the Facility when, for example, vehicles burn gasoline produced at the facility. These upstream and downstream greenhouse gas emissions associated with the overall lifecycle of the finished consumer

product are distinct from the Project-related greenhouse gas emissions evaluated in this section and they are not appropriately considered Project impacts in this EIR, as explained below.

CEQA requires this EIR to make a good-faith effort to disclose and determine the significance of the greenhouse gas emissions that are directly and indirectly "caused by" the Project within the area which would be affected by the Project (Pub. Res. Code § 21060.5; 14 Cal. Code Regs. §§ 15064(d), 1540644.4(a)). Upstream and downstream greenhouse gas emissions, though generated in the petroleum product lifecycle, are not "caused by" the Project. Rather, such emissions are attributable to the growing (State Department, 2014, Section 1.4.2.1) and relatively price-inelastic (State Department, 2014; Cooper, 2003, p. 3) worldwide market demand for petroleum products and transportation fuels. The market demand for transportation fuels is not expected to decrease in the future. Indeed, the use of liquid fuels for transportation increases annually by an average of 1.1% (EIA, 2013). If the Modernization Project were not implemented, then, to satisfy market demand, the processing of higher sulfur crude blends would remain with other refineries, or potentially move to new refineries, that can handle higher sulfur crude blends. The upstream and downstream greenhouse gas emissions would be generated irrespective of Project approval and thus are not fairly attributed to the Project.

The U.S. State Department recently followed a similar line of analysis in its consideration of the environmental impacts associated with the Keystone XL Pipeline. In the Final Supplemental Environmental Impact Statement prepared for that project, the finding is made that "approval or denial of any one crude oil transport project, including the proposed [Keystone XL Pipeline], is unlikely to significantly impact the rate of extraction in the oil sands, or the continued demand for heavy crude oil refineries in the United States (based on expected oil prices, oil-sands supply costs, transport costs, and supply demand scenarios) (State Department, 2014, p. 4.14-5)." Because the demand for crude and refined petroleum products are global, the Final Supplemental EIS concludes that if the Keystone XL Pipeline were not constructed, other conveyances would bring Canadian tar sands oil to market to satisfy demand (State Department, 2014, p.1.4-3 and 4.14-5). Similarly, in this case, if the Modernization Project is not approved, the higher sulfur crude the Project would otherwise process would be processed elsewhere for market consumption. Thus, the upstream and downstream greenhouse gas emissions will be generated irrespective of the Project's fate and, therefore, are not "caused by" the Project.

An analogous market dynamic was predicted in *Potential Impacts of Reductions in Refinery Activity on Northeast Petroleum Product Markets*, a 2012 report prepared by the United States Energy Information Administration, the statistical

and analytical agency within the United States Department of Energy (the Refinery Report) (EIA, 2012). The Refinery Report assesses the impact of the recent closure of two Philadelphia refineries and one Caribbean export refinery on the low sulfur diesel market in the Northeast United States. The Refinery Report concludes that market demand formerly supplied by the closed refineries will be replaced by "common sources of domestic and imported supply," though such supply would likely be "brought in from longer distances" by suppliers incentivized by favorable pricing (EIA, 2012, p. 25). This conclusion demonstrates that market forces adapt to changes in the petroleum supply chain as necessary to meet market demand. Just as market forces are predicted to redirect supplies to satisfy demand formerly fulfilled by the closed refineries, if the Project is not approved, fuel products manufactured from higher sulfur feedstocks will be brought to market by other refineries and the related upstream and downstream greenhouse gas emissions will nevertheless be generated. Thus, these emissions cannot be said to be "caused by" the Project, but rather by consumer demand for a relatively price-inelastic fungible product that will be supplied by other market participants if not by the Project. Because the greenhouse gas emissions generated when these fungible products are extracted, or when they are finally consumed, will occur with or without the Modernization Project, they cannot be attributed to the Modernization Project and, per CEQA, are not appropriately considered a Project impact in this EIR.

When the California Natural Resources Agency released for public comment draft CEQA Guidelines to implement SB97, the draft guidelines included language suggesting that CEQA documents would be required take into account greenhouse emissions generated throughout the lifecycle of products that a Project might consume. This language, however, was later removed from the guidelines that were ultimately adopted. In its Final Statement of Reasons for Regulatory Action published upon adoption of the SB97 greenhouse gas guidelines, the Natural Resource Agency explained its rejection of the lifecycle analytical paradigm as follows:

> As a general matter, the term ["lifecycle"] could refer to emissions beyond those that could be considered "indirect effects" of a project as that term is defined in section 15358 of the State CEQA Guidelines. … CEQA only requires analysis of impacts that are directly or indirectly attributable to the project under consideration. In some instances, materials may be manufactured for many different projects as a result of general market demand, regardless of whether one project proceeds. Thus such emissions may not be "caused by" the project under consideration. Similarly, in this scenario, a lead agency may not be able to require mitigation for emissions that result from the manufacturing processes.

> Mitigation can only be required for emissions that are actually caused by the project. … [T]o avoid potential confusion regarding the scope of indirect effects that must be analyzed, the term "lifecycle" has been removed from [the adopted guidelines] (CNRA, 2009e, p. 71-72).

As recognized by the state agency responsible for crafting guidelines to govern CEQA implementation, upstream and downstream greenhouse gas emissions that result from third-party production and consumption of products manufactured as a result of general market demand, regardless of whether one project proceeds, cannot be attributed to, and are therefore not "caused by," that one project. It follows that the downstream and upstream greenhouse gas emissions caused when petroleum products are produced and consumed by third-parties as a result of general market demand, irrespective of Modernization Project construction and operation, are not emissions that are "caused by," and are therefore not an impact of, the Modernization Project.

Though the upstream and downstream greenhouse gas emissions associated with Facility feedstock are not Project impacts, the Facility and Project-related activities are and will continue to be subject to stringent air quality and climate change regulations, including AB 32 (The Global Warming Solutions Act of 2006), the California Cap-and-Trade Program, AB 1493 (Pavley), the Low Carbon Fuel Standard, and several other regulations described in *Section 4.8.2.3* that are specific to California and explicitly regulate and reduce greenhouse gas emissions. The Facility's finished products such as gasoline and diesel would mostly be sold within the California market, and consumed by California cars and trucks that are among the cleanest and most energy efficient in the world. Therefore, approval of the Project would result in the production of petroleum products associated with lower greenhouse gas emissions than those produced in other states or nations with greenhouse gas regulatory regimes less stringent than California and which could displace supply otherwise produced by the Facility were the Project not approved.

4.8.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

There are no aspects of the Modernization Project that would result in no impacts in relation to the CEQA Guidelines Appendix G topics regarding greenhouse gases, as listed in *Section 4.8.3.1* above. Therefore, all of the CEQA Guidelines Appendix G topics are discussed further in the sections that follow.

4.8.4 Impacts and Mitigation Measures

In accordance with CEQA, the City of Richmond as the lead agency must determine a significance conclusion for overall Project emissions. As described earlier, Appendix G of the state CEQA Guidelines provides thresholds for

evaluating whether the impact of a project would be considered significant. Impacts 4.8-1 and 4.8-2 below address the first question from Appendix G, regarding whether the project would generate greenhouse gas emissions, either directly or indirectly, that may have a significant adverse impact on the environment. Impact 4.8-3 below addresses the question of whether the Project would conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

4.8.4.1 Project Greenhouse Gas Emissions

4.8.4.1.1 *Construction Emissions*

Impact 4.8-1: Construction of the Project could result in emissions of greenhouse gas emissions exceeding 10,000 metric tons carbon dioxide equivalent (MT CO_2e) per year. However, best management practices and mitigation measures would be incorporated as applicable to reduce greenhouse gas emissions during construction to less than 10,000 MT CO_2e per year. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Project construction emissions were calculated based on the type and quantity of construction activities per phase, including construction vehicle and equipment operations, construction worker vehicular trips, soil movement activities, and demolition and debris removal activities. A detailed discussion of construction phases is presented in *Chapter 3, Project Description*. To varying degrees, these construction phases would generate greenhouse gas emissions from two main source types:

1. Off-road construction equipment.
2. On-road mobile sources such as vendor trucks, material hauling trucks, worker commuting vehicles, and worker transport vehicles.

Project construction-related greenhouse gas emission estimates were calculated using the same standard BAAQMD-approved methodologies used in *Section 4.3, Air Quality*. Specifically, the emissions were modeled and assessed using methodology from the CalEEMod land use emission estimation computer model. CalEEMod is designed to model construction emissions for land use development projects using CARB-approved emission factors models (OFFOAD and EMFAC), and allows for the input of project-specific information. This analysis used detailed construction information provided by Chevron when possible and available. Where Project-specific data were not available, default assumptions from CalEEMod were used to estimate construction emissions. Details of the calculation methodologies, data sources, and assumptions are described in *Appendix 4.3-CST*.

Construction of several components of the Project were well underway in the 2-year gap between the City's approval of the 2008 Project and the appellate court decision invalidating the EIR, vacating the City's project approvals, and halting further construction. This EIR includes both a comprehensive emission estimate for all future construction emissions and a status report for partially constructed Project components and Project-related emissions that have already occurred and will not recur. As in *Section 4.3, Air Quality*, "completed construction" refers to construction that has already occurred in 2008-2009 (in support of the 2008 Project for which Chevron requested permits from the City of Richmond in 2005 and for which Chevron was granted conditional use permits in 2008), while "future construction" refers to construction activities that have yet to occur. For this analysis, future construction is assumed to begin in 2014 and continue through 2016.[5]

Using this methodology, Project-related construction is expected to generate greenhouse gas emissions as shown in Table 4.8-2. Emissions that have already occurred as a result of partial construction of some Project components, and total Project construction greenhouse gas emissions are also included in Table 4.8-2.

TABLE 4.8-2 PROJECT CONSTRUCTION GREENHOUSE GAS EMISSIONS (INCLUDES COMPLETED AND FUTURE CONSTRUCTION AND TOTAL CONSTRUCTION EMISSIONS)

	Total ($MT CO_2e$)
Total Project Construction	40,393
Completed Construction (2008-2009)	-18,564
Future Construction (2014-2016)	21,829

Notes: Emissions from completed construction (2008-2009) is subtracted from total project construction, resulting in future construction emissions (2014-2016).
Source: *Appendix 4.3-CST.*

Construction emissions are one-time emissions in that they occur during a discrete period are not expected to occur repeatedly year after year as with operational emissions. The completed construction emissions are 18,564 MT

[5] Chevron Data Transmittal #36O Rev #3, 2014) provides equipment data for eight consecutive quarters. Because the exact start date of future construction is uncertain, the emissions analysis conservatively uses emission factors for 2014 for the first four quarters of construction, and 2015 emission factors for the last four quarters of construction.

CO_2e and the future construction emissions are 21,829 MT CO_2e, giving total Project construction emissions of 40,393 MT CO_2e.

Mitigation Measure 4.8-1: Consistent with air quality mitigation measures for construction activities, Chevron would be required to implement the following mitigation measures to reduce its Project construction emissions. Implementation of the mitigation measures would result in further reductions in greenhouse gas emissions.

1a: All vehicle speeds on unpaved roads shall be limited to 15 miles per hour (mph).

1b: Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California Airborne Toxic Control Measure, Title 13 of California Code of Regulations [CCR], Section 2485). Clear signage shall be provided for construction workers at all access points.

1c: All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.

1d: The idling time of diesel-powered construction equipment shall be limited to 2 minutes.

1e: The Project shall develop a plan demonstrating that the off-road equipment (more than 50 horsepower) to be used in construction (i.e., owned, leased, and subcontractor vehicles) would achieve a Project-wide fleet-average 20% nitrogen oxide reduction and 45% particulate matter reduction compared to the most recent CARB fleet average. Acceptable options for reducing emissions include the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available. (Several of these measures would also reduce greenhouse gas emissions.)

1f: All contractors shall be required to use equipment that meets CARB's most recent certification standard for off-road heavy duty diesel engines.

1g: Reuse and recycle construction and demolition waste (including, but not limited to, soil, vegetation, concrete, lumber, metal, and cardboard).

1h: Enforce and follow limits on idling time for commercial vehicles, including delivery and construction vehicles.

1i: Using alternative fueled (e.g., biodiesel, electric) construction vehicles/equipment on at least 15% of the fleet.

1j: Using local building materials of at least 10%.

1k: Recycling or reusing at least 50% of construction waste or demolition materials.

As described above, BAAQMD does not provide a quantitative significance threshold for greenhouse gas emissions from construction. For purposes of the Modernization Project, a significance threshold of 10,000 MT CO_2e per year is applied as described in *Section 4.8.3.1*.

As shown in Table 4.8-2 above, future construction emissions are 21,829 MT CO_2e. A year-by-year breakdown of future construction emissions is shown in Table A4.3-CST-12 in *Appendix 4.2-CST*. Construction greenhouse gas emissions in 2014 are 15,644 MT CO_2e and exceed the 10,000 MT CO_2e/year threshold. Construction greenhouse gas emissions in 2015 and 2016 are less than the 10,000 MT CO_2e/year threshold (4,301 MT CO_2e and 1,884 MT CO_2e, respectively). The higher construction emissions estimated for 2014 is consistent with the higher construction activity in the first year of construction, which includes the hydrogen plant tie-in, hydrogen plant replacement, sulfur removal improvements, existing storage tank domed roof installation, and water reuse project. In 2015, construction activity is limited to the hydrogen plant replacement and sulfur removal improvements. In 2016, the only construction activity occurring is for the demolition of the existing hydrogen plant. If after quantification of greenhouse gas reduction measures for 2014, construction emissions are shown not to be below 10,000 MT CO_2e per year, then Chevron must implement the following additional measures:

1l: For each year of Project construction, Chevron shall hire, at commercially reasonable rates and at Chevron's expense, a qualified third-party entity reasonably acceptable to the City to quantify and verify in writing whether the reductions achieved from the above described construction greenhouse gas mitigation measures for that year of Project construction adequately mitigated this potentially significant impact, which report shall be subject to City's reasonable approval. For any year of construction for which construction-related diesel emissions are not reduced to or below the 10,000-MT CO_2e per year significance threshold, Chevron shall implement one or more of the following measures in an amount sufficient to reduce construction period greenhouse gas emissions to less than significant levels:

(i) Reduce diesel emissions from other equipment at the Facility, such as a diesel-powered generator, in an amount equal to the construction-related greenhouse gas emissions in excess of 10,000 MT CO_2e per

year for any calendar year of Project construction, which reduced emission level Chevron shall maintain for the following 2 years.

(ii) Permanently retire, or retrofit from diesel to electric power, one or more Facility sources that emit more than 300 MT CO_2e per year.

Implementation of Mitigation Measure 4.8-1 above would reduce the impact to a less-than-significant level. With incorporation of construction greenhouse gas reduction measures and implementation of Mitigation Measure 4.8.1, construction greenhouse gas emissions from construction would be less than the 10,000 MT CO_2e per year threshold and therefore impacts would be less than significant.

4.8.4.1.2 *Operational Emissions*

Impact 4.8-2: Operation of the Project would result in aggregate greenhouse gas emissions exceeding the BAAQMD CEQA significance threshold of 10,000 MT CO_2e per year, and would exceed Baseline. This impact would be reduced to a less-than-significant level under CEQA, and achieve the Project objective of NNI in greenhouse gases, after mitigation (including mitigation requiring implementation of Project Design Features). (LTS after Mitigation)

Potential greenhouse gas impacts associated with Modernization Project operations were evaluated by comparing greenhouse gas emissions for a range of future scenarios with Baseline greenhouse gas emission levels. As considered for air quality impacts, operational emissions considered for greenhouse gas impacts include emissions from the refinery, shipping, trucking, and rail operations. In contrast with the air quality analysis, the greenhouse gas analysis also includes indirect emissions from electricity and water use since greenhouse gas emissions are emitted as a result of their usage, and greenhouse gas emissions have a global impact, unlike criteria air pollutants and toxic air contaminants evaluated for air quality impacts. Modernization Project greenhouse gas emissions were calculated by using an analysis tool called a URM[6] developed by independent petroleum refinery experts retained by the City. The URM estimates how Facility operations change when the Facility refines heavier or lighter crude oil blends, crude and purchased gas oil with higher and

[6] The URM also responds to the Writ, which directed the City to evaluate whether the Modernization Project would enable the Facility to refine different types and volumes of crude oil, and to evaluate potential emission consequences that might be associated with any such use. As discussed below, and in more detail in *Appendix 4.3-URM*, the URM was used to evaluate Facility operations, and operational limitations related to physical and permit constraints, for a range of very heavy, very light, high sulfur, and utilization rates ranging from 93% (higher than the 2008-2010 utilization rate of approximately 89%) up to 100% (the theoretical maximum level that, in practice, cannot feasibly be sustained).

lower sulfur content, and operates at higher or lower utilization levels than during 2008-2010. Consistent with the CAP and TAC analysis described in *Section 4.3, Air Quality,* the URM results were used to scale Baseline Refinery Operations, shipping and truck and rail emission levels to generate greenhouse gas emissions for each future scenario evaluated in this EIR. For example, if the throughput for a certain Facility processing unit increased from Baseline utilization levels by 20% in a scenario, Baseline greenhouse gas emissions for that unit were increased by 20%. As discussed below, emissions from all Facility sources (except sources unaffected by changes in Facility utilization) were calculated by scaling URM results against the Baseline in each scenario.

Similar to analyses for air quality, several Facility operational scenarios are analyzed in this EIR to evaluate potential Modernization Project greenhouse gas impacts, including the 93% and 100% Utilization Scenarios. The analysis also evaluates several other scenarios to provide additional information about potential Modernization Project greenhouse gas impacts, and, consistent with the Writ, to consider the extent to which the Modernization Project might allow the Facility to use significantly different types and volumes of crude oil blends than during 2008-2010. These scenarios are the same scenarios analyzed in *Section 4.3, Air Quality*.

The impact analysis first evaluates changes from Baseline levels under the CEQA significance criteria and the Modernization Project NNI objective (no increase in greenhouse gas emissions above Baseline levels) for the 93% Utilization Scenario, similar to the approach for CAP emissions. Then, Project Design Features and mitigation measures are identified to reduce potential greenhouse gas impacts to less-than-significant levels and to achieve the greenhouse gas NNI objective for the 93% Utilization Scenario.

Changes from Baseline CAP emissions are also evaluated for the 100% Project Crude Blend Utilization with Maximum Hydrogen Plant Production Scenario. Additional mitigation measures are identified to reduce impacts to less-than-significant levels and to achieve the greenhouse gas NNI objective in the event that the Facility greenhouse gas emissions exceed the levels associated with the 93% Utilization Scenario.

Finally, changes from Baseline greenhouse gas emissions are estimated for 17 other crude oil blends, crude oil sulfur content, and Facility utilization scenarios. The additional mitigation measures that were identified in the analysis of the 100% Utilization Scenario would also be implemented if greenhouse gas emissions exceed the levels associated with the 93% Utilization Scenario in any of these cases.

4.8.4.1.2.1 *Modernization Project Scenarios Evaluated for Air Quality Impacts*

Similar to the air quality analysis described in *Section 4.3, Air Quality*, changes from Baseline greenhouse gas emissions are estimated and impacts evaluated for 19 Modernization Project future scenarios. Consistent with *Section 4.3, Air Quality*, the 19 Modernization Project scenarios analyzed for greenhouse gas impacts are:

1. Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario
2. Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario
3. Project Crude Blend, 100% Utilization
4. Project Crude Blend, 93% Utilization
5. Most Sour Crude Blend, Max Hydrogen Production, 100% Utilization
6. Most Sour Crude Blend, Max Hydrogen Production, 93% Utilization
7. Most Sour Crude Blend, 100% Utilization
8. Most Sour Crude Blend, 93% Utilization
9. Heaviest Crude Blend, Max Hydrogen Production, 100% Utilization
10. Heaviest Crude Blend, Max Hydrogen Production, 93% Utilization
11. Heaviest Crude Blend, 100% Utilization
12. Heaviest Crude Blend, 93% Utilization
13. Lightest Crude Blend, Max Hydrogen Production, 100% Utilization
14. Lightest Crude Blend, Max Hydrogen Production, 93% Utilization
15. Lightest Crude Blend, 100% Utilization
16. Lightest Crude Blend, 93% Utilization
17. Maximum Sulfur Utilization
18. Very Heavy Crude Oil Utilization
19. Very Light Crude Oil Utilization

As shown in above, certain scenarios are evaluated assuming 93% and 100% Facility utilization. As used in this EIR, the Facility utilization rate refers to the percentage of: (1) the maximum crude unit permitted capacity (257,200 barrels per day); and (2) the maximum daily throughput limits of the five processing units though which all purchased gas oil must initially be fed (the "gas oil gateway units")[7] that is used in each scenario. A 93% Utilization Scenario assumes that 239,200 barrels per day of crude oil (93% of the permitted crude unit limit of 257,200 barrels per day) is used by the Facility and that the gas oil gateway units operate at 93% of permitted capacity. A 100% Utilization Scenario

[7] The gas oil gateway units are discussed in *Appendix 4.3-URM*, Section II.B and include the fluid catalytic cracker, FCC FHT, hydrocracker, light neutral hydrocracker, and heavy neutral hydrocracker. The URM assumes that all purchased gas oil is routed through one of these five units. The Facility's total purchased gas oil processing capacity is less than the sum of the units' throughput limits because certain of the gas oil gateway units are fed by other gas oil gateway units, by gas oil distilled from the crude unit, and by de-asphalted gas oil from the SDA unit.

assumes that 257,200 barrels per day of crude oil is used by the Facility and that the gas oil gateway units operate at 100% of permitted capacity. Additional details on throughputs in both scenarios are provided in *Section 4.3, Air Quality*.

The 93% and 100% Utilization Scenarios are Modernization Project-related cases because they include a range of Modernization Project future operations that are representative of potential crude oil blends and gas oils that could be run by the Facility at the specified utilization rates without exceeding one or more processing unit throughput limit. Utilization rates of 93% and 100% were analyzed to provide a conservative assessment of potential Modernization Project greenhouse gas impacts. Discussion on how the utilization rates of the facility and the hydrogen plant were determined is in *Section 4.3, Air Quality*.

The Maximum Sulfur, Very Heavy Crude Oil, and Very Light Crude Oil Utilization Scenarios address the Writ by considering Modernization Project operations using much heavier and much lighter crude oil than during 2008-2010. The scenarios also analyze operations assuming that the crude and gas oil feedstocks contain the maximum amount of sulfur (900 long tons per day) that the Facility would be able to process as a result of the Modernization Project. As discussed below and in more detail in *Appendix 4.3-URM*, the Facility cannot use very heavy or very light crude oil up to the existing crude unit permit capacity due to the throughput constraints of the solvent de-asphalting unit (SDA) (for very heavy crude oil) and the naphtha hydrotreater (for very light crude oil). The SDA unit and naphtha hydrotreater throughput constraints would not be increased by the Modernization Project. As a result, the Very Heavy Crude Oil and Very Light Crude Oil Utilization Scenarios indicate that Facility's total daily crude oil and purchased gas oil use, and the greenhouse gas emissions that are related to Facility activity, would be lower than the Project Crude Blend, Max Hydrogen Production 93% Utilization Scenario levels because of processing unit capacity constraints.

The following sections describe the Modernization Project scenarios used to evaluate Project Design Features and mitigation measures in more detail. Details on other scenarios can be found in *Section 4.3, Air Quality*.

4.8.4.1.2.1.1 *Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario*

This scenario assumes the Facility uses a crude oil blend with a higher sulfur content (2.5% versus 1.58% by weight[8]) and slightly lower API gravity (31.6°

[8] All crude and gas oil sulfur content percentages in this EIR refer to sulfur content by weight.

versus 33.7º), a higher sour (higher sulfur content) gas oil sulfur content (2.25% versus 1.50%), and a higher Facility utilization rate (93% versus 89%) than during 2008-2010. The scenario also assumes that the hydrogen plant replacement would operate at maximum capacity. The Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario includes a crude oil blend and sulfur content that is reasonably representative of potential crude oil blends and gas oils that could be run by the Facility consistent with Modernization Project objectives. The 93% Facility and 100% hydrogen plant utilization represent conservative operational assumptions. As a result, the Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario is used to initially analyze greenhouse gas changes from Baseline levels, and to identify mitigation that would be implemented to reduce impacts to less-than-significant levels and achieve greenhouse gas NNI Project objective.

4.8.4.1.2.1.2 *Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario*

This scenario is the same as the Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario except that the Facility is assumed to operate at a 100% utilization rate to provide a more conservative assessment. The Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario is used to identify additional mitigation that may be implemented to reduce impacts to less-than-significant levels and achieve greenhouse gas NNI Project objective if future emissions exceed the Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario levels.

Based on crude oil blend, crude and gas oil sulfur content, and Facility utilization inputs, the URM generates estimates of processing units throughput (in barrels per day, gas oil purchases (in barrels per day) hydrogen demand (in million standard cubic feet per day), and total sulfur removed from crude and gas oil (in long tons per day). The model also takes into account applicable Facility physical or permit throughput limits, including the increased hydrogen plant production, sulfur recovery, and fluid catalytic cracker feed hydrotreater (FCC FHT) processing capacity that would result from the Modernization Project. The URM is discussed in detail in *Appendix 4.3-URM*.

Except for certain Refinery Operations (described below) and electricity and water use, greenhouse gas changes from Baseline levels are estimated by scaling Baseline Facility operational results against the URM throughput or total crude oil and purchased gas oil calculations. For example, under Baseline conditions, a processing unit might generate 100 MT of greenhouse gases per year with an average throughput of 1,000 barrels per day. If the same unit processes 1,200 barrels per day in a URM scenario, greenhouse gas emissions from the unit

would increase by 20% (1,200-1,000)/1,000 barrels per day) from Baseline levels, or to 120 MT per year (100 MT + 100 MT x 20%), with this methodology. Greenhouse gas changes from Baseline levels for other Facility activities, including shipping and trucks and rail emissions, are scaled against the Facility's Baseline total daily crude oil and gas oil purchases (approximately 273,300 barrels per day). The impact assessment methodology proportionately increases or decreases Baseline shipping, truck, rail and certain other facility emissions by the amount that total daily crude oil and purchases in each URM scenario is greater or less than the Baseline level of 273,300 barrels per day taking into account transport that changes with the Project. Calculation details on greenhouse gas emissions for the Facility including indirect emissions associated with water and electricity usage are included in *Appendix 4.8-GOP*.

4.8.4.1.2.2 *Methodology for Analyzing Modernization Project Scenario Impacts*

Similar to the air quality analysis, the methodology used to analyze greenhouse gas impacts for each scenario includes the following steps:

1. Estimate Facility processing unit throughputs, total crude and purchased gas oil volumes, total sulfur recovery, and Facility demand from the hydrogen plant based on applicable crude oil, gas oil and utilization inputs to the URM (see *Appendix 4.3-URM*, Attachment 1 for a summary of the URM inputs required to analyze each scenario).
2. Calculate the applicable scaling factor for each emission source based on CARB greenhouse gas emission reports and the BAAQMD EI.
3. Calculate the greenhouse gas emissions for each of the 19 scenarios by multiplying Baseline greenhouse gas emission levels by the applicable scaling factors and URM output.
4. Characterize impacts for each scenario with reference to applicable CEQA criteria and Modernization Project NNI objective for greenhouse gas.
5. Quantify Project Design Features and identify mitigation measures as required to reduce impacts to less-than-significant levels and achieve Modernization Project NNI objective for greenhouse gas.

The following sections describe these steps in more detail.

4.8.4.1.2.2.1 *Estimating Facility Operations*

As discussed in *Appendix 4.3-URM,* Facility operations are estimated for each Modernization Project scenario by inputting applicable crude oil, gas oil and utilization information into the URM. Additional details on this process can be found in *Appendix 4.3-URM* or *Section 4.3, Air Quality*.

4.8.4.1.2.2.2 *Calculating Applicable Scaling Factors*

As discussed above, the total emissions and change from Baseline levels for each Modernization Project scenario are, in general, calculated by scaling the level of activity associated with Baseline emissions to the level of activity calculated by the URM. Scaling factors for each refinery operational, shipping, trucking and rail emissions source were developed by the City's air quality expert consultants (ENVIRON) in consultation with the BAAQMD and are discussed in detail in *Appendix 4.3-OP* for Refinery Operations, *Appendix 4.3-SHP* for shipping, and *Appendix 4.3-TRANS* for rail and trucking.

Refinery Operations' scaling factors are used by URM throughput results or total level of crude and purchased gas oil compared to the 2008-2010 period. No scaling was applied to certain sources because emissions from these sources were assumed to remain relatively constant over time, be offset by anticipated future efficiencies, and other factors summarized in *Appendix 4.8-GOP,* Table A4.8-GOP-10. Estimation of greenhouse gas emissions from electricity and water use is discussed in *Appendix 4.8-GOP*.

Baseline shipping emissions, and emissions for certain Modernization Project scenarios, including the Project Crude Blend, 100% Utilization Scenario, were provided in a report prepared for Chevron by ICF (Chevron Data Transmittal #26F, 2014) and are discussed in *Appendix 4.3-SHP*. Scaling factors for rail and truck emissions are based on the total level of crude and purchased gas oil calculated by the URM compared with the level of crude and purchased gas oil during 2008-2010. Certain truck activities were not scaled because they were related to conveyance functions that would not vary with Facility operational levels, or were scaled in a non-linear manner to more accurately reflect train or truck deployment for certain activities. More detail on scaling methods is provided in *Appendix 4.3-URM* and *Section 4.3, Air Quality*.

4.8.4.1.2.2.3 *Calculating Greenhouse Gas Emissions*

Table 4.8-3 summarizes the total greenhouse gas for the Facility, and change in greenhouse gas emissions relative to the Baseline, for each of the 19 scenarios analyzed in this EIR.

Modernization Project greenhouse gas impacts are initially analyzed for the Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario and mitigated to less-than-significant levels and to achieve Modernization Project greenhouse gas NNI objective. Impacts are then evaluated for the Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario and additional mitigation measures are identified that would be implemented if emissions

TABLE 4.8-3 FACILITY MODERNIZATION PROJECT GREENHOUSE GAS EMISSIONS BY CASE WITHOUT PROJECT DESIGN FEATURES

	Emissions (MT CO_2e/year)					
Emissions Case	Facility	Electricity and Water	Shipping	Rail and On-Road Mobile	Total	Difference from Baseline
2008-2010 Period	4,610,849	24,680	41,333	9,969	4,686,831	--
Baseline (2016)	4,536,239	16,164	40,910	9,634	4,602,947	--
Project Crude Blend, Max Hydrogen Production, 100% Utilization Scenario	5,420,481	16,341	52,170	12,717	5,501,709	898,762
Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario	5,256,496	16,220	44,057	11,753	5,328,526	725,579
Project Crude Blend, 100% Utilization	5,164,638	16,341	52,170	12,717	5,245,866	642,919
Project Crude Blend, 93% Utilization	4,877,238	16,220	44,057	11,753	4,949,268	346,321
Sourest Crude Blend, Max Hydrogen Production, 100% Utilization	5,425,956	16,341	52,021	13,042	5,507,360	904,413
Sourest Crude Blend, Max Hydrogen Production, 93% Utilization	5,263,831	16,220	47,966	12,314	5,340,331	737,384
Sourest Crude Blend, 100% Utilization	5,213,062	16,341	52,021	13,042	5,294,466	691,519
Sourest Crude Blend, 93% Utilization	4,966,436	16,220	47,966	12,314	5,042,936	439,989
Heaviest Crude Blend, Max Hydrogen Production, 100% Utilization	5,409,068	16,341	51,243	12,516	5,489,168	886,221
Heaviest Crude Blend, Max Hydrogen Production, 93% Utilization	5,246,362	16,220	47,155	11,699	5,321,436	718,489
Heaviest Crude Blend, 100% Utilization	5,170,328	16,341	51,243	12,516	5,250,428	647,481
Heaviest Crude Blend, 93% Utilization	4,921,208	16,220	47,155	11,699	4,996,282	393,335
Lightest/Max Shipping, Max Hydrogen Production, 100% Utilization	5,414,735	16,341	50,080	10,949	5,492,105	889,158
Lightest/Max Shipping, Max Hydrogen Production, 93% Utilization	5,267,539	16,220	47,883	9,758	5,341,400	738,453
Lightest/Max Shipping, 100% Utilization	4,982,567	16,341	50,080	10,949	5,059,937	456,990

TABLE 4.8-3 FACILITY MODERNIZATION PROJECT GREENHOUSE GAS EMISSIONS BY CASE WITHOUT PROJECT DESIGN FEATURES

	Emissions (MT CO_2e/year)					
Emissions Case	**Facility**	**Electricity and Water**	**Shipping**	**Rail and On-Road Mobile**	**Total**	**Difference from Baseline**
Lightest/Max Shipping, 93% Utilization	4,723,118	16,220	47,883	9,758	4,796,979	194,032
Max Sour	5,216,901	16,341	52,004	13,062	5,298,308	695,361
Max Heavy	4,914,489	16,341	37,224	10,525	4,978,579	375,632
Max Light	4,596,660	16,341	50,730	10,449	4,674,180	71,233

Source: *Appendix 4.8-GOP*.

exceed the Project Crude Blend, Max Hydrogen Production, 93% Utilization Scenario levels.

4.8.4.1.2.2.4 *Characterizing Impacts for Each Scenario*

Impacts are characterized for the 93% Utilization Scenario and the 100% Utilization Scenario against CEQA significance thresholds in *Section 4.8.4.1.2.3* and *Section 4.8.4.1.2.4* below, respectively.

4.8.4.1.2.2.5 *Identifying Mitigation Measures*

Mitigation measures are identified for both the 93% Utilization Scenario and the 100% Utilization Scenario in the next two sections.

4.8.4.1.2.3 *Impact of 93% Utilization Scenario*

Project greenhouse gas emissions at the 93% Utilization Scenario, without Project Design Features, are summarized in Table 4.8-4.

Operational emissions include emissions from the Refinery Operations, shipping, rail and on-road mobile sources, and indirect sources associated with the delivery of electricity and water to the Facility.

Similar to CAP and TAC emissions described in *Section 4.3, Air Quality*, the URM calculations show that Project greenhouse gas emissions increase primarily due to increased Facility utilization, as compared with 2008-2010 throughput. Greenhouse gas emissions also increase with increased usage of the hydrogen plant. Increased Facility utilization requires additional fuel combustion and also results in additional process greenhouse gas emissions, therefore resulting in greater overall greenhouse gas emissions. Changes in the sulfur content of the crude oil also affect greenhouse gas emissions. The technical details are explained in more detail in *Section 4.3, Air Quality* and *Appendix 4.3-URM.*

There are energy efficiency improvements in the FCC FHT and the new hydrogen plant. These energy efficiency improvements allow for some additional throughput without requiring additional consumption of fuel, which would reduce greenhouse gas emissions. The new hydrogen plant would employ pressure swing adsorption technology for the purification stage of hydrogen production. The pressure swing adsorption technology enables the hydrogen plant to use about 20% less gas to produce the same amount of hydrogen, compared the existing hydrogen plant. A power recovery turbine would be installed as part of the Sulfur Removal Improvements to generate power to operate equipment at the Facility. The recovery of the energy from elsewhere in the Facility would contribute to reduced fuel consumption. These energy efficiency improvements are included in Project emissions in the form of fuel gas

TABLE 4.8-4 AGGREGATE OPERATIONAL PROJECT GREENHOUSE GAS EMISSIONS WITHOUT PROJECT DESIGN FEATURES (UTILIZATION RATE OF FACILITY AT 93% AND HYDROGEN PLANT AT 100%)

	Project Annual Operational (MT CO_2e/Year)	Baseline (2016) (MT CO_2e/Year)	Difference (Project-Baseline) (MT CO_2e/Year)
Facility	5,256,496	4,536,239	720,257
Indirect (Electricity, Water)	16,220	16,164	56
Shipping	44,057	40,910	3,147
Rail and On-Road Mobile	11,753	9,634	2,119
Total	**5,328,526**	**4,602,947**	**725,579**

Source: *Appendices 4.8-GOP* and *4.3-SHP.*

consumption projections, where reductions in fuel gas also result in reductions in greenhouse gas emissions.

As a Project objective, Chevron has committed to NNI in greenhouse gas emissions for Chevron's 93% and 100% Utilization Scenarios. This NNI objective reduces greenhouse gas emissions to below the BAAQMD CEQA significance threshold of 10,000 MT CO_2e per year, described in *Section 4.8.3.1*. Therefore, by adopting the NNI Project objective, Chevron has made a Project commitment that goes beyond what CEQA requires.

As will be discussed in detail below, in the 93% Utilization Scenario, the Project (including Project Design Features) would be consistent with the NNI Project objective and with adopted greenhouse gas reduction plans and programs through the implementation of Facility greenhouse gas reductions, funding the Community Greenhouse Gas Reduction Programs, and primarily through purchasing cap-and-trade allowances and funding the Clean Air Improvement Fund.

The following Project Design Features, of which cap-and-trade allowances are the largest contributor, are included in the Project.

4.8.4.1.2.3.1 *Chevron Facility Greenhouse Gas Reductions*

Chevron would implement several Project Design Features within the Facility and related Chevron operations to reduce greenhouse gas emissions. The measures include water conservation, light-emitting diode (LED) lighting retrofits, Marin Clean Energy participation, and fluid catalytic cracker cooling water tower motor

upgrades. The minimum amount of greenhouse gas reductions to be achieved by these Project Design Features is 1,312 MT CO_2e/year. All reductions would be monitored for verification.

The water conservation measures would reuse stripped sour water in the distillation and reforming area and the South Isomax area. The reuse of water in these areas would result in greenhouse gas emission reductions of 109 MT CO_2e per year. LED lighting retrofits of approximately 6,000 lighting fixtures would result in greenhouse gas emission reductions of 339 MT CO_2e per year. Participation in Marin Clean Energy would reduce greenhouse gas emissions by 0.3 MT CO_2e per year for commercial accounts and 288 MT CO_2e per year for industrial accounts (assuming industrial account participation in the Marin Clean Energy Program is practicable). Upgrading the motors that drive the fluid catalytic cracker cooling water tower to be more energy efficient would reduce greenhouse gas emissions by 576 MT CO_2e per year. *Appendix 4.8-GOP* has more details on how the conservative greenhouse gas emission reductions were estimated.

Air quality impacts of construction of the water conservation measures, LED installations and fluid catalytic cracker motor upgrades are discussed in *Appendix 4.3-CST*. The aesthetic impact of LED lighting is discussed in Section *4.1, Aesthetics, Visual Quality, Light, and Glare*, and the water impact of the water conservation measures is discussed in the *Section 4.9, Hydrology and Water Quality*. Participation in Marin Clean Energy would not result in any direct physical impacts to the environment.

4.8.4.1.2.3.2 *Funding for Community-Based Greenhouse Gas Reduction Programs*

Chevron would fund community-based greenhouse gas reduction programs (CGRPs) to be selected and administered by the City of Richmond, with input from community stakeholders in the City and North Richmond, and Chevron, as described below. Potential CGRPs are identified below and further described in *Appendix 4.8-CGRP*. Further CGRPs may also be identified in the future. For planning purposes, reductions of 5,500 MT CO_2e per year for a period of 10 years, commencing at the start of Project operations, are evaluated.[9] Should greenhouse gas annual reductions from the CGRP fall short of this planning level, Chevron has agreed to purchase additional cap and trade allowances as needed to achieve its NNI Project objective.

[9] 5,500 MT CO_2e per year corresponds to the increase in indirect, shipping, rail, and on-road emissions at the 93% Utilization Scenario from Baseline as these emissions are not covered under the cap-and-trade regulation.

To fund the selected CGRPs, Chevron would deposit $3 million annually for 10 years with the City, with the initial payment due at the commencement of Modernization Project construction. The City would draw upon this amount to administer and fund the implementation of the CGRPs. City administrative costs would not exceed 15% of the cost of the CGRPs implemented on an annual basis.

Several criteria were considered in evaluating the CGRPs from which the City may select for implementation:

- **Cost effectiveness** – The cost effectiveness of measure in terms of cost per MT of greenhouse gas emission reductions. Certain measures are more cost effective (i.e., require less money to achieve a certain amount of greenhouse gas reductions) while other measures can be less cost effective (i.e., require more money to achieve a certain amount of greenhouse gas reductions).
- **Local job creation** – The potential for a measure to create or maintain quality local jobs. Jobs are created from construction activities (e.g., energy efficiency retrofit work, installation of solar systems), increased recycling and composting activities, and tree planting and park maintenance activities. In addition, when residents save on energy costs this could translate into additional money to be spent in the community and the creation of additional local jobs.
- **Local greenhouse gas emission reductions** – The magnitude of greenhouse gas emission reductions to be achieved locally through implementation of the measure. Local greenhouse gas emission reductions tend to bring co-benefits to the community compared to greenhouse gas emission reductions that occur remotely.
- **Community health co-benefits** – The potential for a measure to improve community health by improving outdoor and indoor air quality (e.g., from reduced criteria air or toxic air pollutant emissions) and by promoting increased physical activity (e.g., walking or biking).
- **Community wealth and resilience** – The potential for a measure to create community wealth and resilience (e.g., by reducing energy costs for residents, or enhancing the value of homes or other structures).
- **Other environmental sustainability enhancements** – The potential for a measure to enhance other types of environmental sustainability (e.g., waste diversion to recycling and compost bins, reduced fuel consumption, reduced energy consumption) or provide other environmental co-benefits (e.g., urban greening, habitat creation, improved groundwater quality).

- **Accurate Metric/Verifiable** – The availability of accurate metrics to measure and verify greenhouse gas reductions achieved through implementation of the measure.
- **Magnitude of greenhouse gas reductions available** – The magnitude of local greenhouse gas emissions available to be reduced through implementation of the measure.
- **Leveraging potential** – The potential for leveraging of additional resources (e.g., funds, labor, etc.) for further greenhouse gas emission reductions through program enhancements or expansions.

The CGRPs considered include:

- **Urban Forestry** – Enhance tree planting programs on private property, City parks and City streets. Environmental program benefits include improved air quality and prevention of heat island impacts. Greenhouse gas emissions are reduced through sequestering CO_2 and decreased building energy use due to shading impacts.
- **Zero Waste Programs** – The City has an opportunity to increase the waste diversion percentage from its current 52% to 75% by 2020. This could be achieved by implementing cost effective programs such as free recycling bins to businesses and residents, and providing technical assistance and outreach services to facilitate recycling and composting. Benefits include local job creation and enhanced environmental sustainability.
- **Residential Energy Efficiency Rebate** – Provide home weatherization services and other home performance energy efficiency rebates to incentivize homeowners to improve the energy efficiency on their homes by the state's goal of 40%. Benefits include creating community wealth and resilience through less spending on utilities, local job creation, improved public health, and enhanced environmental sustainability.
- **Commercial Energy Efficiency Rebate** – Provide energy efficiency rebates to Richmond businesses to incentivize energy efficiency upgrades. The rebates would be structured to increase proportionally with greater energy reductions. Benefits include local job creation and decreased dependence on non-renewable sources of energy.
- **Residential Solar Rebate** – Provide solar rebates to incentivize homeowners to install photovoltaic (PV) panels on rooftops. Residents may leverage rebates from the state and the Marin Clean Energy program to make solar more cost competitive. Benefits include local job creation and decreased dependence on non-renewable sources of energy.

- **Commercial Solar Rebate** – Provide solar rebates to incentivize Richmond businesses to install PV panels. The rebates would be structured to increase proportionally with greater PV installation. Benefits include local job creation and decreased dependence on non-renewable sources of energy.
- **Pedestrian Plan and Bicycle Master Plan Implementation** – Implement bicycle and pedestrian improvements identified in the Pedestrian Plan and Bicycle Master Plan to encourage transportation via bicycle or walking rather than by car. Special attention would be made to focus these improvements in Priority Development Areas, areas expected to accommodate growth, near public transit. Benefits include improved public health through physical activity, contribution to community wealth and resilience through less spending on vehicle fuel, improved public health through fewer vehicle emissions, and decreased dependence on non-renewable sources of energy.
- **Electric Vehicles** – Encourage the purchase of electric vehicles by providing rebates to residents and businesses that install electric vehicles charging stations and/or provide direct rebates for the purchase of electric vehicles. Benefits include contribution to community wealth and resilience through less spending on vehicle fuel, improved community health through fewer vehicle emissions, and decreased dependence on non-renewable sources of energy.
- **Ride Share/Green Transportation** – Encourage the availability of low-greenhouse gas transportation alternatives, such as acquiring an electric bus and charging station for the City, and providing funding to support car-share and shuttle services. Benefits include contribution to community wealth and resilience through less spending on vehicle fuel, improved community health through fewer vehicle emissions, and decreased dependence on non-renewable sources of energy.
- **Bicycle Program** – Develop a bicycle share program that allows for residents to rent bicycles by the hour. Bicycles could be picked up and dropped off at designated secure stations. Benefits include improved public health through physical activity, contribution to community wealth and resilience through less spending on vehicle fuel, improved air quality through fewer vehicle emissions, and decreased dependence on non-renewable sources of energy.
- **Transit Access** – Encourage participation in reduced cost, group purchased, monthly public transportation access (e.g., reduced cost Clipper Card). Benefits include contribution to community wealth and resilience through less spending on vehicle fuel, improved community health through fewer vehicle emissions, and decreased dependence on non-renewable sources of energy. Fund transit stop improvements.

- **Wetlands Creation** – Purchase and restoration of tidal wetlands in Richmond. Benefits include creation of habitats for plant and animal species, stormwater runoff mitigation, erosion control, and improved aesthetics.
- **Chevron Solar Project (2 megawatts [MW])** – Construct a 2-MW ground-mounted PV solar facility on approximately 13 acres of Chevron property, comprised of approximately 7,800 PV solar panels, each rated at 295 watts. It would be located adjacent to Castro Street near the intersection with Richmond Parkway (Chevron Data Transmittal #43, 2013), as shown in Figure 4.8-1. The use of this property for solar power generation would constitute a beneficial re-use of a brownfield site. The projected energy output would be 3,800 megawatt-hours per year, which would supply the northern California electrical grid (Chevron Data Transmittal #69, 2014). This would constitute a reduction of approximately 644 MT CO_2e per year from non-renewable power generation using conservative emission factors.[10] Greenhouse gas emission reductions could be as high as 1,629 MT CO_2e per year depending on how PG&E reduces its greenhouse gas intensity to meet the Renewables Portfolio standard. This could be partially funded by the CGRP in an amount not to exceed $100,000. The difference would be funded directly by Chevron or other solar project developer.
- **Climate Action Plan Implementation** - Additional reduction measures identified in the City of Richmond Climate Action Plan when the plan is finalized, consistent with the prioritization criteria.

Table 4.8-5 provides estimates of reductions from the CGRPs given an illustrative distribution of $30,000,000 across the programs over time. A description of all CGRPs along with a corresponding quantification of emission reduction estimates, is included in *Appendix 4.8-CGRP*.

4.8.4.1.2.3.2.1 *Environmental Impacts of CGRP Implementation*

CEQA requires that the potentially significant adverse environmental impacts of Project Design Features, as well as mitigation measures, also be considered, and mitigated to the extent feasible. Chevron would be required to fund, and the City would be required to implement, the CGRP as noted below. There are 12 CGRP measures identified that, if implemented, would occur primarily outside the Facility, and one—the Chevron Solar Project—that would occur within the Project site. For purposes of evaluating the environmental impacts of each measure, these measures have been grouped into the following categories: (1) measures

[10] This was conservatively calculated using an emission factor projected for 2016 (370 pounds per megawatt-hour) and the CH_4 and N_2O emission factors reported by CARB (PG&E, 2013; CARB, 2010).



2/22/2014 U:\Chevron Renewal\ENVIRON Files\Report\Figures\DEIR Figures\GHG\Figure 4.8-1 Solar Project.mxd

Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T38 r1 and T43)

Figure 4.8-1
Chevron Refinery Modernization Project EIR
Potential Location of 2-MW Solar Facility

TABLE 4.8-5 ESTIMATED EMISSION REDUCTIONS FROM CGRPS IN THE FIRST YEAR (HYPOTHETICAL BUDGET SPREAD)

Program	Annual Greenhouse Gas Emission Reduction ($MT CO_2e$)[1]
Urban Forestry	130
Zero Waste Programs	2,047
Residential Energy Efficiency Rebate	265
Commercial Energy Efficiency Rebate	903
Residential Solar Rebate	27
Commercial Solar Rebate	108
Pedestrian and Bicycle Master Plan Implementation	3,351
Electric Vehicles	1,039
Ride Share/Green Transportation	590
Bicycle Program	307
Transit Access	360
Wetlands Creation	11
Chevron Solar Projects	229
Total	**9,367**

Note: The emission reductions shown in this table are estimated emissions in the first year assuming funds are spread evenly across all programs. Emission reductions in subsequent years are expected to increase.
Source: *Appendix 4.8-CGRP*.

with no significant adverse impacts requiring further mitigation; and (2) measures resulting in potentially significant adverse impacts requiring mitigation. These two categories are discussed in the sections below.

4.8.4.1.2.3.2.1.1 *Measures with No Significant Adverse Impacts Requiring Further Mitigation*

A. Transportation Measures

Five transportation-related measures are designed to reduce single-occupancy private automobile trips and greenhouse gases from vehicles miles traveled:

1. Pedestrian Plan and Bicycle Master Plan Implementation

Implementing the Pedestrian Plan and Bicycle Master Plan, approved with a Mitigated Negative Declaration in 2011, to reduce greenhouse gas emissions from automobile use and achieve co-benefits including improved localized air quality, encouraging exercise and related health benefits, encouraging economic activities along pathways, and reducing crime. Plan implementation activities already covered on a programmatic level in the Mitigated Negative Declaration, which is hereby incorporated by reference, would result in no significant adverse impacts beyond those considered and mitigated in the approved Mitigated Negative Declaration (City of Richmond, 2011). Specific projects identified in the Pedestrian Plan and Bicycle Master Plan may need to be further evaluated for environmental impacts.

2. Rebates for Electric Vehicle and Electric Charging Station

Implementation of the Electric Vehicle and Electric Charging Station Rebate program would reduce vehicle-generated greenhouse gas emissions by providing rebates to residents for the purchase of electric vehicles, and to residents and businesses for the installation of electric vehicle charging stations. Co-benefits of this measure include improved localized air quality, lower overall energy usage, economic benefits for local residents receiving rebates and incurring lower operational fueling costs for electric vehicles, and economic benefits to local residents and customers of local businesses incurring lower operational fueling costs due to increased access to charging stations.

The Electric Vehicle Rebate measure would not result in any physical changes to the local environment, since electric cars are and will continue to be sold at automobile dealerships. Payment of a rebate would not result in any significant adverse impacts requiring mitigation.

The Electric Charging Station Rebate program would likewise not result in any physical changes to the local environment, since charging stations are currently being installed in Richmond residents and business locations, although the availability of a rebate may encourage more residents and businesses to install such charging stations. The charging stations themselves are very minor modifications to existing facilities (e.g., in or adjacent to garage or carpool spaces, or parking lots), and are required to comply with applicable building and electric codes to assure public safety and avoid creating temporary construction-related nuisance conditions (e.g., by avoiding excess noise or blocking street access). Permitting, including inspections, will assure also the absence of any localized conditions of concern (e.g., substandard electric wiring). Compliance with these applicable codes reduces potential adverse impacts to less-than-significant levels, and no mitigation is required.

3. Subsidize Ride Share and Shuttle Services

The Ride Share Program would fund low-greenhouse gas transportation alternatives such as linking individuals with similar schedules and destinations to facilitate ridesharing, and providing subsidies for a local shuttle vehicle or acquiring an electric bus. Greenhouse gas reductions occur because individual trips in personal vehicles are eliminated as residents use the shuttles or buses. Co-benefits of this measure include improved local air quality, reduced traffic congestion, and economic benefits to shuttle riders who can avoid more costly transportation options such as private automobile or taxi use. No potentially significant environmental impacts would result from implementation of a rideshare program, or funding a shuttle service that would use existing roads within the City.

4. Bicycle Program

Under the Bicycle Program, the City would purchase or lease bikes, and provide for designated areas for bike storage, to increase the number and convenience of bicycles available to Richmond residents for routine, localized trips (e.g., to local employers, schools, and retailers). Greenhouse gas reductions would occur because individual trips in personal vehicles are eliminated as residents use bicycles. Co-benefits are similar to the implementation of the Pedestrian Plan and Bicycle Master Plan, and include improved localized air quality, enhanced health, and reduced crime. Community program bicycles would be stored, and made available for rental, at existing retail or parking areas. No new bike paths would be constructed as part of this program.

5. Subsidize Transit Services

This measure would provide for discounted transit service “Clipper Cards” for City residents, reducing transit costs for Bay Area Rapid Transit and AC Transit bus trips. Greenhouse gas reductions would occur because this would further incentivize lower-cost transit usage relative to higher cost private automobile usage, and reduce vehicle miles traveled from avoided private automobile trips. Co-benefits would include improvements to localized air quality, reduced congestion, and increased wealth to city residents spending less on transportation services. This measure would have no potential adverse impact on the physical environment, and no mitigation is required.

B. Energy Efficiency Rebate Measures

The second group of CGRP measures involves providing rebates to Richmond residents and businesses that agree to improve energy efficiency, or generate solar energy, from residential and business structures. The rebate programs would not result in any direct physical impacts to the environment, but would likely increase the number of Richmond structures that are retrofitted with these

energy-related technologies - and expand green technology employment opportunities for those selling and installing these technologies. Rebates would be offered for:

1. Energy efficiency Improvements for residences, including for example replacing single-paned windows with double-paned windows, adding insulation to walls and attic spaces, and installing more energy- and water-efficient replacements for major appliance and fixtures.
2. Energy efficiency improvements for commercial structures, which would provide Richmond businesses with the same range of energy efficiency improvements provided to residents.
3. Rooftop solar power generation installations for residences, including PV solar panels or other passive solar generating technologies suitable for residential (single- and multi-family) structures.
4. Rooftop and/or parking lot solar power generation installations for commercial users, including PV solar panels or other passive solar generating technologies suitable for commercial structures.

Each of these measures would involve providing a financial incentive for completing minor modifications to existing structures. The availability of a rebate is intended to increase technology retrofits, but the rebate does not itself create an independent new environmental impact. These minor retrofits would be required to comply with electric and building codes to assure public safety, would be required to comply with permitting and related requirements during construction to avoid excess noise or adverse localized traffic impacts from construction equipment, and would be required to obtain permits with corresponding inspection requirements to assure that there were no localized potential problems such as substandard electrical wiring and to assure that these energy-related technologies were properly installed and operating.

Rooftop solar power generation installations may have impacts to aesthetics. The General Plan 2030 (City of Richmond, 2012a) acknowledges that the City is an "evolving urban environment where change is the only constant, including for example: the evolving emphasis on green technology, renewable energy, sustainable practices…" The General Plan 2030 further states that the changing visual character is protected by its ongoing evolution and implementation of adopted policies and standards. Therefore, the impacts to aesthetics are considered less than significant.

C. Zero Waste Program

The Zero Waste Program is intended to further reduce the amount of greenhouse gas emissions generated at local landfills by continuing programs to encourage Richmond businesses and residents to increase diversion of waste from landfill disposal to recycling and composting. The programs under this measure would, for example, provide funding for indoor recycling bins and compost bins, outreach materials, cart stickers, technical assistance, and multi-lingual trainings. Co-benefits of this measure include improving green business practices, encouraging Richmond residents to develop a zero-waste lifestyle, and creating local jobs from staff time required to manage additional recycling and composted materials. No new recycling or composting facilities are proposed as part of this program, and efforts to reduce waste volumes going to landfill and facilitate recycling and composting are already underway. No environmental impacts would be caused by enhanced funding of these activities.

D. Urban Forestry

Planting appropriate (drought-resistant, non-invasive) trees in city parks, in city rights-of-way, and on private residential and commercial properties would sequester CO_2 and thereby lower atmospheric levels of greenhouse gas. Co-benefits of this measure include improved air quality,[11] improved stormwater quality, local job creation from tree planting and maintenance, improved aesthetics and quality of life, increased property values, and reduced crime. Urban forestry activities would be phased in over time, and would result in temporary construction-related activities and temporary enhanced irrigation and water utilization. These are consistent with routine landscaping and maintenance activities, and would not cause any significant adverse impacts to the environment.

4.8.4.1.2.3.2.1.2 *Measures Resulting in Potentially Significant Adverse Impacts Requiring Mitigation*

Two categories of measures – wetlands creation and utility-scale renewable energy facility construction such as the Chevron 2MW solar PV project – involve more extensive physical construction activities over larger areas, and would require mitigation to reduce potentially significant adverse impacts to less-than-significant levels. Generally, these categories of measures would require further site-specific review, and processing under CEQA. One of these potential measures, the 2-MW solar facility to be constructed within the Chevron Facility, is

[11] Trees such as redwood, deodar cedar, live oak, and oleander have been shown to reduce airborne concentrations of particulate matter and TACs (BAAQMD, 2012).

considered in sufficient detail in this EIR to allow for implementation without further CEQA review.

A. Wetlands Creation

Creation of tidal or vernal pools, or other types of wetlands, sequesters CO_2 and thus lowers amounts of greenhouse gases in the atmosphere. Co-benefits of this measure would generally include creation or enhancement of habitat for plant and animal species; improved water quality (e.g., wetlands help filter contaminants from stormwater, and can serve as a buffer to improve water quality to larger adjacent surface water bodies such as the Bay); flood protection and management; sea level rise resiliency and wave attenuation; and erosion control. Wetlands can also improve water storage from groundwater infiltration, and provide new or enhanced recreational and natural land community resources. Wetlands creation activities generally occur on a larger scale, with temporary construction and permanent changes to land forms, on open space lands. Wetlands creation activities may also result in the need for additional permits from federal or state wildlife and water protection agencies, and hazardous materials management agencies. Site-specific information is required to adequately assess and mitigate the potential impacts associated with this measure. For example, dredging during wetland creation could have impacts on hydrology and water quality and biological resources. This measure could be implemented without potentially adverse environmental impacts to fund feasibility, design and impact studies, complete CEQA and agency permitting processes, and fund open space land acquisition that may potentially be suitable for wetland creation activities. Actually creating new wetlands would not be an authorized use of funding until the site-specific CEQA and agency permitting processing was completed.

B. Utility-Scale Renewable Energy Facility Construction

Similar to wetland creation, the construction of larger utility-scale renewable energy facilities (2 MW or larger) could have potentially significant adverse impacts requiring further study and evaluation under CEQA, and the details of those studies and roster of appropriate mitigation measures would vary based on site-specific considerations. It is also possible that some environmental impacts for some project sites, or some types of renewable energy generating technology, would result in significant unavoidable impacts.

One such utility-scale renewable energy facility that provides an illustrative context for the types of impacts requiring consideration for utility-scale renewable energy facilities, which has been proposed by Chevron as a CGRP, is a 2-MW solar PV facility (solar facility) to be located on an existing 13-acre area of the Project site adjacent to Castro Street, as shown in Figure 4.8-1. This area

currently encompasses a capped landfill, fertilizer catchment and waste impoundment basins and is bisected by Herman's Slough. Impacts of the solar facility are described below, and this Chevron solar facility is considered in sufficient detail in this EIR to allow for implementation without further CEQA review.

Aesthetics, Visual Quality, Light, and Glare

The site for the 2-MW solar facility would be located adjacent to Castro Street, in an area only viewable to drivers traveling along that street. The solar facility site is an open area, lined on the southeast side with shrubs that limit views of the solar facility site from public vantage points (though there are few breaks in the vegetation that would allow drivers to see some portion of the site).

As discussed in *Section 4.1, Aesthetics, Visual Quality, Light, and Glare*, there are no scenic vistas or scenic highways in the vicinity of the Project site. The solar facility would not be visible in a designated scenic vista and would not be visible from a scenic highway. Therefore, there is no impact on scenic vistas or scenic resources within a scenic highway. The area is generally industrial in character. While the solar field would be visible from certain areas of the East Bay hills, the solar field is consistent with the already-existing industrial character of the Facility. The solar facility would result in an incremental change to the visual character but, because of the industrial nature of the area, this would be less-than-significant adverse impact. The impacts related to light and glare would be less-than-significant because there are many existing sources of both light and glare in the area and the solar facility would not be easily visible from the road. No need for mitigation would be anticipated.

Agricultural Resources

There is no prime farmland, unique farmland, or farmland of statewide importance at the solar facility site; therefore there is no potential to convert prime farmland, unique farmland, or farmland of statewide importance to non-agricultural use. The site is currently zoned M-3, an industrial zoning category. The solar facility would have no impacts on any Appendix G criterion regarding agriculture and agricultural resources.

Air Quality

The 2-MW solar facility would not create air emissions during its operation since there would be no combustion taking place, no chemical processes occurring that would directly emit air pollutants, and no fugitive sources of air pollutants. Construction activities would be a source of air emissions. The construction of the solar facility would be expected to take approximately 5 months. Emissions of criteria air pollutants would be less than 1% of the construction emissions for

the Project and Project Design Features.[12,13] Thus impacts from the emissions of criteria air pollutants would be considered less than significant.

Similarly, the excess lifetime cancer risk, chronic health index, and emissions of particulate matter of 2.5 microns in size or smaller generated by construction of the 2-MW solar facility are also minimal.[14] Therefore, impacts from the emissions of toxic air contaminants would be considered less than significant.

Biological Resources

The solar facility site is located entirely on disturbed upland habitats dominated by non-native and/or invasive grass and forb species. However, the site is situated within close proximity to Herman's Slough, an open water brackish channel bordered by degraded coastal brackish marsh habitat that supports a moderate cover of invasive plant species such as ice plant and Scotch broom. Despite their low habitat quality, adjacent marsh habitats have the potential to support special-status plant and animal species, although none were observed during site assessments. In addition, upland buffer habitats adjacent to the Herman Slough including coyote brush scrub and non-native annual grassland have a low potential to support special-status plants. There is a potential for a significant adverse impact to special-status plant or animal species. Potential impacts for plants is mitigated to a less-than-significant level by requiring avoidance of any unexpected special-status plant species relative to the placement of solar panels on the site (CGRP Solar Mitigation Measure Bio-1) and potential impacts to special status animal species is mitigated to a less-than-significant level by requiring avoidance of any unexpected discovery of a fully-protected species, avoidance of any unexpected discovery of a burrow occupied by any special status burrowing animals or birds, and avoidance of occupied bird nests. PV solar project design provides flexibility to adjust the placement of PV panels and support structures if any of these unexpected biological resource constraints are identified. Chevron would also be required to obtain wildlife agency permission prior to disturbing protected federal or state species, none of which are expected to be present on this capped remediation location.

The solar facility would not conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

[12] It was conservatively assumed that the construction would start in January 2014.
[13] The calculation of emissions associated with construction is described in *Appendix 4.3-CST*.
[14] The calculation of health risk associated with construction is described in *Appendix 4.3-HRA*.

The solar facility site is located in the Bay Area-Delta Bioregion. The solar facility would not impact sensitive natural communities comprising the Bay Area-Delta Bioregion. The site is not located within any other Habitat Conservation Plan or other local, regional, or state habitat conservation plan areas.

In order to avoid potential adverse stormwater quality or mammal impacts to Coastal Brackish Marsh Habitat located adjacent to the solar site, CGRP Solar Mitigation Measure Bio-1 and Bio-2 is also required to be implemented:

CGRP Solar Project Mitigation Measure Bio-1: Standard construction BMPs and specific Project Design Features shall be implemented to treat and minimize discharge of soil and pollutants into the marsh and other off-site vegetated areas during construction and operation of the proposed project. Standard construction BMPs shall be implemented according to a Stormwater Pollution Prevention Plan required under the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit). Catch basin inlet protection and installation of straw wattles (fiber rolls) shall be used throughout the Project site during construction. Additional construction BMPs required by the Regional Water Quality Control Board and San Francisco Bay Conservation and Development Commission shall also be implemented. Potential impacts on the coastal brackish marsh during construction activities shall also be avoided by placement of exclusion fencing 5–10 feet from the perimeter of the coastal brackish marsh boundary or on the edge of the temporary disturbance area when this distance is greater. The Facility shall provide environmental awareness training for all construction personnel, bright-colored fencing and signage shall identify and restrict construction within environmentally sensitive areas, and a construction monitor/environmental inspector shall confirm the fence integrity on a daily basis to protect the area from accidental equipment damage. Fence repair and/or reinforcements shall be completed immediately.

CGRP Solar Project Mitigation Measure Bio-2: Although Herman's Slough contains marginally suitable habitat for mammal species, there is small potential that one could migrate onto the solar facility site from nearby degraded marsh habitat. To avoid inadvertent construction impacts on salt marsh harvest mouse, Suisun ornate shrew, saltmarsh wandering shrew, and San Pablo vole, a qualified biological monitor shall be present during initial clearing and grubbing activities prior to installation of solar panel arrays in the vicinity of Herman's Slough. The monitor shall pre-survey disturbance areas to confirm the absence of special-status small mammals. Contractor education shall include a section specific to species identification and protection measures. The entire project construction area abutting coasts brackish marsh habitats shall be surrounded by exclusion fencing. Fencing installed around the project disturbance area during

construction shall be adequate to exclude these species. A maximum speed limit of 25 mph shall be observed by construction and maintenance vehicles.[15] The Facility shall provide environmental awareness training for all construction personnel, bright-colored fencing and signage shall identify and restrict construction within environmentally sensitive areas, and a construction monitor/environmental inspector shall confirm the fence integrity on a daily basis to protect the area from accidental equipment damage. Fence repair and/or reinforcements shall be completed immediately.

Cultural Resources

There are no historic resources as defined in Section 15064.5 within or near the solar facility site; therefore there would be no impacts to historic resources.

As described in *Section 4.4, Cultural Resources*, there are no known unique or significant archeological resources, unique geologic structures or paleontological resources located within or near the solar facility site. There are no known human remains or burial sites within or near the solar facility site. There is a remote possibility that an unexpected archeological or paleontological resource, or human remains, could be discovered during construction of the solar facility. Since the solar facility project would occur as part of the Modernization Project, this potentially significant adverse impact would be mitigated to a less-than-significant level through implementation of Mitigation Measure 4.5-1, Mitigation Measure 4.5-2, and Mitigation Measure 4.5-3 in this EIR.

Energy

The construction of the solar facility would require consumption of fuel and electricity for equipment and transportation fuel for construction vehicles. The scope of the construction of the solar facility would be much less than the construction of the Project. Since impacts on energy from construction of the Project were less than significant, the impacts from construction of the solar facility would also be less than significant.

The operation of the solar facility would result in generation of electrical energy from a renewable source (i.e., sunlight) to be put back into the electrical grid. This would result in less energy overall being used to generate electricity from the utility provider.

Geology, Soils, Seismicity, and Mineral Resources

[15] As discussed in *Section 4.3, Air Quality*, for purposes of dust control, Mitigation Measure 4.3-1 will require all vehicle speeds on unpaved roads to be limited to 15 mph.

The solar facility site is underlain by a capped landfill. The potential for the construction of the solar facility to breach the cap and encounter landfill wastes is described in the Public Safety discussion below. Since the solar facility site is relatively flat, landslide hazards would not be expected. The potential for erosion and the regulatory requirements that address erosion control are discussed below in the Hydrology and Water Quality discussion.

The solar facility is located in an area likely to experience at least one major earthquake within the next 30 years. Ground shaking could potentially expose persons and property to seismic-related hazards, including localized liquefaction and seismically induced settlement, and expansive soils. This impact would be less than significant because the solar facility would be constructed in accordance with the current California Building Code.

The solar facility site is not delineated by the General Plan 2030 as a locally important mineral resource area. Similarly, the California Geological Survey has not identified any mineral resources at the solar facility site (USDA, 1996). Thus, construction and operation of the Modernization Project would not result in the loss of a locally important mineral resource recovery site.

There would be no on-site septic systems installed, and therefore no impact related to placement of septic tanks.

Greenhouse Gases

As discussed above in the Air Quality discussion, the 2-MW solar facility would not create greenhouse gas emissions during its operation since there would be no combustion taking place, no chemical processes occurring that directly emit air pollutants, and no fugitive sources of air pollutants. Construction activities would be a source of greenhouse gas emissions. The construction of the solar facility would be expected to take approximately 5 months. Emissions of greenhouse gas emissions would be less than 1% of the construction emissions for the Project and Project Design Features, and would fall well below applicable BAAQMD significance thresholds.[16] Thus impacts from the emissions of greenhouse gas emissions would be considered less than significant.

Hydrology and Water Quality

Construction of the solar facility would require excavation and grading. This soil disturbance could expose soils to erosion and off-site sedimentation. Since the area of disturbance would exceed 1 acre, it would be required to comply with the NPDES Construction General Permit (Order No. 2009-0009-DWQ, NPDES No.

[16] It was conservatively assumed that the construction would start in January 2014.

CAR000002). In addition, the project would be required to treat stormwater runoff in accordance with the San Francisco Bay Region Municipal Regional Stormwater NPDES Permit, Order No. R2-2009-0074, NPDES Permit No. CAS612008. Compliance with existing regulatory programs would ensure that water quality impacts related to project development would be less than significant, CGRP Solar Project Mitigation Measure Bio-2 would further reduce this less-than-significant impact. No additional mitigation measures are required.

No use of groundwater resources would occur at the solar facility, and therefore the solar facility project would not substantially deplete groundwater supplies by pumping groundwater. The solar facility site is capped and minimal infiltration is expected to occur under existing conditions. Therefore, the solar facility project would have a less-than-significant adverse impact on groundwater recharge.

The solar facility project would not substantially alter the existing drainage pattern of the site or result in a substantial increase in runoff because the site is relatively flat and impervious under existing conditions and would remain flat and impervious after construction. No stream or river crosses the solar facility site.

Portions of the solar facility site are located within 100-year flood hazard area as designated by the Federal Emergency Management Agency (FEMA, 2009). Any development within the 100-year flood hazard area would be required to comply with the City of Richmond Municipal Code (Chapter 12.56 Flood Damage Prevention) Flood Ordinance, which requires physical improvements that are susceptible to flooding to be elevated above the 100-year inundation level and anchored to prevent floatation. Therefore, this is a less-than-significant impact.

Land Use, Plans, and Policies

The solar facility site is located completely on Chevron property and would not divide an existing community. There is no impact. The site is designated for industrial use and the solar facility would be a compatible use under the existing land use and zoning designations. There would be no conflicts with any applicable plans or regulations. No mitigation would be needed.

Noise

Construction of the solar facility would require the use of heavy equipment for several months. The highest level of construction activity is expected to occur in the first quarter of construction when a belly dump, grader, compactor, two forklifts, and two power generators are expected to operate (Chevron Data Transmittal #69 Rev #1, 2014). Using sound levels identified in the Federal Highway Administration Roadway Construction Noise Model (FHWA, 2008),

construction-related sound levels at the nearest residential receivers were predicted using the CadnaA noise model.

Modeled sound levels of construction noise ranged from 40 to 53 A-weighted decibels (dBA) at the nearest residential locations south, east, and northeast of the solar facility site. These modeled levels would comply with the noise standard of 60 dBA identified in the Richmond Noise Ordinance for weekday (7 a.m. to 7 p.m.) construction activities greater than 15 days. They would also comply with the stricter noise limit of 55 dBA applicable on weekends between 9 a.m. and 8 p.m. Furthermore, construction of the solar facility is expected to increase ambient daytime sound levels by only 0 to 2 dBA. Because noise from construction of the facility would comply with the Richmond noise limits and would increase the ambient levels by 2 dBA or less, no significant adverse noise impacts are anticipated during construction of the facility.

Noise from operation of the solar facility is expected to be minimal and result in no significant noise impacts.

Employment, Population, and Housing

Similar to what is described in *Section 4.12, Employment, Population, and Housing*, the solar facility would have no impact on displacing housing or people because there is no existing housing or population at the location. There could be a short-term increase in construction workforce; however, this would be a less-than-significant impact because any increase in population would be temporary and minimal in comparison to the current local population.

Public Safety

The CEQA significance criteria for public safety are listed in Appendix G of the CEQA Guidelines. Each criterion is addressed as follows:

(A) Would the project create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

The operation of the solar facility would not result in the routine transport, use or disposal of hazardous materials as hazardous materials are not required for its operation. The construction of the solar facility would be estimated to last for 5 months and may require the transport, use or disposal of hazardous materials. However, the duration of the construction period would not be long enough to be considered routine.

(B) Would the project create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

Construction and operation of the solar facility would require only nominal levels of hazardous materials (e.g., construction vehicle use, and operational maintenance cleansers and lubricants), and would not result in reasonably foreseeable upset or accident conditions involving the release of hazardous materials into the environment. No mitigation is warranted.

(C) Would the project emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within ¼ mile of an existing or proposed school?

The solar facility would not be located within ¼ mile of an existing or proposed school. The closest school to the Facility boundary is 0.32 mile southeast of the Facility boundary.

(D) Would the project be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

The solar site is part of a remediated contaminated soil management area, and construction or operation of the solar project has the potential to disturb the remedial design of this area. Implementation of the following CGRP Solar Project Mitigation Measure Haz-1 would reduce this impact to a less-than-significant level.

Haz-1. Prior to commencing construction of the solar project, Chevron shall submit for City and RWQCB review the design of the facility, and sufficient information about construction and operational parameters as are determined by the City and/or RWQCB to be needed to assure that the solar project would not reduce the effectiveness of the remediation measures implemented in the solar site area.

(E) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?

The facility is not located within an airport land use plan. The closest public airport is approximately 14 miles to the north-northwest of the facility in Marin County.

(F) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?

The facility is not located within 2 miles of a private airstrip.

(G) Would the project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

The solar facility would be located within the Facility boundary. It would not impair implementation of or physically interfere with an adopted City emergency response plan or emergency evaluation plan. Implementation of CGRP Mitigation Measure Haz-2 would reduce this potential impact to less than significant:

> Haz-2. Prior to commencing construction of the solar project, Chevron shall update Facility emergency response and evacuation plans to account for the presence of the solar site on the Facility, and to assure that the modified emergency response and evacuation plans remain effective given the presence of the solar project.

(H) Would the project expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

The operation of the solar facility would not increase the risk of wildland fires, and would in fact result in a reduced potential for fire on an existed vegetated urbanized site by requiring routine vegetative maintenance as part of solar project operations.

The construction and operation of the solar facility is less than significant for public safety impacts, as mitigated.

Public Services

The solar facility project would not require additional government facilities or services related to fire protection, police protection, schools, or parks. The facility would be fenced and not expected to be particularly targeted for crime. Similarly, solar facilities are not particularly prone to fire. No new schools or parks would be needed to support the solar facility project.

Parks and Recreation

As described above in the Employment, Population, and Housing discussion, there could be a short-term increase in construction workforce. These workers could, during lunch times, temporarily increase the usage of local parks or the proposed segments of the Bay Trail along Western Drive. However, such a temporary impact would not be considered significant. The solar facility would not include any additional park or recreation facilities. There is no impact.

Transportation and Traffic

Similar to what is discussed in *Section 4.16, Transportation and Traffic*, the solar facility would have no impact on air traffic and would not increase transportation-related hazards. There would be no impact on emergency access and no conflict with adopted plans or policies related to public transit, bicycle, or pedestrian facilities.

The construction of the solar facility would generate about 80 daily worker trips and 80 daily delivery truck trips during the workweek over a projected 5 month construction period. Although most of the workers would travel to and from the site during the peak congestion periods, most of the truck trips would be during off-peak hours. As a result, the peak-hour traffic generated during the construction of the solar facility would be very small compared to the total Facility trip generation and within the typical day-to-day fluctuation at the Facility. Thus, the level of additional vehicles on the streets adjacent to the Project site would not be noticeable to most motorists and the increase in delay would be negligible and not considered significant.

Utilities and Service Systems

Operation of the solar facility would not result in new demand for wastewater treatment because the facility would not generate substantial new wastewater load. The only source of wastewater expected would be sanitary sewage related to a new restroom facility. Similarly, the solar facility project would require minimal new water supply. The site is relatively flat and impervious (due to the existing landfill cap). Any new drainage facilities would be designed to convey a post-construction surface runoff (in a similar volume to existing conditions) to existing conveyance facilities. The solar facility project would not generate a significant amount of solid waste during construction or operation. Therefore, impacts related to utilities and service systems would be less than significant.

4.8.4.1.2.3.2.2 *Evaluation and Prioritization of CGRPs*

Each CGRP was evaluated against the prioritization criteria above as shown in Table 4.8-6. Tier 1 CGRPs include measures that do not require additional CEQA compliance analysis (i.e., all CGRP measures except Wetlands Creation and

TABLE 4.8-6 CGRP MEASURES AND PRIORITIZATION CRITERIA

	Measure	Cost Effectiveness ($/MT CO2e)	Create Local Jobs	Reduce Local Greenhouse Gas Emissions	Improve Community Health	Create Community Wealth & Resilience	Enhance Other Environmental Sustainability	Accurate Metric/ Verifiable	Magnitude of Greenhouse Gas Reduction Available	Leveraging
Urban Greening	*Urban Forestry:* Plant trees to help sequester CO_2.	$58	✓	✓	✓	✓	+	✓	✓	–
	Pedestrian and Bicycle Master Plan implementation: Development of bicycle and pedestrian networks.	$22	–	✓	✓	✓	✓	–	✓	–
	Zero Waste Programs: Increase the waste diversion by implementing programs to encourage recycling and compost.	$4	✓	✓	–	–	✓	✓	✓	–
Energy Efficiency	*Healthy Homes/Residential Energy Efficiency (Any Income):* Provide home performance energy efficiency (weatherization) rebates.	$35	9.7 jobs /$1M[a]	✓	✓	✓	✓	✓	+	✓
	Healthy Homes/Residential Energy Efficiency (Low Income): Provide home performance energy efficiency (weatherization) rebates for low income households.	$71	9.7 jobs /$1M[a]	✓	✓	+	✓	✓	✓	✓
	Residential Solar Rebate: Incentivize homeowners to install PV panels through rebates.	$278	9.7 jobs /$1M[a]	–	–	✓	✓	✓	✓	✓
	Commercial Energy Efficiency: Incentivize business owners to increase energy efficiency.	$7	9.7 jobs /$1M[a]	✓	–	✓	✓	✓	+	–
	Commercial Solar Rebate: Incentivize business owners to install PV panels through rebates.	$69	9.7 jobs /$1M[a]	–	–	✓	✓	✓	✓	✓

TABLE 4.8-6 CGRP MEASURES AND PRIORITIZATION CRITERIA

	Measure	Cost Effectiveness ($/MT CO2e)	Create Local Jobs	Reduce Local Greenhouse Gas Emissions	Improve Community Health	Create Community Wealth & Resilience	Enhance Other Environmental Sustainability	Accurate Metric/ Verifiable	Magnitude of Greenhouse Gas Reduction Available	Leveraging
Transportation Greenhouse Gas Reduction Measures	*Electric Vehicle Purchase Rebates:* Encourage purchasing of electric vehicles by providing rebates to residents purchasing electric vehicles.	$15	–	✓	✓	✓	✓	✓	+	✓
	Electric Vehicle Charging Stations Rebates: Encourage use of electric vehicles by providing rebates to businesses that install electric vehicle charging stations.	$85	–	✓	✓	✓	✓	✓	✓	–
	Ride Share/Green Transportation: Encourage the availability of low-greenhouse gas transportation alternatives, such as local shuttle circular and van service, and the acquisition of an electric bus.	$358 - $2,788	✓	✓	✓	✓	✓	–	+	✓
	Bicycle Program: Develop a public bicycle sharing system.	$611	–	✓	✓	✓	✓	–	✓	–
	Transit Access: Encourage participation in reduced cost monthly public transportation access (e.g., reduced cost Clipper Card).	$521	–	✓	✓	✓	✓	–	✓	✓
Other	*Wetlands:* Create wetlands in the City of Richmond for carbon sequestration.	$7K - $45K	–	✓	–	–	+	✓	✓	–
	2-MW Solar Project: Construct a 2-MW PV solar facility on the Project site that supplies the electric grid.	$328	✓	✓	✓	✓	✓	+	✓	✓

[a] Jobs per million dollars metric obtained from RIMS 2010 Data for Construction Industry in Contra Costa County.

Utility-Scale Renewable Energy Facility Construction) and which do not present special challenges (i.e., all CGRP measures except the 2-MW solar PV facility proposed to be constructed at Chevron facility).

Appendix 4.8-CGRP provides details on the evaluation criteria used to assess each program, the methodology used to estimate emission reductions, and costing analyses. It also provides an example of a slate of CGRPs that could be funded at a particular level, and the greenhouse gas reductions on an annual basis that would be achieved from their implementation. (Table 4.8-5) The CGRPs include Tier II greenhouse gas reduction programs, too, that may be appropriately implemented over time at the election of the City. Such Tier II programs could be funded and implemented only if: (1) the program and program implementation activities were evaluated in compliance with CEQA; and/or (2) program implementation would result in verified, quantified greenhouse gas reductions, and overcome design challenges. The environmental review/clearance status of each of the CGRPs has been described above.

4.8.4.1.2.3.2.3 *CGRP Selection and Monitoring Process*

Not less than 6 months prior to the implementation of the CGRPs, the City (with input from stakeholders from the City, North Richmond, and Chevron) would select and establish the funding level for each CGRP that the City would cause to be implemented over the following 2-year period (CGRP Selection). The first CGRP Selection would be made not later than 6 months prior to the start of Project operation.

The City would track greenhouse gas reductions from CGRP measures on a periodic basis and would report on the CGRP implementation, including actual greenhouse gas reductions achieved, on an annual basis for a period of not less than 10 years following the first year of the start of Project operations. The City (with input from stakeholders from the City, North Richmond, and Chevron) would make mid-course modifications (e.g., change funding levels, add or abandon specific CGRPs), during any 2-year implementation period, as appropriate.

4.8.4.1.2.3.3 *Cap-and-Trade Allowances*

Chevron would purchase cap-and-trade greenhouse gas allowances to fully offset any emission increase from the Project ("remaining greenhouse gas offset") to achieve its NNI commitment after accounting for reductions associated with all of the above-described Project Design Features (i.e., remaining greenhouse gas offset = annual project greenhouse gas emissions – (annual facility greenhouse gas reductions + annual CGRP reductions) – Baseline greenhouse gas emissions).

4.8.4.1.2.3.3.1 *Use of Greenhouse Gas Cap-and-Trade Allowances*

Chevron has proposed to use greenhouse gas cap-and-trade allowances[17] (greenhouse gas allowances) created pursuant to AB 32 to augment the greenhouse gas reductions required to meet its greenhouse gas NNI goal and CEQA greenhouse gas threshold. As discussed in *Section 4.8.2.2*, under the California cap-and-trade program, CARB created a system of greenhouse gas allowances as the primary tool for achieving statewide greenhouse gas emission reductions from larger industrial sources such as refineries, power plants, cement kilns, and other designated manufacturing activities. Each allowance represents 1 MT of CO_2e that an entity may emit in a particular year. The total quantity of allowances available in California decreases each year, forcing a decrease in statewide greenhouse gas emissions. Allowances representing a refinery's emissions must be surrendered to CARB on an annual basis.

A certain number of allowances are distributed freely to entities, based on rules in the cap-and-trade regulation depending on the type of facility. The remainder of allowances required for annual compliance must be purchased from auctions managed by CARB, from owners of greenhouse gas allowances, or from third-party traders. In order to meet its cap-and-trade obligations, Chevron would be required to purchase greenhouse gas allowances through one of these methods.

Chevron's participation in the cap-and-trade program is consistent with a statewide reduction in greenhouse gas emissions to meet AB 32 requirements for California greenhouse gas emissions to be reduced to 1990 levels by 2020. Only Facility emissions are subject to the cap-and-trade regulation. Other categories of greenhouse gas emissions associated with the Project, however, are not covered under the cap-and-trade regulation. These categories of greenhouse gas emissions not covered by the cap-and-trade regulation include: indirect (electricity and water); and transportation (shipping, rail, and on-road mobile emissions). Thus, Chevron's obligations under the cap-and-trade regulation do not cover these categories of emissions, but must be offset under Chevron's NNI commitment. In other words, any increase in greenhouse gas emissions from Baseline for these categories must be accounted for through the Chevron Facility Greenhouse Gas Reductions (e.g., water conservation, LED lighting retrofits, Marin Clean Energy participation) and funding of CGRP measures. If greenhouse gas emission reductions from Chevron Facility Greenhouse Gas Reductions measures and CGRP measures are less than the increase in emissions for these non-covered categories, then Chevron would achieve its NNI commitment by

[17] This would also include the use of CARB offset credits as compliance instruments.

purchasing additional greenhouse gas allowances, above and beyond what is required for its cap-and-trade compliance, to make up the shortfall.

Under the 93% Utilization Scenario, the emissions not covered by the cap-and-trade regulation are just less than 5,500 MT CO_2e. In the first year of operation (2016), expected greenhouse gas emission reductions from Chevron Facility Greenhouse Gas Reductions and CGRPs are 1,312 and 9,377 MT CO_2e, respectively. Thus, the uncovered emissions categories are expected to be fully offset, and Chevron would not be required to purchase additional cap-and-trade allowances beyond what is required for cap-and-trade compliance.

4.8.4.1.2.3.3.2 *Timing and Process for Using Allowances to Eliminate Remaining Greenhouse Gas Offset*

The mechanism and timing for eliminating any Remaining Offset would be as follows using the operational year 2016 as an example:

- Operational 2016 greenhouse gas emissions are determined in 2017. Facility greenhouse gas emissions for 2016 are reported by Chevron to CARB by April 10, 2017 (EI). A state-credentialed third-party verifies this EI by September 1, 2017, at which point the refinery EI is considered final for purposes of this evaluation. Indirect (electricity and water), shipping, rail, and on-road vehicle greenhouse gas emissions are not subject to AB 32 and, therefore, greenhouse gas emissions from these sources are not submitted to CARB. However, Chevron would finalize those emissions by September 1, 2017. The City of Richmond would also finalize its determination of emission reductions from Project Design Features by September 1, 2017.
- The Remaining Offset, if any, is determined by subtracting the Baseline operational emissions and, the emission reductions from (Project Design Features) from the Project operational emissions (i.e., $\text{Remaining Offset}_{2016}$ = $\text{Annual Project Emissions}_{2016}$ – (annual facility greenhouse gas reductions_{2016} + annual CGRP reductions_{2016}) – Baseline greenhouse gas emissions). If this number, the Remaining Offset, is negative (i.e., Project emissions are less than Baseline emissions), then Chevron is not required to purchase additional greenhouse gas allowances (to cover non-cap-and-trade emissions) or to fund the Clean Air Improvement Fund pursuant to Mitigation Measure 4.8-3a below.
- If the Remaining Offset value is positive (i.e., Project emission minus Project Design Feature emission reductions are greater than Baseline emissions), then Chevron would deposit money into the Clean Air Improvement Fund. The amount deposited would be equivalent to the cost of the Remaining Offset based on the settlement price of 1 MT CO_2e established at the 2014

CARB allocation auctions, adjusted annually for inflation using the consumer price index. The deposit shall occur before the end of 2017.

- By December 31, 2017 Chevron would have achieved its greenhouse gas NNI commitment for 2016 emissions by purchasing any cap-and-trade allowances as required and has provided verification of purchases to the City of Richmond.

Chevron's Project Design Features are included as part of the Project and are also separately required to be implemented as mitigation measures as described below, and would be monitored and tracked in the MMRP as described further in *Section 4.8.6.*

Table 4.8-7 summarizes the greenhouse gas emission reductions from these supplemental Project Design Features.

TABLE 4.8-7 FACILITY PROJECT DESIGN FEATURE EMISSION REDUCTIONS AT 93% UTILIZATION PROJECT SCENARIO

Project	Annual Greenhouse Gas Emission Reduction (MT CO_2e)
Water Conservation	109
LED Lighting Retrofits	339
Marin Clean Energy Participation	288
Fluid Catalytic Cracker Cooling Water Tower Motor Upgrade	576
CGRPs (provided for illustrative purposes only)[a]	5,500
Cap-and-Trade Allowances	718,767
Total	**725,579**

[a] Actual greenhouse gas reductions from the CGRP program will vary over time. Chevron is required to purchase additional cap and trade allowances for years in which CGRP program implementation results in less than 5,500 MT of CO2e.

For the 93% Utilization Scenario, the total reduction required for Project-related greenhouse gas emissions would be 725,579 MT CO_2e per year. Actual Modernization Project emissions may vary over time, with different utilization rates and potential variation among crude and gas oil blend quality among the 19 Scenarios considered in the URM. Actual greenhouse gas emission levels would be calculated annually, using CARB-validated greenhouse gas totals for

refinery stationary source operations, and transportation sector greenhouse gas totals estimated in consultation with BAAQMD.

For any year that Facility greenhouse gas emissions are greater than Baseline emissions, Chevron shall implement the following mitigation measures.

Mitigation Measure 4.8-2: Chevron shall implement all greenhouse gas Project Design Features described above, including those measures described in subsections 2a through 2f below. If implementation of subsections 2a through 2f, below, does not reduce Facility greenhouse gas emissions to Baseline levels on an annual net basis, then Chevron shall implement subsection 2g, below. If implementation of subsections 2a through 2g, below, does not reduce Facility greenhouse gas emissions to Baseline levels on an annual net basis, then Chevron shall implement subsection 2h, below:

2a: Implement water conservation measures during Modernization Project construction;

2b: Install LED Lighting at the Facility during Modernization Project construction;

2c: Implement fluid catalytic cracker cooling water tower motor upgrades during Modernization Project construction;

2d: Participate, for Chevron Commercial Facilities (and industrial accounts, if practicable), in the Marin Clean Energy Program prior to commencement of construction;

2e: Provide $30M over ten years in funding for implementation of the Community Greenhouse Gas Reduction Measures, which measures shall be selected by the City through a public process with input from stakeholders from the City, North Richmond, and Chevron, as described above;

2f: Acquire and timely surrender to CARB Cap and Trade Emission Allowances in quantities sufficient to reduce Facility greenhouse gas emissions to or below Baseline levels on a net basis (rounded up to the nearest metric ton), after taking into account reductions achieved by Mitigation Measures 2a-2e above;

2g: Acquire greenhouse gas reduction credits through the California Air Pollution Control Officers Association (CAPCOA) GHG Rx credit exchange, or through a similar exchange certified by the BAAQMD or CARB, in quantities sufficient to reduce Facility greenhouse gas emissions to or below Baseline

levels on a net basis (rounded up to the nearest metric ton), after taking into account reductions achieved by Mitigation Measures 2a-2e above, and after taking into account net reductions achieved by Mitigation Measure 2f above;

2h: Curtail facility operations such that Facility greenhouse gas emissions are reduced to or below Baseline levels on a net basis (rounded up to the nearest metric ton), after taking into account reductions achieved by Mitigation Measures 2a-2e above, and after taking into account net reductions achieved by Mitigation Measures 2f-2g above.

Mitigation Measure 4.8-2B: *Clean Air Improvement Fund*. Chevron shall fund and participate in a Clean Air Improvement Fund for any Facility greenhouse gas emissions over Baseline. Chevron is required to comply with applicable pollution control laws which are anticipated to result in further decreases in Facility emissions, as described in *Section 4.3, Air Quality*. If the Modernization Project is approved, operational greenhouse gas emissions as mitigated and through Project Design Features would be lower than otherwise required by Assembly Bill (AB) 32 and other air quality laws, regulations and permit programs, due to the broader scope of the CEQA and the NNI Project objective.

- Funding shall be in an amount equivalent to the difference between Project and Baseline greenhouse gas emissions (in MT CO_2e) multiplied by the settlement price of greenhouse gas emission allowances determined at the 1st quarter 2014 California Air Resources Board (CARB) auction, annually adjusted by the Consumer Price Index value for the San Francisco Bay Area. The difference between Project and Baseline greenhouse gas emissions shall be determined in accordance with the procedures for determining the Remaining Offset described above in *Section 4.8.4.1.2.3.3.2*.
- Funding shall be paid annually and in accordance with the procedures described above in *Section 4.8.4.1.2.3.3.2*.
- Funding shall be spent on greenhouse gas emission reduction measures in the following priority order: (1) reductions from Facility emissions; (2) reductions within the City; and (3) reductions from the North Richmond area closest to the Facility.
- Funding and implementation decisions shall be made by the City, as part of a public process, with input from stakeholders including representatives from the City, North Richmond, and Chevron.

- A brief report shall be prepared for each major emission reduction measure implemented using such funds, and be made available to help inspire other emission reduction opportunities.

Mitigation Measure 4.8-3 does not create any exception to Chevron's obligation to fully comply with all mitigation measures and Project Design Features included in this EIR.

Implementation of Mitigation Measures 4.8-2 and 4.8-3 will reduce greenhouse gas emissions from the Modernization Project to less-than-significant levels for CEQA purposes, and achieve the NNI in greenhouse gas emissions Project objective.

4.8.4.2 Project Compliance with Greenhouse Gas Plans and Policies

Impact 4.8-3: Greenhouse gas emissions associated with the Project would not conflict with greenhouse gas reduction plans and policies. This impact would be less than significant and no mitigation is necessary. (LTS)

Under the second CEQA Guidelines Appendix G criterion described in *Section 4.8.3.1*, above, the City evaluated the Project for consistency with the following plans, policies, and regulations:

- AB 32 (California Global Warming Solutions Act of 2006), including:
  - Scoping Plan
  - Mandatory greenhouse gas emissions reporting regulations
  - California Cap-and-Trade program
- BAAQMD greenhouse gas reduction target
- Plan Bay Area
- Richmond General Plan 2030
- Executive Order S-3-05

Each plan, policy, and regulation is described in detail in *Section 4.8.2.2,* above. A discussion of Project consistency with each plan, policy, and regulation is presented below.

4.8.4.2.1 *Assembly Bill 32*

The heart of the California Global Warming Solutions Act of 2006 (AB 32) is the requirement for statewide greenhouse gas emissions to be reduced to 1990 levels by 2020. The Project would be consistent with this mandate by maintaining NNI in greenhouse gas emissions as a result of the Project. AB 32 also required the adoption of discrete Early Action Items (CARB, 2007) which resulted in the development of the Low Carbon Fuel Standard, the SmartWay Truck Efficiency Regulation, and the Goods Movement Emission Reduction

Program, among other things. As described in *Section 4.8.2.2,* the Facility complies with these regulations with or without the Project, by tracking the carbon content of transportation fuels produced and employing fuel-efficient technologies and operational practices in the truck and ocean-going vessel fleets. Further, AB 32 required the development of a Scoping Plan for achieving the necessary greenhouse gas reductions in a technologically and economically feasible manner, the adoption of a mandatory greenhouse gas emissions reporting regulation, and the establishment of a market-based declining emission limit program (i.e., the cap-and-trade program). Project consistency with each of these programs is discussed below.

4.8.4.2.1.1 *Scoping Plan*

The AB 32 Scoping Plan identifies over 70 measures for reducing greenhouse gas emissions to 1990 levels by 2020. In addition to the discrete Early Action Items described above, specific measures discussed in the Scoping Plan that are relevant to the Project include the Energy Efficiency and Co-Benefits Assessment of Large Industrial Sources, Renewables Portfolio standard, Advanced Clean Cars program, Goods Movement Emission Reduction Program, Vessel Speed Reduction program, Freight Transport Efficiency program, Refinery Flare Recovery Process Improvements, and Removal of Methane Exemption from Existing Refinery Regulations.

The Facility is subject to the Regulation for Energy Efficiency and Co-Benefits Audits of Large Industrial Facilities and submitted the required one-time fuel and energy assessment report to CARB in 2011.

The Renewables Portfolio standard applies to retail sellers of electricity to achieve 33% renewable energy sources by 2020. While the Facility is not a regulated entity under the Renewables Portfolio standard, the electricity the Facility purchases from PG&E and the associated greenhouse gas emissions reflect the renewable sources incorporated by the utility in order to comply with the Renewables Portfolio standard.

Similarly, the Advanced Clean Cars Program applies to vehicle manufacturers. While the Facility is not a regulated entity under this regulation, the vehicles used by Chevron employees and contractors reflect the greenhouse gas emission limits required by the regulation.

A statewide vessel speed reduction program and freight transport efficiency program are still under development by CARB. As with the other regulations under the Scoping Plan, the Facility and the Project would comply with any regulations developed under the vessel speed reduction and freight transport efficiency programs.

The Refinery Flare Recovery Process Improvements measure and Removal of Methane Exemption from Existing Refinery Regulations measure were both proposed in the Scoping Plan; however, CARB has yet to move forward with the development of these measures. As described in the Scoping Plan, the first measure would limit greenhouse gas emissions from refinery flares, while the second measure would remove the current fugitive methane exemption that is present in the volatile organic compound regulations of most air districts, including the BAAQMD (BAAQMD, 1994). As with the other regulations under the Scoping Plan, the Facility and the Project would comply with any regulations developed under these Scoping Plan measures.

Overall, the Project would not conflict with any of the Scoping Plan plans, programs, or regulations because the Project would achieve NNI in greenhouse gas emissions.

4.8.4.2.1.2 *Mandatory Greenhouse Gas Emissions Reporting Regulations*

The State of California and federal mandatory greenhouse gas emissions reporting regulations require facilities exceeding a specified threshold of greenhouse gas emissions to report their EI. Both regulations require reporting of emissions from stationary combustion and process emissions sources. This does not include non-stationary combustion sources such as from shipping, rail, and trucking or indirect emissions from water and electricity usage. Further, the state regulation requires emissions reports to be verified by a third party. The Facility complies with these regulations with or without the Project by submitting the required EI reports to CARB and the EPA each year and obtaining the required verifications.

4.8.4.2.1.3 *California Cap-and-Trade Program*

The California cap-and-trade program imposes a "cap" on total greenhouse gas emission from covered entities, with the quantity of emissions allowed under the cap decreasing each year to ultimately reach the AB 32 goal of returning statewide greenhouse gas emissions to 1990 levels by 2020. The Facility is subject to the first compliance period of the cap-and-trade regulation, which started January 1, 2013. The Project would be consistent with this regulation because it would achieve NNI in greenhouse gas emissions at the Facility and therefore would not affect the total amount of compliance instruments the Facility must surrender to CARB.

4.8.4.2.2 *BAAQMD Significance Threshold*

As described earlier, the BAAQMD's CEQA threshold of significance for evaluating the significance of greenhouse gases from industrial sources is 10,000 MT CO_2e per year. With mitigation, the Project would achieve NNI in

greenhouse gas emissions; therefore, it would comply with this BAAQMD CEQA threshold.

4.8.4.2.3 *Plan Bay Area*

Plan Bay Area developed under SB 375 included the Facility as an industrial source in its employment analysis. The Project would preserve this industrial source employment status, and is thus consistent with Plan Bay Area.

4.8.4.2.4 *Richmond General Plan 2030*

The General Plan 2030, adopted in April 2012, includes, among other things, an Energy and Climate Change Element that provides policy direction for the City to promote mitigation, sustainability, and adaptation in response to climate change. The General Plan 2030 establishes several policies that support the following six goals: provide leadership to manage climate change, promote clean and efficient transportation options, encourage sustainable and efficient energy systems, promote sustainable development, support community revitalization and economic development, and build climate-resilient communities. Consistency with the General Plan 2030 is discussed in *Section 4.10, Land Use, Plans, and Policies*.

4.8.4.2.5 *City of Richmond Climate Action Plan*

The City of Richmond is in the process of creating a Climate Action Plan as was included in the General Plan 2030 (City of Richmond 2012a). As part of the Climate Action Plan, the City would determine actions to reduce emissions within the City and establish an emissions reduction target. As the Climate Action Plan has not been completed, the Project cannot be compared against goals in the Plan.

4.8.4.2.6 *Executive Order S-3-05*

As discussed previously, Executive Order S-3-05 establishes the goal of reducing greenhouse gas emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by 2050. The reduction in 2020 is incorporated into AB 32 goals, but the 2050 goals are exclusive to the Executive Order. The text of Executive Order S-3-05 does not explain how the targets should be applied to individual development projects. At this time no specific strategies have been identified to reach the 2050 goal. Nevertheless, the Project would achieve NNI in greenhouse gas emissions from the Baseline. Therefore, the Project is consistent with S-3-05.

Mitigation Measure 4.8-3: None required.

4.8.5 Cumulative Impacts

4.8.5.1 CEQA Cumulative Impacts

CEQA requires that an EIR evaluate cumulative impacts when a project's impact would be "cumulatively considerable" (14 CCR 15130). The CEQA Guidelines define "cumulatively considerable" as meaning "the incremental impacts of an individual project are significant when viewed in connection with the impacts of past projects, the impacts of other current projects, and the impacts of probable future projects" (14 CCR 15065).

Unlike many impacts such as noise or traffic, the adverse consequences of greenhouse gas emissions depend on the cumulative impacts of every project in the state, the nation and, to a large extent, the world. Even if a project in Richmond complies with or exceeds AB 32 requirements, its greenhouse gas emissions, although reduced, may nonetheless contribute to a cumulatively significant problem when, for example, a factory in another country opens that is subject to minimal or no regulations. The City of Richmond has no jurisdiction to control the climate change impacts of projects outside of its boundaries. So long as levels of greenhouse gas emissions in the atmosphere generally are at levels that create adverse impacts, the emissions of a particular project, even if not significant on an individual basis, may nonetheless contribute to an adverse, unavoidable cumulative impact because other projects do not meet such standards.

At one extreme is the so-called "one molecule" theory, which states that *any* contribution to an already adverse impact could be considered cumulatively significant. This approach would make virtually every project's cumulative impacts significant, in effect rendering the standard meaningless in terms of providing guidance to decision-makers on which projects are better or worse. It would also, by finding a significant adverse impact, require an EIR for nearly all projects, which would be inconsistent with CEQA and guidance developed to date, which provides for Negative Declarations and Categorical Exemptions for many small projects. Moreover, regulation of such projects would have only a trivial impact on the greenhouse gas problem. In the CEQA Guidelines amendments developed pursuant to SB 97, as described above, the CNRA made clear that there was no "one molecule" rule under CEQA and that this approach was not appropriate for considering the CEQA significance of greenhouse gas emissions.

At the other extreme is the conclusion that the impact of any one project is insubstantial when measured against the many MMT of greenhouse gas

emissions in the world. Most calculations would require decimal calculations that are statistically meaningless.[18] In fact, notwithstanding the quantity of California's greenhouse gas emissions, eliminating the whole of California's greenhouse gas emissions, when considered on a global scale, would not result in any meaningful decrease in the concentration of greenhouse gases in the global atmosphere. Aside from not being a useful standard—in this case, every project would be cumulatively insignificant—this approach is inconsistent with CEQA's cumulative impact analysis requirements, which case law has held do not allow a project's impacts to be dismissed solely because of the magnitude of the overall problem.

Nevertheless, since Chevron's NNI commitment would result in NNI in greenhouse gas emissions, neither the "one molecule" theory nor the conclusion that the impact of any one project is insubstantial in the context of worldwide emissions need to be considered here. The NNI commitment obviates the need to evaluate cumulative impacts. Thus, the Project cumulative impacts are less than significant.

As explained earlier, when determining CEQA significance thresholds, Appendix G of the CEQA Guidelines encourages lead agencies to rely on the specialized air quality expertise of regional air agencies such as the BAAQMD. The BAAQMD's guidelines for assessing cumulative impacts from greenhouse gas emissions are described in the next section.

4.8.5.2 BAAQMD Cumulative Impact Thresholds

The 2010 BAAQMD CEQA Guidelines and significance thresholds do not establish a separate numerical criterion for determining when a greenhouse gas emissions increase is considered "cumulatively considerable" and thus triggers the need for a quantitative cumulative impacts assessment. As described in the Project-level analysis detailed above, the Project would achieve NNI in greenhouse gas emissions through a combination of Project Design Features, mitigation measures, and environmentally beneficial Project components. The Project also would be consistent with AB 32, the state cap-and-trade program, the General Plan 2030, and other applicable plans, policies, and regulations described under Impact 4.8-2 above that were adopted for the purpose of reducing greenhouse gas emissions.

[18] As discussed by the California Supreme Court in Save the Plastic Bag Coalition v. City of Manhattan Beach, where a project has a "minuscule contributive effect" the agency can find that impact is not significant. (2012) 52 Cal. 4th 155, 174.

4.8.5.3 Additional Community and Disparate Impact Analysis

In addition to evaluating Project impacts based on this EIR's significance conclusions, the Project was also evaluated based on public health, economic, demographic, educational, and other factors considered in the Office of Environmental Health Hazard Assessment CalEnviroscreen guidance and the BAAQMD Community Air Risk Evaluation programs as described more fully in *Section 4.3, Air Quality*, of this EIR. Facility-related and community greenhouse gas reduction programs would be implemented as possible first, and the rest of the greenhouse gas emission reductions would be covered by AB 32 cap-and-trade allowances in order to maximize local co-benefits of greenhouse gas reductions.

4.8.6 Mitigation Monitoring and Reporting

4.8.6.1 Summary of CEQA MMRP Obligations

CEQA requires the City, as the lead agency, to adopt a Mitigation Monitoring and Reporting Program (MMRP) to ensure implementation of mitigation measures and conditions of project approval that avoid, minimize, or mitigate a significant adverse impact (Section 15097(a) of the CEQA Guidelines). CEQA also allows the lead agency to delegate this mitigation monitoring and reporting obligation to another public agency that accepts the delegation, but the lead agency remains responsible for ensuring that the measures are implemented. Chevron's Project Design Features and mitigation measures would be included in the MMRP.

4.8.6.2 BAAQMD Role in MMRP

The City has requested, and the BAAQMD has agreed, to monitor Chevron's implementation of the air quality and greenhouse gas Project Design Features identified in this EIR, implementation of which would be required as mitigation measures in MMRP. The implementation of the Project Design Features would ensure that the Facility meets its NNI commitment. The completion of Project Design Features would be required prior to commencing operation of the new hydrogen plant or modified sulfur recovery unit.

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4.9 HYDROLOGY AND WATER QUALITY

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) changes to relevant plans and policies, including the adoption of a new Richmond General Plan. These revisions generally maintain the conclusions presented in the 2008 EIR in that the Modernization Project would not result in any significant adverse impacts; however, mitigation would be necessary to ensure wastewater discharge limits and capacity requirements are met.

IMPACT SUMMARY

- With mitigation, the Modernization Project would not violate any water quality standards or waste discharge requirements, such as the discharge limits and capacity requirements in Chevron's current National Pollutant Discharge Elimination System permit.
- With mitigation, the Modernization Project would not disturb, expose, or otherwise alter the present state of the existing soil contamination to an extent that would lead to significant adverse changes to wastewater effluent quality.
- No use of groundwater resources is proposed for the Modernization Project. As a result the Project would not substantially deplete groundwater supplies or interfere with groundwater recharge.
- The Modernization Project would not substantially alter the existing drainage pattern of the site, including through alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in substantial erosion, siltation (the pollution of water by fine material with a particle size dominated by silt or clay), or flooding on or off site.
- The Modernization Project would not create or contribute to runoff water that would exceed the capacity of existing or planned stormwater drainage systems. While some of the Modernization Project components would include new impervious surfaces, the existing surface soils are highly compacted and frequently underlain by shallow bedrock, limiting infiltration rates.

  The Modernization Project is located on a hilly peninsula that extends into the Bay; the Federal Emergency Management Agency flood zones (Zone VE) mapped around most of the perimeter of the peninsula are related to coastal flooding hazards (e.g., high tides and storm surges) (FEMA, 2009). As such the Modernization Project would not place structures within the 100-year flood hazard area that would impede or redirect flood flows and any new development within the 100-year flood hazard area would be done in accordance with the Richmond Municipal Code.

- The Modernization Project would place structures in areas subject to coastal flooding, including tsunami wave run-up and sea level rise. A tsunami in San Francisco Bay is a low probability event, however, and Chevron has a contingency plan in place. Therefore, this impact would be less than significant.
- Shipping volumes would increase under the Modernization Project; however, any potential increase in shipping would remain below the 900 vessel calls analyzed in the Chevron Long Wharf EIR. Operations of commercial vessels can result in the discharges of ship-borne pollutants and invasive species from ballast water. However, since the Modernization Project would not create any new impacts above and beyond those analyzed and mitigated in the Long Wharf EIR, this impact would be less than significant.

4.9.1 Introduction

This section addresses water-related impacts associated with the Modernization Project. This section describes and discusses the existing hydrology and water quality conditions and analyzes potential impacts caused by both the construction and the operation of the Modernization Project, and presents measures to mitigate significant adverse hydrology and water quality impacts.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities that could potentially affect hydrology and water quality. For example, as described in *Section 3.3, Project Description*, construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing

adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

4.9.2 Setting

4.9.2.1 Regional Setting

4.9.2.1.1 *Precipitation*

The climate of the San Francisco Bay Area is characterized as Mediterranean with cool wet winters and relatively warmer dry summers. The mean annual rainfall in Richmond, for the period between 1950 and 2012, is approximately 23.1 inches (WRCC, 2012). Analysis of long-term precipitation records indicate that wetter and drier cycles, lasting several years, are common in the region.

Floods in the San Francisco Bay Area result from intense rainstorms, generally preceded by a prolonged rainfall period that has saturated the ground. Peak flows are usually of short duration. Historically, major flood problems have occurred in urban areas located in the relatively flat, wide valleys near the mouths of rivers.

4.9.2.1.2 *Hydrology*

The Facility lies within the San Francisco Bay Area region, which covers approximately 4,603 square miles (RWQCB, 2013). The region is highly developed and densely populated. There are 28 groundwater basins within the region.

The Project site is located within the East Bay Plain Subbasin of the Santa Clara Valley Groundwater Basin (DWR, 2003). The East Bay Plain Subbasin is bounded by San Pablo Bay to the north, contact with the Franciscan bedrock to the east and Niles Cone Subbasin to the south. To the west, the subbasin extends beneath San Francisco Bay. Flows from this subbasin are generally toward the west towards San Francisco or San Pablo Bay. The water bearing formations of this region include alluvial fan deposits (Santa Clara Formation), mud, and alluvial deposits associated with an estuarine environment (Alameda Formation), alluvial silts, clays, and gravels (Temescal Formation), and artificial fill found mostly along the bay front (DWR, 2003). In general, these unconsolidated sediments can range up to 1,000 feet thick.

Groundwater is an important component of the hydrologic system in the region. Aquifers (groundwater-bearing zones) are located at varying depths throughout the San Francisco Bay and provide excellent natural storage, distribution and filtration of underground water supplies. Groundwater also supplies high quality

water for drinking, irrigation, and industrial processing and service (RWQCB, 2013). For the purposes of this discussion, groundwater is of importance only because of its influence on surface water quality in the San Francisco Bay Estuary[1] and, specifically, in San Pablo Bay.

Groundwater is not used at the Facility, and all process wastewater is first treated, and then discharged along with stormwater to surface waters. As discussed later, there are ongoing groundwater remediation efforts at the Facility to contain, intercept, and extract contaminated groundwater and treat it through the existing wastewater treatment system.

4.9.2.1.3 *Coastal Flooding*

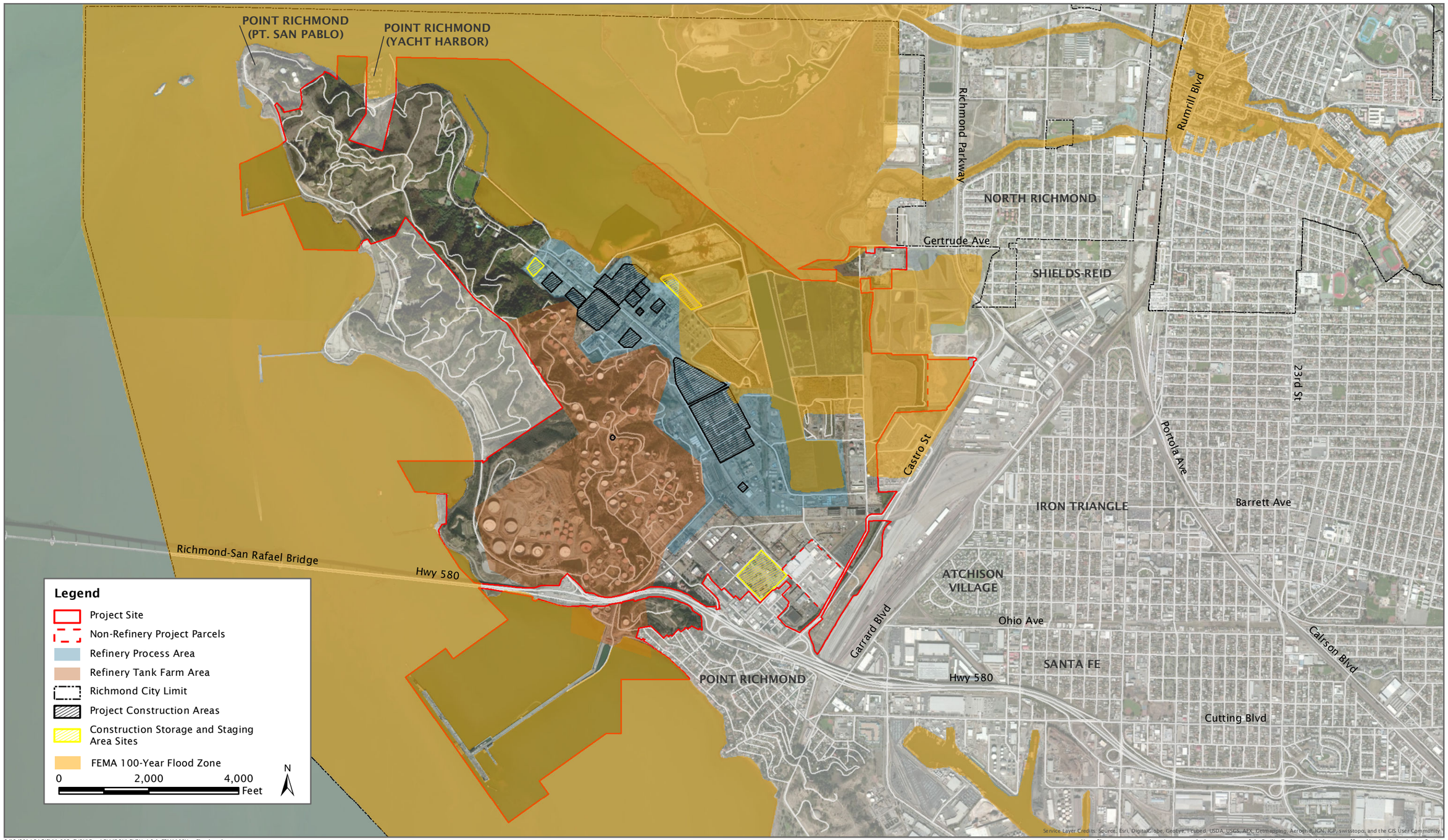
Portions of the Project site are located within the Federal Emergency Management Agency (FEMA) 100-year flood hazard area (Figure 4.9-1). These areas are subject to inundation by the 1%-annual-chance flood event (FEMA, 2009).

4.9.2.1.3.1 *Tsunamis*

Tsunamis are long period waves that are typically caused by underwater disturbances (landslides), volcanic eruptions, or seismic events. Areas that are highly susceptible to tsunami inundation tend to be located in low-lying coastal areas such as tidal flats, marshlands, and former bay margins that have been artificially filled but are still at or near sea level. There have been approximately 20 recorded tsunamis in the northern California area during the period of 1868 to 1968 (CGS, 2012). The maximum wave height associated with these tsunamis was 7.4 feet at the Golden Gate Tide Gage (Contra Costa County, 2005). After natural attenuation across the Bay, estimates have been made that the wave height was approximately half that on the Richmond shoreline and reduced to nothing by the Carquinez Strait (Contra Costa County, 2005).

Based on a comparison of recent tsunami inundation hazard data for the area and the proposed locations of the Modernization Project facilities, some of the land areas where Project components are would be located in areas that may be inundated during a tsunami event (CEMA, et al., 2009).

[1] An estuary is a partially enclosed body of water along a coast that is formed when fresh water from a river or rivers flows into and mixes with salt water from the ocean. The terms “estuary” is used in this document when referring to the Sacramento River and San Francisco Bay system as a whole. The term “bay” is used when referring to specific areas within the estuary (e.g., San Pablo Bay).



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T38r1 and T54); FEMA, 2009

Figure 4.9-1
Chevron Refinery Modernization Project EIR
FEMA 100-Year Flood Zone

4.9.2.1.3.2 *Seiche*

A seiche is a free or standing wave oscillation(s) of the surface of water in an enclosed or semi-enclosed basin that may be initiated by an earthquake. No seiches have ever been recorded in the Bay Area. Due to the relatively large size of San Pablo Bay with an inlet to the south and an outlet to the west, the hazard of seiche waves is interpreted to be low. In addition, there is no historic record of such waves occurring in San Pablo Bay during recent strong earthquakes.

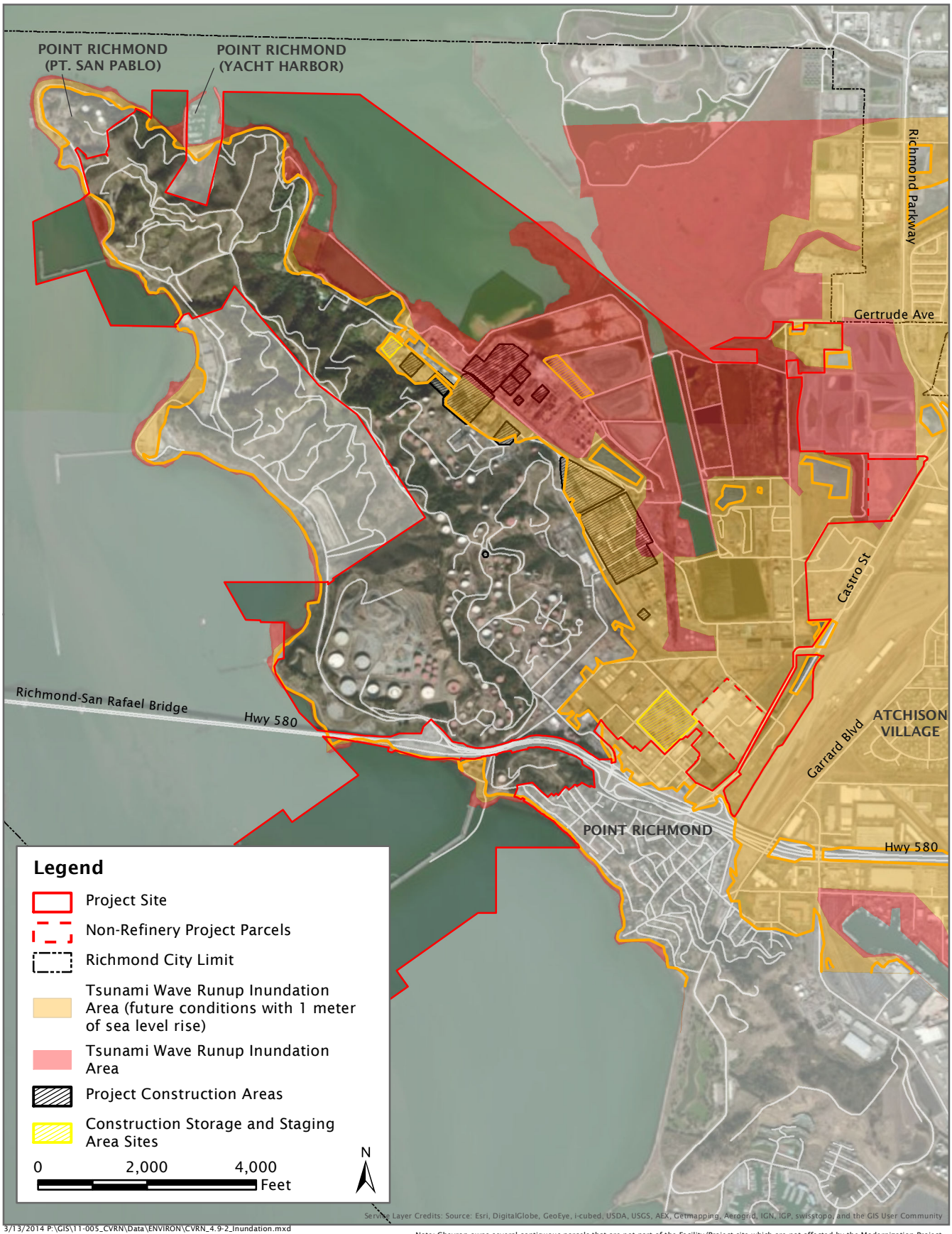
4.9.2.1.3.3 *Sea Level Rise*

The earth has gone through several cycles of cooling and warming over recent geologic time, resulting in periods of glaciation with an associated sea level lowering, and climate warming with sea level rise. The most recent cycle of global climate change is a warming trend of the earth's atmosphere (an increase of approximately 1.8 degrees Fahrenheit in the past 100 years), which has resulted in sea level rise. Rates of sea level rise may vary at specific locations as local subsidence or uplift affects the relative change in sea level between land masses and the ocean. In the San Francisco Bay Area, the background rate of sea level rise has been estimated to be approximately 0.079 inch per year over the past 100 years (NOAA, 2012).

An increased rate of sea level rise is anticipated in the near future due to projected global climate change. Although the rate of increase has not been precisely modeled and cannot be known with certainty, several projections predict a rise in sea level of at least 50 centimeters (approximately 20 inches) and as much as 200 centimeters (approximately 80 inches) by the year 2100 (Knowles, 2010). Even a moderate projection for sea level rise of 100 centimeters (1.0 meter or 39 inches) could affect areas on the Richmond Peninsula not currently considered at risk of flooding and exacerbate areas currently subject to flooding. Figure 4.9-2 shows the areas that would be subject to future tsunami inundation hazard taking into account 1.0 meters (39 inches) of sea level rise.

4.9.2.1.3.4 *San Francisco Bay Estuary*

The San Francisco Bay Estuary is the largest estuary on the Pacific Coast of the United States. The estuary has two basic elements: San Francisco Bay and the Delta, a 2,800-square-kilometer wetland formed at the confluence of the San Joaquin and Sacramento Rivers. San Francisco Bay can be divided into two distinct water bodies, the northern and southern reaches, each with different physical and chemical properties. The northern reach includes three major embayments: Suisun Bay, San Pablo Bay, and Central Bay. Suisun Bay conveys outflow from the Delta at its head and thus can be considered to be a typical estuary. Central Bay is deeper and more oceanic in character than the northern and southern reaches because of its proximity to ocean inflow through the



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: CEMA, 2009; Chevron (T38r1 and T54)

Figure 4.9-2
Chevron Refinery Modernization Project EIR
Tsunami Inundation Areas

Golden Gate, a deep narrow channel through the coastal range. San Pablo Bay lies between the two. The southern reach is separated from the northern reach by the Central Bay and extends from the Oakland Bay Bridge to San Jose.

Freshwater strongly influences environmental conditions in the San Francisco Bay Estuary. The vast majority of the estuary's fresh water originates from the Sacramento-San Joaquin drainage basin and enters the northern reach. The Sacramento River provides most of this flow, and the San Joaquin River and other streams contribute the remainder. The remaining freshwater comes from the San Francisco Bay watershed and flows into the southern reach. The southern reach, like the northern reach, has the physiographic characteristics of an estuary but lacks the fresh water inflow to drive a strong estuarine circulation. As a result, circulation in the southern reach is influenced predominantly by tides, evaporation, and wastewater discharges and thus functions much like a tidally oscillating lagoon for most of the year.

The total annual volume of fresh water reaching the estuary is highly variable and depends on the amount of rainfall in the Central Valley watershed and the amount of fresh water diverted or stored for agriculture, municipal, industrial, and other uses in the Central Valley. Beginning in the 1850s, flood control projects and agricultural diversions began to influence the volume of the annual fresh water inflow into the estuary. As a result, the annual volume of water entering the estuary has significantly been reduced over the years. This fluctuation is important because high flows flush the estuary and check the inland migration of saline ocean water into the Delta.

Water storage and diversions affect not only the total volume but also the seasonal flow of fresh water into the estuary. Today's level of development reduces fresh water flow to the estuary. The impacts on seasonal flow are the greatest in the spring. Spring seasonal flows during the months of April, May, and June play an important role in the reproductive success and survival of several estuarine species, including striped bass and salmon, by transporting eggs and young through the Delta and into the estuary.

Freshwater flows affect the influx of pollutants to the estuary from the Delta and water movements disperse and eventually transport toxic materials out of the estuary. Circulation is relatively complicated in San Francisco Bay because of the complex geometry and the variable amount of freshwater flow during the year. Maintaining a sufficient Delta flow of freshwater is important for dispersing and flushing the estuary of wastes discharged into the Bay, whatever their source. The circulation of water in the Bay is driven by tides, wind, and estuarine circulation. Estuarine circulation is driven by the density difference between fresh and saline ocean water, and its magnitude is controlled by the amount of fresh

water flowing into the estuary from the Delta. Tides are responsible for most of the water motion within the Bay and contribute greatly to the dispersion of material within the estuary. However, tidal motion contributes little to the transport of material out of the Bay. Net transport into and out of the Bay is driven primarily by estuarine circulation.

4.9.2.1.3.5 *San Pablo Bay*

The physical characteristics (i.e., salinity, temperature, and suspended solids) of the waters of San Pablo Bay vary greatly on a given day due to its location between the less salty Suisun Bay and the saltier San Francisco Bay. The interaction between the fresh and saline water has a major influence on the circulation of water in the San Pablo Bay itself. When freshwater and saltwater meet, the denser saltwater tends to flow under the freshwater until the waters are mixed by stronger tidal currents and winds.

While the major source of freshwater to San Pablo Bay is inflow from the Sacramento/San Joaquin Delta, surface water flow, surface stormwater runoff, and groundwater all are important sources of fresh water to San Pablo Bay. The San Pablo Bay watershed has numerous rivers, creeks, and small streams that all flow toward the Bay (among them the San Pablo Creek, which drains the San Pablo Reservoir and Wildcat Creek).

Surface runoff creates the majority of freshwater flows within the rivers and streams. Consequently, stream flow in all the creeks and rivers varies from season to season depending on precipitation. Most of water flow during a given year occurs during the rainy season, from October to May. Flows in smaller streams located in the upper reaches of the watershed are intermittent and start to run dry after the end of the rainy season. Major streams intercept some groundwater in their lower reaches, which allows them to flow all year.

Groundwater is used primarily by agriculture and rural residents. Rain and irrigation water recharge groundwater reserves. The principal groundwater watersheds in the San Pablo Bay watershed underlie the alluvial plains of the valleys. The water-bearing formations consist of younger and older alluvium deposits, along with volcanic and continental deposits.

4.9.2.1.4 *Surface Water Quality*

The quality of the waters in the bays and creeks of San Francisco Bay is a product of a mix of point and nonpoint source[2] discharges, ground and surface water

[2] A point source is any discernible, confined and discrete conveyance (e.g., a pipe, culvert, channel, etc.) that transports pollutants into "waters of the United States") (surface

interactions, and water quality/water quantity relationships. San Francisco Bay is an estuary with complex hydrodynamics and sediment and biochemical fate and transport processes. A number of water bodies are impaired due to excessive siltation (the pollution of water by fine material with a particle size dominated by silt or clay), but it is very difficult to distinguish between excessive siltation and impairment due to flow alterations.

Surface water bodies in the Project site are used primarily for commercial and sport fishing, estuarine habitat, fish and wildlife habitat, recreation, rare species habitat, and industrial service supply. The Regional Water Quality and Control Board (RWQCB), San Francisco Bay Region, has listed impaired water bodies due to elevated levels of contaminants (see further discussion below) (RWQCB, 2013). Among the impaired water bodies for the San Francisco Bay Region are central San Francisco Bay, San Pablo Bay, San Pablo Creek, and Wildcat Creek. The pollutants include chlordane, pesticides, dioxins, furans, mercury, polychlorinated biphenyls (PCBs), and selenium (SWRCB, 2010). The sources of these pollutants or stressors include nonpoint sources from urban development, atmospheric deposition, ballast water, industrial and municipal point sources, agriculture, natural sources, and exotic species.

4.9.2.2 Project Setting

The Facility is located on the San Pablo Peninsula, which contains a steep-sided, northwest-trending ridge about 3 miles long, separating the San Francisco and San Pablo Bays. Elevations range from just over 300 feet above mean sea level at the ridge crest to at or near sea level at the San Pablo Bay edge. Most of the Refinery Operations are situated on the southeast side of the peninsula on the former tidal and slough lands that were reclaimed by the placement of fill. These flat lying areas are generally below elevations of 20 feet above mean sea level. As described in *Section 3.3, Project Description*, much of the construction for the Modernization Project has already been completed. All Modernization Project components constructed so far were placed in or near existing and/or previously used process areas within the Refinery Process Area. All remaining construction or reconstruction of processing equipment and dismantling of the existing hydrogen plant would occur on several sites within the these same existing and/or previously used flat lying areas located within the Refinery Process Area, with the exception of tank domes, which would be installed on existing tanks in hillside areas.

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waters). Nonpoint sources are sources that are not discrete, identifiable conveyances, and are instead diffuse sources that run off and dissipate in a natural impeded manner (e.g., sheet flow).

The Facility processed during the baseline period (2008-2010) an average of 227,900 barrels of crude oil per day, though quantities can vary for a variety of reasons, including maintenance shutdowns. The crude oil blends are refined into a variety of petroleum products such as various fuels, lubricants, intermediates, and blending components. By-products of the refining process included elemental sulfur, ammonia, and some petrochemicals. The Facility processes several different types of crudes and other raw materials. The crudes are delivered to the Facility by ship over the Long Wharf.

Industrial facilities, such as the Facility, are often associated with areas with contaminated soil and groundwater. The soil and/or groundwater quality throughout the Facility has been impacted by historic Facility-related releases (RWQCB, 2012). Chevron has implemented corrective actions to intercept contaminated groundwater at various locations to prevent migration to San Pablo Bay and San Francisco Bay. The corrective actions include combinations of source removal, subsurface barrier walls (to restrict the movement of contaminated groundwater), and extraction trenches/wells to capture and treat contaminated groundwater. Approximately 24,700 feet of extraction trench, 18,535 feet of barrier wall, over 200 groundwater extraction sumps, and one groundwater treatment plant have been installed at the Facility and along the Facility perimeter (RWQCB, 2012). The extracted groundwater is routed to the Facility's effluent treatment system and discharged in accordance with existing 2011 National Pollutant Discharge Elimination System (NPDES) permit requirements (Order No. R2-2011-0049). The groundwater containment and extraction systems are referred to collectively as the groundwater protection system.

In addition to extracted groundwater seepage from the groundwater protection system, numerous sources of water are discharged from the Facility, including treated process wastewater (defined below), stormwater, steam condensate, and firewater. In addition, wastewater from General Chemical Corporation facility located on Castro Street, and stormwater runoff from certain areas of the former Chevron Chemical Company facilities located on Hensley Street and Castro Street are routed to the Facility's wastewater treatment system for treatment and discharge, as authorized by the Facility's 2011 NPDES permit (see discussion of 2011 NPDES permit below). All treated effluent and stormwater are ultimately discharged to San Pablo Bay or San Francisco Bay.

The effluent wastewater is regulated under a NPDES permit issued by the RWQCB (R2-2011-0049). The permit identifies five streams (rainfall, stormwater, treated effluent, free water, and recycled wastewater) and 23 outfalls (RWQCB, 2011).

4.9.2.2.1 *Wastewater Treatment Plant*

The Facility's process wastewater and most of the stormwater runoff is collected and managed in the Facility's existing industrial wastewater treatment system that is regulated by the RWQCB. Discharged "process wastewater" includes treated process wastewater from process units, cooling water tower and blowdown, fresh water treatment facilities (reverse osmosis plant), steam and electrical generation facilities, steam distribution systems, fire protection and safety systems, laboratories, the General Chemical Richmond Works facility, the recovered oil system and groundwater protection system, and some runoff from the City. The process wastewater is collected from two areas—the North Yard and the South Yard. The RWQCB 2011 NPDES permit lists the 2006 through 2010 average discharge from the Facility as 6.6 million gallons per day (MGD), with a reported single day maximum flow of 27.5 MGD (RWQCB, 2011). For the baseline period of 2008-2010, Chevron reported average dry-weather daily discharges of 4.92 MGD in 2008, 5.03 MGD in 2009, and 5.77 MGD in 2010[3] (Chevron Data Transmittal #45D, 2013). Process wastewater is treated in the Facility effluent treatment system prior to release into the Bay(s).

Treatment of oily and some non-oily wastewater streams begins in one of three oil water separators. Separated oil is returned to the process stream, and water from the separators is then routed for biological treatment in an aerated lagoon (bioreactor) and then treated by an activated carbon facility. Non-oily wastewater may be routed directly to the lagoon for treatment. A portion of the aerated lagoon effluent can, as an option, be routed to the Richmond Refinery Water Enhancement Wetland, also referred to as the "water enhancement wetland" in the 2011 NPDES permit. The final discharge of the effluent water is through a deepwater outfall, between 30 and 50 feet deep, located 2,000 feet offshore to the north of Point San Pablo.

Stormwater from across the Facility is either directly discharged through the various permitted outfalls, commingled with process wastewater and treated in the wastewater treatment plant, or entrained in the groundwater (see Table 4.9-1).

In addition to the deepwater outfall (Discharge Point 001) that discharges treated wastewater and stormwater to the San Pablo Bay and the Long Wharf Discharge Point 002 outfall that discharges both stormwater runoff and biologically treated

[3] During the wet season, in addition to the average process wastewater, large amounts of rainfall also enter the wastewater treatment system. The Refinery has the ability to segregate and divert certain streams of storm water to minimize unnecessary loading of the wastewater treatment system (Chevron Data Transmittal #45D, 2013a).

TABLE 4.9-1 FACILITY EFFLUENT WASTE STREAMS AS IDENTIFIED UNDER THE NPDES PERMIT

Discharge Point No.	Description	Sources	Receiving Water Body
001	Facility and General Chemical Wastewater	Various process operations from Facility, Chevron Research and Technology Research Center, General Chemical wastewater, groundwater, ship ballast water and smaller contributions from other industrial sources.	San Pablo Bay – deepwater outfall at an average depth of 30-50 feet and 2,000 feet offshore
002	Long Wharf	Stormwater from the wharf and biologically treated wastewater from wastewater treatment system (Discharge Point 001) may also contain Bay water, residual steam condensate, and water related to rinsing the exterior of the Long Wharf pipelines.	San Francisco Bay
003	North Yard Impoundment Basin	Stormwater runoff mixed with steam condensate, groundwater seepage, non-contact Bay water, hydrotest water, and fire protection water from former waste water treatment basin (407-acre area).	San Pablo Bay
004	Point Orient Tank Farm Area (12-Basin)	Stormwater runoff from 3-acre area.	San Francisco Bay
005	Former Point Orient Tank Farm Area (11 Basin)	Stormwater runoff from a 4-acre area.	San Francisco Bay
006	Former Point Orient Tank Farm Area (10 Basin)	Stormwater runoff from 48-acre area that also may include runoff from 12 Basin and Horse Pasture areas.	San Francisco Bay
007	Horse Pasture	Stormwater runoff from 17-acre area in former Point Orient Tank Farm Area.	San Francisco Bay
008	Tank Farm Area 100-Foot Channel	Stormwater runoff from 496-acre area, mixed with steam condensate, groundwater seepage, hydrotest water, and fire protection water.	San Pablo Bay
009	Quarry Tank Field (8-Basin)	Stormwater runoff from 26-acre area, mixed with steam condensate, groundwater seepage, hydrotest water, and fire protection water.	San Francisco Bay
010	Reclamation Area	Stormwater runoff from 6-acre area.	Gertrude Street Ditch to Wildcat Creek to Castro Creek to San Pablo Bay
011	Former Chevron Chemical Co. Hensley Street Plant Runoff	Stormwater runoff from 36-acre area, groundwater irrigation water, Facility washdown water, and fire protection water.	Castro Creek to San Pablo Bay

TABLE 4.9-1 FACILITY EFFLUENT WASTE STREAMS AS IDENTIFIED UNDER THE NPDES PERMIT

Discharge Point No.	Description	Sources	Receiving Water Body
012	Fertilizer Evaporation Pond	Stormwater runoff from 19-acre area, mixed with groundwater (seepage and extracted from containment systems), steam condensate, fire protection water.	Castro Creek to San Pablo Bay
013	Integrated Wastewater Pond System	Stormwater runoff from 81 acres synthetically lined impoundment and 4-acre capped Class II waste management unit. Also may receive waters from Waste 011 and Waste 012.	Castro Creek to San Pablo Bay
014	Consolidation Area	Stormwater runoff from capped 5-acre waste management area.	Castro Creek to San Pablo Bay
015	Office Hill Tank Farm Area (1-Basin)	Stormwater runoff from 4-acre area.	38-foot channel to San Pablo Bay via Discharge Point 020
016	Office Hill Tank Farm Area (2-Basin)	Stormwater runoff from 5-acre area.	38-foot channel to San Pablo Bay via Discharge Point 020
017	Office Hill Tank Farm Area (3-Basin)	Stormwater runoff from 7-acre area. May also contain fire protection water.	San Francisco Bay
018	Quarry Tank Farm Area (9-Basin)	Stormwater runoff from 29-acre area. May also contain steam condensate, hydrotest water, and fire protection water.	San Francisco Bay
019	SP Hill Tank Farm Area (7-Basin)	Stormwater runoff from 20-acre area. May also contain steam condensate, hydrotest water, and fire protection water.	San Francisco Bay
020	Castro Street (1-Basin, 2-Basin)	Stormwater runoff from 260 acres of Richmond through its stormwater management system. Discharge from 1-Basin and 2-Basin.	Castro Creek to San Pablo Bay
021	Landfill 15	Stormwater runoff from 41-acre landfill site.	Castro Creek to San Pablo Bay
022	Parr-Richmond Site	Stormwater runoff from 24-acre capped waste management unit.	Gertrude Street Ditch to Wildcat Creek to Castro Creek to San Pablo Bay
023	Gertrude Street	Stormwater runoff from 3-acre capped waste management area.	Gertrude Street Ditch to Wildcat Creek to Castro Creek to San Pablo Bay

Source: RWQCB, 2011.

wastewater used in the Facility's fire protection system, there are 21 regulated stormwater outfalls located around the perimeter of the Facility (Table 4.9-1).

Each outfall has a monitoring location where representative samples of stormwater are collected and tested for compliance with the numerical effluent limitations (included in the 2011 NPDES permit) before being discharged to the Bay. Chevron is required to monitor water quality at all of the discharge locations for compliance per the 2011 NPDES permit. Historic effluent limitations and monitoring data are presented in Table 4.9-2.

Over the course of the last permit period from 2006 through mid-2011, there were a total of three NPDES violations reported. One violation, reported in 2008, was related to an exceedance of the selenium effluent limit of 34 micrograms per liter (µg/l). The measured effluent concentration was 47 µg/l and is considered a "serious effluent violation" (SWRCB, 2014). The violation occurred due to a power outage to a sour water plant, which resulted in a loss of steam to a stripper unit, as described in *Chapter 3, Project Description, Section 3.3* and in *Appendix 3, Overview of Oil Refining Process* (Chevron, 2008). Chevron has since improved its administrative controls and installed additional alarms to provide warnings that would allow the situation to be identified and actions taken sooner to prevent wastewater containing elevated levels of selenium from being discharged (Chevron, 2008). Based on review of the State Water Resources Control Board (SWRCB) California Integrated Water Quality System Project website, there have been no reported violations of the selenium effluent limitation since this 2008 event (SWRCB, 2014).

Chevron also had two less serious violations during the last permit period. One violation occurred in 2008 for late submittal of their Annual Stormwater Report. In 2009, Chevron had one violation due to the pH values reported in the stormwater discharge exceeding the discharge limit. The stormwater discharge exceedance was due to construction activities and not related to wastewater treatment. Since issuance of the new permit in 2011, violations related to elevated pH values (which pose only a minor threat to water quality as defined by the SWRCB (SWRCB, 2014)) and sulfide occurred. The sulfide violation occurred when one sample collected in April 2013 exceeded the daily maximum effluent limit. The violation of the daily maximum limit is not subject to a mandatory minimum penalty (non-serious) under Section 13385 of the Water Code because it only exceeded the effluent limit by a few percentage points (Schlipf, 2014a).[4]

[4] Only one sample per month is required to be collected and analyzed for sulfide under the Refinery's 2011 NPDES permit. Therefore, this one sample was also compared to the monthly average effluent limit and was found to exceed this effluent limit as well.

TABLE 4.9-2 WATER QUALITY EFFLUENT DISCHARGE LIMITATIONS

		Historical Effluent Limitations and Monitoring Data (2005-2010)			
Parameter	**Units**	**Highest Monthly Average**	**Highest Daily Discharge/ Concentration**	**NPDES Monthly Average Limitation**	**NPDES Daily Maximum Limitation**
BOD (5-day @20C)	lbs/day	3,072	3,072	5,100	9,600
TSS	lbs/day	1,471	1,471	4,200	6,600
TOC	lbs/day	2,274	2,274	11,000	21,000
Oil & Grease	lbs/day	194	194	1,600	3,000
Oil & Grease	mg/l	3.53	3.53	8	15
Phenolic Compounds	lbs/day	2.3	2.3	22	70
Ammonia as Nitrogen	lbs/day	368	368	1,900	4,200
Sulfide	lbs/day	4.2	4.2	28	62
Settleable Solids	ml/l-hr	<0.1	<0.1	0.1	0.2
Total Chromium	lbs/day	1.1	1.1	25	72
Hexavalent Chromium	lbs/day	0.33	0.33	2.1	4.6
pH	standard units	6.1 – 8.9		6.0 – 9.0	
Copper	µg/l	--	6.2	13	25
Lead	µg/l	--	1.7	7.4	15
Heptachlor Epoxide	µg/l	--	<0.002	0.00088	0.0018
PCBs (Sum)	µg/l	--	<0.02	0.00017	0.00034
Mercury	µg/l	--	0.070[a]	0.017	0.046
Nickel	µg/l	--	27	45	66
Selenium	µg/l	--	47[b]	4.4	7.4
Cyanide	µg/l	--	21[c]	3.7	6.4
Tetrachlorinated dibenzo-p-dioxin (TCDD) Equivalents	µg/l	--	4.6×10^{-8}	--	1.0×10^{-7} (a)
Acute Toxicity	percent	--	98 (b)/98 (c)	(d)	--
Chronic Toxicity	TUc	--	7.8 (e)/8.8 (f)	(g)	--

TABLE 4.9-2 WATER QUALITY EFFLUENT DISCHARGE LIMITATIONS

		Historical Effluent Limitations and Monitoring Data (2005-2010)			
Parameter	Units	Highest Monthly Average	Highest Daily Discharge/ Concentration	NPDES Monthly Average Limitation	NPDES Daily Maximum Limitation

Notes:
BOD = biological oxygen demand
TOC = total organic carbon
TSS = total suspended solids
ml/l-hr = milliliters per liter-hour
mg/l = milligrams per liter or parts per million
µg/l = micrograms per liter or parts per billion
TUc = toxicity unit chronic, equivalent to 100 divided by the no observed effect concentration
NA = not analyzed
<x.x = not detected above laboratory reporting limit of x.x
-- = no data available or no daily/monthly average limitation value applied
For complete footnote annotation to these data, please refer to Tables F-3 and F-4 in RWQCB Order No. R2-2011-0049 (RWQCB, 2011a).

[a] The sample found to contain 0.070 µg/l of mercury was collected and analyzed on May 30, 2008 when the interim effluent limit was 0.075 µg/l. Therefore, this did not represent a violation.

[b] This concentration exceeded the interim effluent limit of 34 µg/l that was in effect at the time and represented a violation and is discussed further above in the section subtitled "Wastewater Treatment Plant." The interim limits were effective until April 27, 2010.

[c] The sample found to contain 21 µg/l of cyanide was collected and analyzed on September 23, 2008 when the interim effluent limit was 25 µg/l. Therefore, this did not represent a violation. The current NPDES permit daily limit for cyanide is 45 µg/l.

Source: RWQCB, 2011a; RWQCB 2010.

An investigation was conducted that indicated the result may have been laboratory error, but the cause of this violation was never fully resolved (Chevron, 2013). Based on conversations with RWQCB staff, sulfide exceedances in wastewater discharges from refineries, including the Facility, are very unusual and not a typical concern (Schlipf, 2014a). Monitoring data provided by the RWQCB for the period between September 2011 and December 2013 indicate that the average sulfide level in discharge is more than an order of magnitude below the daily effluent limitation (Schlipf, 2014b).[5]

[5] Of the 25 samples collected, sulfide levels were below the laboratory detection limit in 11 of these samples. Sulfide levels exceeded 5 lb/day in two of the samples collected (74.3 lb/day on April 1, 2013 and 19 lb/day on May 1, 2013). The remaining 12

4.9.2.2.1.1 *Receiving Waters*

All of the Facility effluent ultimately is discharged into either the San Pablo Bay or the San Francisco Bay of the San Francisco Delta system. San Pablo Bay is the first water body that receives flows from the Sacramento-San Joaquin Delta and the Petaluma, Sonoma, and Napa Rivers. The drainage areas that contribute flows to the rivers comprise about 37% of the land area of the state. Much of the land area is primarily devoted to agricultural and forestry land uses, with some major urban centers that contribute discharges into the rivers. Pollutants produced by these activities reach the San Francisco Bay through discharge from wastewater treatment plants, municipal stormwater systems, agricultural operations, dredging activities, and abandoned mines (acid mine drainage).

The receiving waters for the Facility discharge, which include the San Pablo Bay are tidally influenced water bodies with significant fresh water inflows during the wet weather season that allow frequent flushing and dilution. These receiving waters are designated as "estuarine" by the RWQCB (RWQCB, 2011). Therefore, the effluent limitations specified for discharges to San Pablo Bay are based on the lower of the marine and freshwater water quality criteria.

4.9.2.2.2 *NPDES Discharge Limitations*

Discharges from the Facility are currently governed by Waste Discharge Requirements specified in the 2011 NPDES permit (Order No. R2-2011-0049) and regulated by the RWQCB. This RWQCB 2011 NPDES permit addresses the discharge of process wastewater from the wastewater treatment plant, stormwater runoff, and ship ballast water discharges. Routine water quality monitoring is conducted on all the discharge points identified in Table 4.9-1 as well as points for the receiving waters, land observations, influent waters, and representative rainfall for the area.

Effluent limitations are derived from the SWRCB's Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Policy); the 2011 Regional Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan); California Toxics Rule (Federal Register Volume 65, No. 97), Quality Criteria for Water (United States Environmental Protection Agency [EPA] 440/5-86-001, 1986 and subsequent amendments "Gold Book"), applicable Federal Regulations (40 CFR Parts 122 and 131), National Toxics Rule (NTR) (57 FR 60848, 22 December 1992; 40 CFR Part

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samples had sulfide levels ranging from 5 to 0.3 lb/day. The daily effluent limitation is 71 lbs/day.

131.36(b), NTR Amendment (Federal Register Vol. 60, No. 86, 4 May 1995 pg. 22229-22237), and best professional judgment as defined in the Basin Plan.

Toxicity bioassays are required for discharges from outfall, Discharge Point No. 001. These bioassays consist of acute and chronic testing. The acute testing requires placing *Oncorhynchus mykiss* (Rainbow trout) in undiluted treatment plant effluent and evaluating their survival over a 96-hour period. For acute toxicity, the survival of test fish in 96-hour flow-through bioassays of Discharge Point No. E-001 as discharged is determined from an 11-sample[6] median value of not less than 90% survival, and an 11-sample 90-percentile[7] value of not less than 70% survival. For chronic toxicity, a three-sample median value[8] of 10 toxicity unit chronic (TUc),[9] and a single-sample value equal to or less than 20 TUc. Discharge from Discharge Point No. E-001 is also subject to the following receiving water limitations:

- No floating, suspended, or deposited macroscopic particulate matter or foam;
- No bottom deposits or aquatic growth;
- No alteration of temperature, turbidity or apparent color beyond present natural background levels;
- No visible, floating, suspended, or deposited oil or other products of petroleum origin; and
- No toxic or other deleterious substances to be present in concentrations or quantities that would cause deleterious impacts on aquatic biota, wildlife, or waterfowl, or which render any of these unfit for human consumption either at levels created in the receiving waters or as a result of biological concentrations.

Monitoring of the discharge from the treatment plant to the Bay is required under the self-monitoring program to confirm compliance with the RWQCB NPDES Order, and is reported monthly to the RWQCB.

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[6] A bioassay test showing survival of less than 90% represents a violation of this effluent limitation, if five or more of the past 10 or less bioassay tests show less than 90% survival.

[7] A bioassay test showing survival of less than 70% represents a violation of this effluent limit, if one or more of the past 10 or fewer tests show less than 70% survival.

[8] A test sample showing chronic toxicity greater than 10 TUc represents toxicity and a violation of this limitation, if one or more of the past two or fewer tests show toxicity greater than 10 TUc.

[9] Chronic toxicity unit, which is equal to 100/no observable effect concentration.

4.9.2.3 Regulatory Setting

The regulatory requirements for the Modernization Project include:

- The federal floodplain management requirements of FEMA
- The federal Clean Water Act, as implemented and enforced by the San Francisco RWQCB, under the oversight of the EPA
- The California Porter-Cologne Water Quality Control Act and related California Administrative Code sections administered by the SWRCB and the San Francisco Bay RWQCB

The applicable plans, policies, and regulations are discussed below.

4.9.2.3.1 *Federal Surface Water Quality Requirements*

4.9.2.3.1.1 *Federal Clean Water Act*

The purpose of the Clean Water Act is to protect and maintain the quality and integrity of the nation's waters by requiring states to develop and implement state water plans and policies. Section 303 of the Clean Water Act requires states to establish water quality standards consisting of designated beneficial uses of water bodies and water quality standards to protect those uses for all waters of the United States. Under Section 303(d) of the Clean Water Act, states, territories and authorized tribes are required to develop lists of impaired waters. Impaired waters are those that do not meet water quality standards, even after point sources of pollution have installed the required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for waterways on the lists and develop action plans to improve water quality. This process includes development of total maximum daily loads (TMDLs) that set waste load[10] allocations for point source and load allocations for non-point source pollutants.

San Pablo Bay is included on the California 303(d) List (SWRCB, 2010) as an impaired water body resulting from the presence of chlordane, dichloro-diphenyl-trichloroethane, dieldrin, dioxin compounds, furan compounds, invasive species, mercury, PCBs (nondioxin-like and dioxin-like), and selenium. The 303(d) list identifies the sources of each pollutant–ranging from unknown nonpoint sources (for PCBs) to municipal point sources, resource extraction, atmospheric deposition, natural sources and nonpoint sources (for mercury) and

[10] The load represents the total amount of a pollutant that can be discharged over a given time period. This differs from the discharge limits that usually focus on the concentration of a pollutant in the wastewater discharged into the receiving water.

industrial point sources, agriculture, natural sources and exotic species (for selenium). The 303(d) listing for selenium identifies "significant contributions from oil refineries" and notes that there is a "control program in place." (SWRCB, 2010.) As of 2012, TMDLs have been completed for only PCBs and mercury for the San Francisco Bay (including San Pablo Bay). The TMDL for selenium for the North San Francisco Bay is under development. In addition to these Bay TMDLs, there are site-specific objectives and related water quality attainment strategies for copper and nickel. The copper objectives apply to the San Pablo Bay and Central San Francisco Bay. For nickel, the site specific objectives only apply south of the Dumbarton Bridge. The 303(d) program has been and will continue to be administered through California's permitting process, which is administered by the SWRCB and its nine RWQCBs.

4.9.2.3.1.2 *Environmental Protection Agency*

The EPA is responsible for implementing federal laws designed to protect air, water, and land. While numerous federal environmental laws guide EPA's activities, its primary mandate with respect to water quality is the Clean Water Act. EPA has developed national technology-based standards and states have developed water quality standards in accordance with the Clean Water Act. EPA has developed national technology-based effluent limitation guidelines for a variety of industrial sectors, including the petroleum refining sector that must be included in all NPDES permits. In addition, states are required to adopt water quality standards (or objectives) in accordance with the Clean Water Act. The EPA has established such standards for certain toxic pollutants applicable to California waters, in the NTR and California Toxics Rule (CTR). These standards are used to determine the amount and the conditions under which pollutants can be discharged.

On April 28, 2000 the Office of Administrative Law approved the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Policy). The SWRCB adopted the policy in March 2000. On May 18, 2000, the EPA published in the Federal Register the CTR establishing water quality standards for toxic pollutants for California waters (FR 31681). The CTR was effective on the date of publication. The State Implementation Policy (discussed below) became fully effective on May 18, 2000 because it was conditioned on the effective date of the CTR. The State Implementation Policy was updated in 2005 (SWRCB, 2005).

In addition, the EPA regulates, under the NPDES vessel general permit, discharges incidental to the normal operation of vessels operating in a capacity as a means of transportation (including petroleum tankers). The vessel general permit was first issued in 2008 and included general effluent limits applicable to all discharges; general effluent limits applicable to 26 specific discharge streams;

narrative water-quality based effluent limits; inspection, monitoring, recordkeeping, and reporting requirements; and additional requirements applicable to certain vessel types. The new vessel general permit (which was reissued in December 2013) and superseded the 2008 permit, includes more stringent controls on ballast water discharges. Specifically, the 2013 permit requires owners/operators to test ballast water for organisms both greater and less than 50 micrometers in dimension. Ballast water cannot be discharged unless test indicate there are fewer than: (1) 10 living organisms per cubic meter for organisms greater than 50 micrometers; and (2) 10 living organisms per milliliter for organisms between 10 and 50 micrometers.

4.9.2.3.1.3 *National Pollutant Discharge Elimination System*

Section 402 of the Clean Water Act established the NPDES permit program, under which point source discharges of pollutants to waters of the US are prohibited except in compliance with the terms and conditions of an NPDES permit. Under the NPDES program, industrial facilities such as the Facility and commercial marine vessels that call at the Facility are required to obtain an NPDES permit that specifies allowable limits and other requirements applicable to their discharges to surface waters. NPDES permits typically contain technology-based effluent limitations (which are based on available wastewater treatment technologies appropriate to the industry) and any more stringent water quality-based effluent limitations that are necessary to meet applicable water quality standards.

Stormwater discharges are regulated somewhat differently. The SWRCB has issued general NPDES permits, which apply on a statewide basis to discharges of stormwater associated with industrial activities and to discharges from construction areas involving 1 or more acres.

Permit coverage can be obtained either by filing a Notice of Intent to comply with the general permit or by applying for and obtaining an individual permit. In most cases where a facility such as the Chevron Richmond Facility is already subject to the requirement to obtain an individual permit, stormwater discharges are typically regulated under the umbrella of the existing permit. In contrast, due to the time-limited nature of stormwater discharges from construction sites, these types of discharges are most often regulated under the construction general permit, even if the facility already has an individual NPDES permit.

4.9.2.3.1.4 *Flood Control*

Under Executive Order 11988, FEMA is responsible for management of floodplain areas defined as the lowland and relatively flat areas adjoining inland and coastal waters subject to a 1% or greater chance of flooding in any given year (also termed the 100-year floodplain). FEMA requires that local governments covered

by federal flood insurance pass and enforce a floodplain management ordinance that specifies minimum requirements for any construction within the 100-year floodplain. The vast majority of the Refinery Operations are outside the 100-year floodplain although the property boundary includes areas that are within the 100-year floodplain (FEMA, 2009). Some of the Modernization Project elements in the eastern portion of the site would be located within the FEMA 100-year floodplain.

4.9.2.3.2 *State, Regional and Local Water Quality Regulations and Agencies*

4.9.2.3.2.1 *Porter-Cologne Act*

The SWRCB and the RWQCBs share the responsibility under the Porter-Cologne Act to formulate and adopt water policies and plans, and to adopt and implement measures to fulfill Clean Water Act requirements. Specific to the Project site, the Regional Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) serves to protect the water quality of the State consistent with identified beneficial uses.

Prior to authorizations of waste discharge by the RWQCB, the Porter-Cologne Act requires reports of waste discharges to be filed. The RWQCB then prescribes Waste Discharge Requirements, which serve as NPDES permits under a provision of the Porter-Cologne Act. The 2011 NPDES permit regulates discharges from the Facility wastewater treatment plant into San Pablo Bay.

4.9.2.3.2.2 *Bay Conservation and Development Commission*

The 27-member San Francisco Bay Conservation and Development Commission was created by the California Legislature in 1965 in response to broad public concern over the future of San Francisco Bay. The Commission is made up of appointees from local governments and state/federal agencies. The Commission, among other responsibilities, is charged with:

- Regulating new development within the first 100 feet inland from the Bay to ensure that maximum feasible public access to the Bay is provided.
- Pursuing an active planning program to study Bay issues so that Commission plans and policies are based upon the best available current information.
- Administering the federal Coastal Zone Management Act within the San Francisco Bay segment of the California coastal zone to ensure that federal activities reflect Commission policies.
- Participating in California's oil spill prevention and response planning program.

4.9.2.3.2.3 *State Water Resources Control Board*

The SWRCB administers water rights, water pollution control, and water quality functions statewide. The SWRCB provides policy guidance and budgetary authority to nine RWQCBs, which conduct planning, permitting, and enforcement activities. The SWRCB shares the authority for implementation of the Clean Water Act and the State Porter-Cologne Act with the RWQCBs. The water quality near the Facility is under the jurisdiction of the San Francisco Bay RWQCB.

In 1991, the SWRCB adopted the Enclosed Bays and Estuaries Plan, a water quality policy that applied to all enclosed bays and estuaries in California. As defined by the SWRCB, enclosed bays are indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. San Francisco Bay and its constituent parts, including San Pablo Bay, fall under this category. The original Bays and Estuaries Plan contained a number of numeric water quality objectives for covered waters that were subsequently incorporated by regional water quality control boards into their respective water quality control plans (basin plans). However, in 1994, following several court challenges, the Enclosed Bays and Estuaries Plan was rescinded, leaving in place the requirements of the NTR and various provisions of EPA-approved basin plans that predated the 1991 plan. The deficiencies in state water quality objectives were subsequently remedied by the adoption of the CTR by EPA in 2000. Shortly thereafter, the SWRCB adopted the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California in 2000, which implemented the CTR. The State Implementation Policy was subsequently amended in 2005. The San Francisco RWQCB has since amended its Basin Plan to incorporate all currently effective numeric water quality objectives applicable to San Francisco Bay and its sub-bays, including those promulgated in the NTR and CTR.

The Antidegradation Policy requires that all existing instream water uses and the level of water quality necessary to protect those uses must be maintained, and that where the quality of water exceeds that necessary to maintain “fishable, swimmable” goals of the Clean Water Act, that quality must be maintained unless the State determines that lower water quality is necessary to accommodate important economic or social development in the area. No degradation is allowed for high quality waters that that are designated as outstanding National resources. San Francisco Bay is not among this class of high quality waters. The State’s Antidegradation Policy is reflected in SWRCB Resolution No. 68-16.

4.9.2.3.2.4 *Water Quality Control Plan for the San Francisco Region (Basin Plan)*

The RWQCB is responsible for developing and implementing the Basin Plan, which documents approaches to implementing state and federal policies in the

context of actual water quality conditions. The RWQCB's other activities include permitting of waste discharges, and implementing monitoring programs of pollutant impacts.

On June 21, 1995, the Board adopted a revised Basin Plan, which the SWRCB and the Office of Administrative Law approved in 1995. The Basin Plan is periodically updated; the most recent revisions were approved in November 2012. The Basin Plan identifies beneficial uses of receiving waters, water quality objectives imposed to protect the designated beneficial uses, and strategies and schedules for achieving water quality objectives. Section 303 (c) (2) (B) of the Clean Water Act requires Basin Plans to include water quality objectives governing approximately 68 of EPA's list of 126 priority pollutants.

Water Quality objectives are achieved primarily through the establishment and enforcement of Waste Discharge Requirements for each wastewater discharger. The Basin Plan was amended in 1992 to include stricter water quality criteria that had been previously adopted in 1991 Enclosed Bays and Estuaries Plan and although the Enclosed Bays and Estuaries Plan was later invalidated by court order, certain water quality criteria that were based on that plan remain in the Basin Plan. State policy for water quality control in California is directed toward achieving the highest water quality consistent with maximum benefit to the people of the State. Therefore, all water resources must be protected from pollution and nuisance that may occur from waste discharges. Beneficial uses of surface waters, ground waters, marshes, and mud flats serve as a basis for establishing water quality standards and discharge prohibitions to attain this goal.

The State Implementation Policy, also implemented by the RWQCB establishes the policy for determining effluent limitations for toxic pollutants. The State Implementation Policy establishes the implementation policy for all toxic pollutants including dioxins and furans. The State Implementation Policy also requires monitoring for a minimum of 3 years by all major NPDES dischargers for the seventeen dioxin and furan compounds, whether or not a limit is necessary to prevent exceedance of the water quality standard that has been established for one of the dioxin compounds (2,3,7,8-TCDD). In summary, the steps involve:

- Identifying applicable criteria and objectives,
- Determining whether there is a reasonable potential for the pollutant to cause or contribute to exceedance of a water quality criterion or objective; and
- Calculating a value for the effluent limit taking into consideration the applicable criteria or objective, and discharge variability; or

- If a TMDL is in effect, assigning a portion of the loading capacity to the discharge.

4.9.2.3.2.5 *Waste Discharge Requirements (Point Source)*

For surface waters, Water Quality Objectives are achieved primarily through the establishment and enforcement of NPDES permits (referred to as Waste Discharge Requirements under the Water Code) issued to each wastewater discharger. Discharges to groundwater are also regulated through the issuance of Waste Discharge Requirements (but not under an NPDES permit absent an immediate and direct connection to surface waters). The San Francisco Bay Basin Plan has been amended to include the applicable water quality standards in the NTR and CTR, as well as other previously EPA-approved water quality standards. Water quality objectives for groundwater are also included in the Basin Plan.

In the case of stormwater discharges where the establishment of numeric effluent limitations is currently considered infeasible, the discharger is required to develop a Storm Water Pollution Prevention Plan (SWPPP) and implement best management practices (BMPs) to prevent or minimize industrial pollutants in stormwater. BMPs include structural and nonstructural measures that can reasonably and cost-effectively be used to minimize the potential for exposure of stormwater to pollutants associated with industrial activity. The Facility SWPPP must include information on potential sources of pollutants, including solid and hazardous wastes, and the BMPs that are implemented to control those potential sources.

4.9.2.3.2.6 *Senate Bill 771 California Clean Coast Act of 2005: Vessel Discharges*

Senate Bill (SB) 771, the "California Clean Coast Act of 2005" became effective on January 1, 2006. The Act prohibits discharges of the hazardous wastes, oily bilge water, graywater, and other wastes from ocean-going vessels (including petroleum tankers) and cruise ships. The SB 771 discharge restrictions, which are more stringent than those included in the EPA vessel general permit (discussed above), have been incorporated by the RWQCB into the water quality certification for the EPA vessel general permit.

4.9.2.3.2.7 *Marine Invasive Species Act*

The California Marine Invasive Species Act of 2003 (Public Resources Code Sections 71200 through 71271), which became effective January 1, 2004, revised and expanded the Ballast Water Management for Control of Nonindigenous Species Act of 1999. Beginning on March 22, 2006, all vessels operating within the Pacific Coast Region are required to manage ballast water. Management options include retention of all ballast water, exchange of ballast water in near-coastal waters, before entering the waters of the state, if that ballast water has

been taken on in a port or place or within the Pacific Coast region. All vessels are required to complete and submit a ballast water reporting form, maintain a vessel-specific ballast water management plan and ballast tank log book, remit the necessary fee to the Board of Equalization, and submit to compliance verification inspections.

4.9.2.3.2.8 *Contra Costa Clean Water Program*

The Contra Costa Clean Water Program was established as the local entity responsible for implementing compliance with the Federal Clean Water Act to control stormwater pollution. It is comprised of Contra Costa County, 16 incorporated cities, and the Contra Costa County Flood Control and Water Conservation District. The program is being conducted in compliance with the municipal regional permit (NPDES permit No. CAS0029912) issued by the San Francisco Bay RWQCB. The permit contains a comprehensive plan to reduce the discharge of pollutants to the "maximum extent practicable" and mandated that participating municipalities implement an approved stormwater management plan by September 1, 1993. The program incorporates BMPs that include construction controls (such as a model grading ordinance), legal and regulatory approaches (such as stormwater ordinances), public education and industrial outreach (to encourage the reduction of pollutants at various sources), inspection activities, wet-weather monitoring, and special studies.

The municipal regional permit includes provision C.3 to address potential stormwater quality degradation associated with new development and redevelopment. In accordance with these requirements, new development and redevelopment projects are required to incorporate treatment measures and other appropriate source control and site design features to reduce the pollutant load in stormwater discharges and manage runoff flows. The Modernization Project would not be subject to these requirements because stormwater flows from the Facility are already treated by the water treatment plant and regulated under the existing Chevron 2011 NPDES permit.

4.9.2.3.3 *Groundwater Quality*

The RWQCB has determined that the Facility's groundwater protection system (described above) "is a satisfactory corrective action measure for the containment and removal of contaminated groundwater along the perimeter of the Refinery" (RWQCB, 2012), indicating that this corrective action is protective of public health and the environment. Performance of the groundwater protection system and other remedial actions to address soil and groundwater contamination at the Facility are regulated under RWQCB-issued Site Cleanup Requirements and Waste Discharge Requirements.

4.9.2.3.3.1 *Federal Requirements*

The following laws and regulations impose various requirements on facilities that generate, treat, store or dispose of hazardous wastes/substances. Many aspects of these regulatory programs are designed to protect groundwater quality from hazardous constituents that could leach from wastes, or that are accidentally spilled where they could migrate through soils to groundwater. Soils that are contaminated with chemicals, fuels, oils and other hazardous substances are subject to various release reporting and corrective action requirements.

4.9.2.3.3.1.1 *Environmental Protection Agency*

To implement the following laws, the EPA has developed regulations to implement the federal statutes that provide the general framework of the national hazardous waste management system. Hazardous waste sites, including those with contaminated soil, groundwater, or surface water are subject to one or more of the following laws and implementing regulations:

4.9.2.3.3.1.2 *Resource Conservation and Recovery Act*

The Resource Conservation and Recovery Act (RCRA) was enacted in 1976 as the first step in regulating potential health and environmental issues associated with disposal of solid and hazardous wastes. Solid (municipal) wastes are regulated under RCRA Subtitle D, while hazardous wastes are regulated under RCRA Subtitle C. Underground tanks used for the storage of hazardous substances are regulated under RCRA Subtitle I. Under Subtitle C, EPA regulates the generation, transportation, treatment, storage, and disposal of “hazardous waste” as defined under federal law. Under RCRA, individual states may implement their own hazardous waste management programs, as long as they are consistent with and at least as stringent as the federal program. EPA must approve state programs that have been determined to be equivalent to RCRA. The State of California has been granted final authorization over all aspects of the federal hazardous waste program, with the exception of hazardous waste delistings.

4.9.2.3.3.1.3 *Comprehensive Environmental Response, Compensation, and Liability Act*

Also known as the federal Superfund, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was enacted in 1980 to establish hazardous substance release reporting requirements and to impose liability on “responsible parties” for investigation and remediation of contaminated sites. Crude oil and its fractions (e.g., kerosene, diesel, gasoline, etc.) are excluded from the definition of “hazardous substance” under CERCLA.

4.9.2.3.3.1.4 *Superfund Amendments and Reauthorization Act*

The Superfund Amendments and Reauthorization Act amended CERCLA in 1986 to increase Superfund funding, modify contaminated site cleanup criteria, and revise settlement procedures. It also provides a regulatory program for leaking underground storage tank cleanups, and a broad, emergency planning and community right-to-know program.

4.9.2.3.3.2 *State, Regional, and Local Requirements*

4.9.2.3.3.2.1 *Regional Water Quality Control Board*

Through the state legislation known as the Porter Cologne Act**,** the RWQCB is responsible for enforcing water quality objectives as outlined in the Basin Plan. The Basin Plan designates water quality objectives for waters of the State, including groundwater. It also includes programs of implementation to achieve water quality objectives. The Basin Plan was duly adopted and approved by the SWRCB, EPA, and the Office of Administrative Law where required. The latest version is effective as of June 2013.

The RWQCB shares enforcement responsibility with the Department of Toxic Substances Control over the regulation and cleanup of contaminated sites that pose a threat to groundwater. Regulations for the protection of groundwater quality are found in Title 22 of the California Code of Regulations. However, lead oversight of RCRA groundwater monitoring and corrective action programs at Bay Area refineries, including the Facility, has been assigned to the RWQCB by the Legislature. The San Francisco Bay RWQCB has identified over 5,400 sites with confirmed releases of constituents of concern that have polluted or threaten to pollute groundwater. For each site for which it has lead agency responsibility, the RWQCB approves proposed groundwater and soil cleanup levels. These levels can be based on conservative screening values or determined on a site-specific basis based on risk and other factors. Cleanup activities are subject to the requirements of SWRCB Resolution No. 92-49, Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304. This policy requires cleanup to background water quality or the highest water quality that is technically and economically feasible to achieve.

4.9.2.3.4 *Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan 2030), including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use, Plans, and Policies* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.9.3 Significance Criteria and Methodology

Construction and operation of the Modernization Project could potentially affect the quality of San Pablo Bay and the San Francisco Bay Estuary because of changes in either the quantity of treated effluent discharges or in the quality of these wastewaters. This section evaluates the significance of potential impacts along with mitigation measures where required. One of the impacts evaluated is the ability for the Facility to continue meeting effluent compliance requirements.

4.9.3.1 Significance Criteria

Consistent with Appendix G of the CEQA Guidelines, a significant hydrology and water quality impact would occur if the Modernization Project were to do the following:

(A) Violate any water quality standards or waste discharge requirements, such as the discharge limits and capacity requirements in Chevron's current NPDES permit;

(B) Disturb, expose or otherwise alter the present state of the existing soil contamination leading to significant adverse changes to wastewater effluent quality;

(C) Substantially deplete groundwater supplies or interfere with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table;

(D) Substantially alter the existing drainage pattern of the site, including through alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in substantial erosion, siltation or flooding on or off site;

(E) Create or contribute to runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;

(F) Cause or significantly contribute to violations of ambient water quality objectives, such as contributions of specific toxic materials that already impair the waters of San Francisco and San Pablo Bays;

(G) Place structures within the 100-year flood hazard area that would impede or redirect flood flows;

(H) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam; or

(I) Inundation by seiche, tsunami, or mudflow.

4.9.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of hydrology and water quality related impacts is explained in the context of each impact, as discussed further below.

4.9.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

The Modernization Project could not be considered to have "no impact" in relation to any of the significance criteria listed above. Therefore, all of the criteria are discussed further below. Criterion "I" includes mudflow, a type of landslide. The potential for landslide hazards is discussed in *Section 4.7, Geology, Soils, and Seismicity*, of this EIR.

4.9.4 Impacts and Mitigation Measures

Impact 4.9-1: The Modernization Project has potential to affect the quality and/or quantity of water entering the Facility's wastewater treatment plant, which could in turn affect the quality of receiving waters (the San Pablo and San Francisco Bay). This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

4.9.4.1 Construction

The Modernization Project would include excavation and grading for footings and foundations of new processing units that would potentially expose soils to erosion. Some of these soils may contain residual levels of contamination related to historic on-site chemical releases and spills. However, all proposed excavation related to the Modernization Project would be conducted entirely within the Refinery Process Area of the Facility (see Figure 3-2). Stormwater runoff from within the Refinery Process Area is collected in the stormwater conveyance system and treated by the on-site wastewater treatment system. Any sediment and/or residual contaminants in the runoff would be treated prior to discharge under the Facility's 2011 NPDES permit. As required by Mitigation Measure 4.9-1a, stormwater runoff would also be treated during the construction period (and water quality objectives achieved) through implementation of best management practices documented in a Storm Water Pollution Prevention Plan (SWPPP).

4.9.4.2 Operations

The Modernization Project includes the replacement of the hydrogen plant with a newer, more efficient plant and an increase in the capacity of the sulfur recovery units and gas oil hydrotreater (fluid catalytic cracker feed hydrotreater [FCC FHT]). The new units would allow the Facility to process crude oils blends and gas oils with higher sulfur content. This discussion describes the potential for this operational change to affect the quality of treated wastewater effluent that is discharged to the San Pablo Bay and San Francisco Bay and stormwater runoff.

All new industrial components of the Modernization Project that would have the potential to affect stormwater runoff quality would be located entirely within the Refinery Process Area of the Facility (see Figure 3-2).[11] Stormwater runoff from within the Refinery Process Area is collected in the stormwater conveyance system and treated by the on-site wastewater treatment system. Any sediment and/or residual contaminants in the runoff would be treated prior to discharge under the Facility's 2011 NPDES permit. This is a less-than-significant impact.

Effluent water quality could be affected by the Modernization Project if: (1) the Project would cause a substantial change in the constituent load (the type and/or concentration of constituents) in the process water to be treated such that the plant could not effectively remove these constituents to the effluent limitations specified in the Facility's 2011 NPDES permit; and/or (2) the Project would cause more wastewater to be generated than under current conditions, which could deliver a greater pollutant load over time or more wastewater than the treatment plant could effectively treat (i.e., overwhelmed the capacity of the plant) resulting in discharges that did not receive full treatment.

4.9.4.2.1 *Change in Constituent Load*

4.9.4.2.1.1 *Sulfur*

The Facility currently receives, and after the Modernization Project would continue to receive, crude oils from different sources that vary in composition. The composition of a particular crude source can also change over time. Sulfur is one of the constituents that can vary in crude, and under the Modernization Project, the Facility could accept crudes with higher sulfur content. Sulfur is a product that the Facility removes during the refining process. Processes for removing sulfur include facilities for the capture and removal of sulfur compounds. As described in *Chapter 3, Project Description*, the Modernization Project proposes an increase in the Facility's capacity to remove sulfur from

[11] Note that proposed tank dome installations in the hillside areas do not include activities that would expose contaminants to rainfall or runoff.

crude oils and gas oils by increasing the capacity of the FCC FHT from 65,000 to 80,000 barrels per day of gas oil, and the capacity of the sulfur recovery units from 600 to 900 long tons per day, as well as making related improvements to allow the Facility to process higher levels of sulfur in feedstock. The FCC FHT is a key component in the treatment refining process, in which crude oils and gas oils are treated to remove non-hydrocarbons like sulfur, metals, and nitrogen. The sulfur recovery units convert hydrogen sulfide to elemental sulfur, a product sold for various agricultural and industrial uses. The existing sulfur recovery units consist of three parallel process units with a combined sulfur removal capacity of 600 long tons per day.

Residual concentrations of sulfur compounds, including sulfates and sulfides, may make it into the Facility's wastewater[12] because, at least in part, elemental sulfur is not a stable element in water, but breaks down into sulfides and sulfates. Sulfate is a naturally occurring compound and not a typical water quality contaminant of concern (i.e., there is no sulfate water quality objective in the Basin Plan [RWQCB, 2013]), nor is sulfate included in the Regional Monitoring Program for the San Francisco Bay (SFEI, 2013). Sulfide is the only sulfur-related water quality contaminant of concern specified for routine monitoring under Chevron's 2011 NPDES permit.

The wastewater stream potentially containing residual sulfides is currently treated by the Facility's wastewater treatment plant and would continue to be treated after the Modernization Project. The wastewater treatment plant uses a combination of separation, biological treatment and filtration water treatment processes. Wastewater begins treatment in one of three oil water separators. Wastewater from the separators is then routed for biological treatment in an aerated lagoon (bioreactor) and then treated by an activated carbon system. Non-oily wastewater may be routed directly to the lagoon for treatment. In the past, sludge from the oil water separators has been sent to a recycling facility and used as coker feed in Chevron's El Segundo refinery, and bioreactor dredge spoils have been used to fill the decommissioned oxidation ponds and the 250-foot channel at the Facility (Chevron Data Transmittal #71, 2014).

Past monitoring required by the Facility's NPDES permit indicates that the combination of biological treatment and filtration at the Facility's activated carbon system effectively removes sulfides. The concentration of sulfide (an ion of sulfur) in effluent is regulated in discharges, and has over time been consistently below effluent limitations established in the 2011 NPDES permit.

[12] Elemental sulfur is not a water quality contaminant and is not specifically regulated under Chevron's 2011 NPDES permit (Order No. R2-2011-0049).

The highest daily discharge concentration of sulfide ion detected in the wastewater effluent from the Facility's treatment plant between 2006 and 2010 was 4.2 pounds per day and the effluent limitation contained in the 2006 NPDES permit is 68 pounds per day (Table 4.9-2). (The 2011 NPDES permit limit is 32 pounds per day [30-day average] and 71 pounds per day [daily maximum].) As discussed further in the Wastewater Treatment Plant discussion above, one sample collected in April 2013 exceeded the daily maximum effluent limit for sulfide. The Facility would be required to continue monitoring for sulfides in the wastewater effluent and complying with NPDES effluent limitations.

4.9.4.2.1.2 *Metals in Relation to Sulfur*

Different crude oils and gas oils contain different concentrations of metals and other potentially toxic chemicals. These metals and chemicals in crude oils and gas oils vary in concentration under existing conditions and would continue to vary under the Modernization Project conditions. If metals and other potentially toxic chemicals in the crude oils and gas oils that are proposed to be processed under the Modernization Project were to increase relative to existing conditions, it is possible that an incremental increase in pollutant loading in wastewater and eventually wastewater discharges to the Bay could occur under the Project.

In response to comments made by the RWQCB to the 2008 Draft EIR, Chevron provided Facility-specific analytical data comparing the sulfur and selenium content of 17 different crude blends. The RWQCB reviewed these data and in a written response concluded that: (1) there is no correlation between sulfur content of crude oil and selenium concentration, and therefore under the Project selenium loading would vary as it does under existing conditions; and (2) selenium loadings tend to decrease with lower wastewater flows (RWQCB, 2007). As discussed below, as mitigated, the Modernization Project would result in no net increase in wastewater generation, and thus there is no evidence to suggest that discharges of selenium, a high priority pollutant for the Bay, would increase as a result of the Project.

To further evaluate the potential for an increase in the pollutant loading to the process wastewater stream resulting from processing crude oils and gas oils with higher sulfur content, this EIR analysis statistically evaluated available crude oil analytical data for a variety of crude sources (*Appendix AQ-MET*). Specifically, the concentrations of metals constituents were compared to sulfur content concentrations for over 50 different crude oils (*Appendix AQ-MET*). If there was some sort of geochemical correlation between sulfur content and these metals concentrations, this correlation should be apparent in the data. Data were available for the following metals: barium, calcium, iron, magnesium, nickel, titanium, vanadium, and zinc. Of these, barium, calcium, magnesium, titanium, and zinc had either no correlation or a negative correlation with sulfur content.

Iron, nickel and vanadium were found to have only a statistically weak correlation with sulfur content, indicating that it is possible that a slight increase in these metals would occur under the Modernization Project. Based on the fact that the metals evaluated were found to have either no correlation or a statistically weak correlation to sulfur content, it can be reasonably expected that other metals of concern (i.e., chromium, copper, lead, selenium) would similarly have no or a weak correlation with sulfur.

Even though statistical evaluation indicates there is at most only a weak correlation between metals content and sulfur content in crude oil, metals do occur in crude. Metals in the crude oil are removed during the refining process in the hydrotreating stage. Hydrotreatment involves the chemical reaction of hydrocarbon compounds in the presence of pressure, heat, and a catalyst to treat different fractions of the crude oil.

Any metals or other toxic chemicals that make it into the process wastewater stream are subjected to treatment at the Facility wastewater treatment plant. As described above, the Facility treats wastewater using a combination of separation, biological treatment and filtration water treatment processes. Each of these processes reduces suspended solids concentrations in the wastewater, and therefore reduces concentrations of metals and other chemical that are associated with these solids.

Under their existing 2011 NPDES permit, Chevron is required to conduct regular sampling of their wastewater effluent. As shown on Table 4.9-2, with the exception of one violation in 2008 associated with selenium (for which protocols have been implemented including additional alarms, as described above in the Wastewater Treatment Plant discussion and Chevron Data Transmittal #45G, 2013), the Facility's wastewater treatment plant consistently treated metals and other chemicals to levels below the established effluent limitations during the period between 2005 and 2010 (the period the data in Table 4.9-2 cover). As described above, an additional violation related to discharge of sulfide occurred since issuance of the 2011 NPDES permit. Chevron is also required to conduct sampling that would identify new pollutants or resulting toxicity associated with new pollutants. Specifically, Chevron is required to sample and test effluent for 126 priority pollutants twice each year and conduct weekly toxicity testing where sensitive test organisms are exposed to effluent water (RWQCB, 2011). These required tests cover a broad spectrum of potential pollutants and potential toxicity from known and unknown pollutants.

Overall, the Facility has had a history of compliance with the effluent discharge limits defined by its 2011 NPDES permit, with discharges well within allowable limits, often by an order of magnitude or more. Only one violation considered

serious by the RWQCB occurred within the last permit period (from 2006 through mid-2011), and that violation was addressed by changes in operational protocols as described above.

Since the Modernization Project would include processing of crude oil and gas oils that may have a slightly higher concentration of some metals, it is possible that a slight increase in the pollutant load (i.e., concentrations of pollutants in wastewater) entering the wastewater treatment plant could occur. However, the Facility's existing wastewater treatment systems are operating well within permit limits, including permit limits relating to metals, confirming the operational effectiveness of wastewater treatment methods for removing metals. Facility wastewater discharges would also continue to be limited to those allowed under the existing 2011 NPDES permit, and this permit also requires regular monitoring of effluent and corrective action if wastewater quality limits are exceeded. Continued compliance with the 2011 NPDES would ensure that the Project would have a less-than-significant impact on receiving waters (i.e., the Bay) related to pollutant loads from metals and other constituents, and no increase in metal-related wastewater discharges is anticipated to occur as a result of Modernization Project implementation.

4.9.4.2.2 *Wastewater Quantity*

The 3-year (2008-2010) baseline[13] period average annual wastewater generation is estimated at 1,331 million gallons. As detailed on Table 4.9-3, the overall Modernization Project would not result in an increase in annual wastewater generation. The Modernization Project would include two water reuse Project Design Features that would ensure no net increase in volume of industrial wastewater discharge. These Project Design Features are:

(1) Stripped sour water reuse in the distillation and reforming area, where stripped sour water from the sour water concentrator at the existing sulfur recovery unit would be reused to supply D-852 for use in the distillation and reforming wash water system, displacing the current use of boiler feed water in the distillation and reforming wash water system (Stripped Sour Water Reuse/Distillation and Reforming Area); and

(2) Stripped sour water reuse in the South Isomax Area where stripped sour water from 8 and 18 Plants (sour water stripping plants) would be used to

[13] This 2008-2010 baseline period is appropriate for conducting the hydrology and water quality analysis because no regulatory or Facility equipment or process operation modifications have occurred since this time period that would result in substantive changes to the results of the analysis.

TABLE 4.9-3 MODERNIZATION PROJECT WASTEWATER GENERATION

Physically Modified Plants	Pre-Project 2008-2010 Baseline Average (MGY)	Post-Project 93% Utilization (MGY)	Post-Project 100% Utilization (MGY)	Project Change 93% Utilization (MGY)	Project Change 100% Utilization (MGY)
Hydrogen Plant					
Existing Hydrogen Plant	74	0	0	-74	-74
New Hydrogen Plant Cooling Tower Blowdown	0	158	158	158	158
New Hydrogen Plant Boiler Blowdown	0	11	11	11	11
Sulfur Recovery Units					
Process Water	24	63	63	39	39
Cooling Tower Blowdown	96	100	100	4	4
Boiler Blowdown	22	8	8	-14	-14
FCC FHT					
Process Water	33	33	33	0	0
Cooling Tower Blowdown	--[a]	--[a]	--[a]	--[a]	--[a]
Boiler Blowdown	12	5	5	-7	-6
New Hydrogen Sulfide Plant					
Process Water	0	12	12	12	12
Total for Physically Modified Plants	**261**	**389**	**389**	**129**	**129**
Plants Not Physically Modified					
Process Water	531	542	560	11	29
Existing **Hydrogen Sulfide** Plants	78	82	88	4	10
Total Cooling Tower Blowdown	345	281	292	-63	-52
Total Boiler Blowdown	116	117	119	1	3
Total for Plants Not Physically Modified	**1,070**	**1,023**	**1,060**	**-47**	**-10**
Total for Modified and Not Modified Plants	**1,330**	**1,412**	**1,448**	**82**	**118**
Water Saved by Reuse by Project Design Features	**0**	**-97**	**-97**	**-95**	**-97**
Net Change in Water Use from Project	**1,330**	**1,315**	**1,351**	**-15**	**21**

Notes: Numbers may not sum exactly due to rounding.

MGY = million gallons per year

[a] The FCC FHT shares the North Isomax cooling tower with the existing hydrogen plant.

supply V-891 for use in the South Isomax process water system. This would displace the use of cold pump condensate in the South Isomax process water system (Stripped Sour Water Reuse in South Isomax Area).

These two Project Design Features are also required to be implemented as Mitigation Measures, as noted below. Table 4.9-3 shows that, at 93% Facility utilization, the Hydrogen Plant Replacement and Sulfur Removal Improvements components of the Modernization Project would result in a net increase of wastewater generation of approximately 82 million gallons per year (MGY), but that the two water reuse Project Design Features would fully off-set that increase (Chevron Data Transmittal #51, 2013) (see also *Chapter 3, Project Description, Section 3.3* and *Appendix 3, Overview of Oil Refining Process*). Therefore, the 93% Utilization Scenario would not result in an increase in wastewater generation.

The 100% Utilization Scenario would increase wastewater generation by approximately 118 MGY (Table 4.9-3), and this increase would not be offset by the two Project Design Features. Therefore, utilization above 93% up to 100% would increase wastewater generation. Further sour water reuse measures are included as Mitigation Measures to offset this increase, as noted below.

Some stormwater runoff is directed to the wastewater treatment plant and therefore contributes to the total volume that the wastewater treatment plant must process. Contributions from runoff would be expected to be similar since the new units would not significantly change the amount of impervious surfaces or infiltration rates. Since the existing surface soils are highly compacted and typically underlain by shallow bedrock, infiltration rates are minimal. Therefore, the change in runoff rates between existing conditions (i.e., compacted soil and bedrock) and new impervious surfaces is relatively small. In addition, much of the construction for the Modernization Project, including most of the placement of new impervious surfaces, has already been completed. All Modernization Project facilities and equipment constructed so far were placed in or near existing and/or previously used process areas within the Refinery Processing Area of the Facility, and the remaining construction or reconstruction of processing equipment would occur on several sites within these same existing and/or previously used areas. Adding a small amount of impervious cover would not significantly affect generation of runoff, and therefore would not affect flows to the wastewater treatment plant.

Implementation of the two Project Design Features required to be implemented in Mitigation Measure 4.9-1a will offset increased wastewater generation under the 93% Utilization Scenario. Implementation of two additional stripped sour water reuse measures as identified in Mitigation Measure 4.9-1b would reduce

wastewater generation by approximately 39 MGY (Chevron Data Transmittal #70, 2014), which would more than offset the wastewater generation increase under the 100% Utilization Scenario. As mitigated, the Modernization Project would cause no net increase in wastewater flows and thus this impact is reduced to a less-than-significant level.

Mitigation Measure 4.9-1a: Chevron shall prepare and submit a SWPPP to the RWQCB that includes best management practices to treat stormwater runoff during the construction period (and achieve water quality objectives) at least 10 days prior to commencement of construction activities. The BMPs included in the SWPPP shall be implemented during construction.

Mitigation Measure 4.9-1b: Chevron shall implement two Project Design Features (Stripped Sour Water Reuse/Distillation and Reforming Area and Stripped Sour Water Reuse in South Isomax Area) to offset average annual process wastewater flows under the 93% Utilization Scenario.

Mitigation Measure 4.9.1c: If the Modernization Project increases wastewater generation above the 93% Utilization Scenario, any increases in wastewater generation shall be offset by implementation of additional water reuse projects, which may include (1) reuse of stripped sour water from 8 and 18 plants to supply wash water for the FCC FHT and hydrocracker located in the North Isomax area; and (2) reuse stripped sour water from 8 and 18 plants to supply wash water for lube crackers in the Richmond lube oil plant area. Additional or alternative stripped sour water reuse measures could also be implemented to assure no net increase in wastewater generation with City approval.

Implementation of Mitigation Measure 4.9-1a through 4.9-1c above would reduce the impact to a less-than-significant level.

Impact 4.9-2: The Modernization Project could disturb, expose, or otherwise alter the present state of the existing soil contamination, leading to significant adverse changes in wastewater effluent quality. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Approximately 500 tons of contaminated soils would be excavated in the vicinity of the pipe racks under the Modernization Project (no other contaminated soils would be disturbed) (Chevron Data Transmittal #32, 2012). If not properly managed, contaminants may come into contact with rainfall and runoff. These contaminants could be entrained in runoff and/or infiltrate into the subsurface. This is a significant adverse impact that would be less than significant with implementation of the following mitigation measure.

Mitigation Measure 4.9-2: Any stockpiles of soils containing contaminants generated under the Modernization Project shall be covered with plastic sheeting to ensure that sediments and pollutants are not entrained in runoff or infiltrated into the subsurface during rainfall events. Reuse or disposal of contaminated soils shall be completed in accordance with applicable laws and regulations. If the soil is a hazardous waste, it shall be disposed of off-site at a licensed facility within 90 days of generation.

Implementation of Mitigation Measure 4.9-2 above would reduce the impact to a less-than-significant level.

Impact 4.9-3: The Modernization Project would not substantially deplete groundwater supplies or interfere with groundwater recharge. This impact would be less than significant and no mitigation is necessary. (LTS)

There are no identified users of groundwater supplies in the vicinity of the Modernization Project. The Project would be constructed within an area where groundwater recharge is minimal. In general, surface soils within the Facility are highly compacted and typically underlain by shallow bedrock. This soil condition and presence of shallow bedrock severely limits infiltration potential under the existing condition (i.e., groundwater recharge under existing conditions is negligible). Further, no use of groundwater resources is proposed for the Modernization Project. This is a less-than-significant impact.

Mitigation Measure 4.9-3: None required.

Impact 4.9-4: The Modernization Project would not substantially alter the existing drainage pattern of the site, including through alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in substantial erosion, siltation or flooding on- or off-site. This impact would be less than significant and no mitigation is necessary. (LTS)

The Modernization Project would not alter the course of a stream or river. While some of the Project components would include new impervious surfaces, the existing surface soils are highly compacted and frequently underlain by shallow bedrock, limiting infiltration rates. Therefore, the proposed new impervious cover is not expected to cause a substantial increase in surface water runoff rates or volumes. Because the Modernization Project involves replacement or reconstruction of existing equipment and placement of new equipment in a highly developed area, none of Project components or facilities would substantially alter drainage patterns (e.g., redirect stormwater runoff from one subbasin to another), and therefore this is a less-than-significant impact.

Mitigation Measure 4.9-4: None required.

Impact 4.9-5: The Modernization Project would not create or contribute to runoff water that would exceed the capacity of existing or planned stormwater drainage systems. This impact would be less than significant and no mitigation is necessary. (LTS)

As described above, while some of the Modernization Project components would include new impervious surfaces, the existing surface soils are highly compacted and frequently underlain by shallow bedrock, limiting infiltration rates. Therefore, the proposed new impervious cover is not expected to cause a substantial increase in surface water runoff rates or volumes and therefore this is a less-than-significant impact.

Mitigation Measure 4.9-5: None required.

Impact 4.9-6: The Modernization Project could place structures within the 100-year flood hazard area that would impede or redirect flood flows. This impact would be less than significant and no mitigation is necessary. (LTS)

The Modernization Project is located on a hilly peninsula that extends into the Bay; FEMA flood zones (Zone VE) mapped around most of the perimeter of the peninsula are related to coastal flooding hazards (e.g., high tides and storm surges) (FEMA, 2009). Placement of structures within coastal flooding zones would not adversely impede or redirect flood flows toward some other vulnerable area because the structures would not affect the water levels in the Bay or the energy of surges or waves elsewhere. Therefore, this is a less-than-significant impact.

Mitigation Measure 4.9-6: None required.

Impact 4.9-7: The Modernization Project would place structures in areas subject to storm-related flooding. The Modernization Project also includes ongoing use of Facility equipment in areas subject to coastal flooding, including tsunami wave run-up and sea level rise. A tsunami in San Francisco Bay is a low probability event, and Chevron has an emergency response plan in place for addressing a tsunami event, and therefore near-term impacts related to a tsunami are less than significant. However, future flood risks will likely increase with predicted sea level rise, exacerbating coastal flooding problems. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Portions of the Project site are located within the FEMA 100-year flood hazard area (Figure 4.9-1). These areas are subject to inundation by the 1%-annual-

chance flood event (FEMA, 2009). However, any development within the 100-year flood hazard area would be required to comply with the City of Richmond Flood Ordinance (Municipal Code Chapter 12.56, Flood Damage Prevention), which requires physical improvements that are susceptible to flooding to be elevated above the 100-year inundation level and anchored to prevent floatation.

Based on a comparison of recent tsunami inundation hazard data for the area and the proposed locations of the Modernization Project facilities, some of the land areas where the facilities proposed by the Modernization Project would be located may be inundated during a tsunami event (CEMA, et al., 2009). In addition, this potential inundation hazard will increase over time as sea level rises because if a tsunami wave enters the bay when there is a higher ambient water level, the wave will run up higher on the land surface than it would if water levels were lower. Figure 4.9-2 shows the results of a predictive model that estimates tsunami inundations areas. Using detailed topographic information, the area of inundation related to the modeled tsunami after 1 meter of sea level rise is shown, demonstrating the increased area of potential flooding over time.

Due to the orientation of the Richmond Peninsula, only the southwest side would be in the direct path of a tsunami wave entering the Bay. This southwest side is characterized by relatively steep uplands, and the wave would likely not advance very far inland (as shown on Figure 4.9-2). The northeast side of the peninsula, where there are more low-lying areas, would experience a reduced wave impact but is still susceptible to inundation.

Chevron has developed emergency response plans for the Facility that includes notification, evacuation, shutdown, and monitoring actions that would be implemented by Facility staff if a tsunami were to occur. Most of these actions are focused on managing the Long Wharf facilities and ships.

A tsunami is considered a low probability event, as only two measurable tsunamis have been recorded in San Francisco Bay (1868 and 1964) (CGS, 2012). Considering that a tsunami in San Francisco Bay is a low probability event, Chevron has a contingency plan in place, and the Modernization Project does not result an incremental increase to pre-existing risks, inundation associated with a tsunami under current conditions is a less-than-significant impact.

Current flooding inundation scenarios (including the FEMA 100-year flood hazard delineation and predicted tsunami wave runup shown in Figures 4.9-1 and 4.9-2, respectively) do not address future conditions and sea level rise. As sea level rises (1 meter of sea level rise is estimated by 2100), the base water level in the Bay from which coastal flooding and inundation occurs is raised, exacerbating future flooding problems. This future flooding condition would be particularly relevant to the low-lying area along the northeast portion of the project site. The

potential for injuries and property damage related to more frequent and severe future flooding conditions is a significant impact that that would be less than significant with implementation of the following mitigation measure.

> Mitigation Measure 4.9-7: Within 5 years, Chevron shall retain qualified professionals to develop a Facility flood contingency plan that addresses all types of coastal flooding (i.e., storm-related flooding, extreme high tides, and tsunamis) and how these coastal flooding hazards will increase over time due to sea level rise. The contingency plan shall be submitted to the City of Richmond for review and approval.

The contingency plan shall define the level of protection based on best available estimates for sea level rise from the State of California or the Bay Conservation and Development Commission (currently 1 meter of rise is predicted by 2100). The contingency plan may use a phased approach to providing protection of susceptible facilities (i.e., increase the level of protection as the hazard increases). Potential flood protection methods in the plan may include 1) raising susceptible structures above the future flood inundation levels; 2) raising berms and levees to provide the needed protection; or 3) other equivalent options. The flood protection methods defined in the contingency plan shall be implemented within 5 years of plan completion. The contingency plan shall be updated every 5 years and these updates submitted to the City of Richmond for review and approval. Implementation of Mitigation Measure 4.9-7 above would reduce the impact to a less-than-significant level.

Impact 4.9-8: The Modernization Project would include increased shipping activities related to transportation of crude and gas oils. An increase in shipping activity could incrementally increase potential impacts related to accidental spills and routine discharges from vessels and potentially affect water quality in the Bay. These potential impacts were already addressed in the Chevron Long Wharf EIR. Therefore, this impact would be less than significant and no mitigation is necessary. (LTS)

As described in the Chevron Long Wharf EIR (State Lands Commission, 2006), activities associated with barge and tanker vessel traffic can result in water quality impacts to the Bay. The Long Wharf EIR discussed 12 potential impacts related to vessel traffic and concluded that seven of these potential impacts were significant. The potential impacts found to be significant included: (1) segregated ballast water that contains harmful microorganisms could be discharged to the Bay (segregated ballast water is kept in tanks separated from oily cargo); (2) discharge of non-segregated ballast water to the treatment plant may include nonindigenous organisms (and the treatment plant did not include any specific procedures to prevent the organisms from being discharged to the

Bay); (3) use of anti-fouling paints could impact water quality; (4) routine tanker maintenance and related transfers of lubricating oils could impact water quality; (5) stormwater runoff from the wharf could impact water quality; (6) oil and product spills and leaks at the wharf could impact water quality; and (7) oil spills from vessels in transit could impact Bay or ocean water quality.

Three of the impacts listed above (nos. 2, 4, and 5) were determined to be less than significant after mitigation. However, four of the impacts listed above (nos. 1, 3, 6, and 7) were found to be significant and unavoidable, even with implementation of available mitigation measures. Impact no. 3, the use of anti-fouling paints on vessel hulls, was banned in 2008 and therefore is no longer considered a significant adverse impact. In addition, the 2013 vessel general permit (described above in the Regulatory Setting section) includes more stringent controls on discharge of ballast water (including numeric effluent limitations) than the 2008 vessel general permit (the Long Wharf EIR was prepared in 2006, prior to approval of the first vessel general permit in 2008). Compliance with the increasingly stringent requirements of the new vessel general permit would further reduce the severity of impact no. 1.

Shipping volumes vary under current Refinery Operations, and would continue to vary after installation of the Modernization Project. Under the reasonably foreseeable 93% Utilization Scenario and the 100% Utilization Scenario, shipping would increase relative to the baseline period, as described further in *Section 4.3, Air Quality*. However, a potential increase in shipping compared to the baseline period would be consistent with the shipping volumes previously analyzed in the Long Wharf EIR, as any potential increase in shipping would remain below the 900 vessel calls analyzed in the Chevron Long Wharf EIR. Since the analysis and CEQA review included in the Long Wharf EIR, including mitigation measures addressing shipping-related risks, remain applicable to the Facility, no new impacts above and beyond those that were presented in the Long Wharf EIR would occur based on Modernization Project implementation. Therefore, the potential impacts to Bay water quality related to the Modernization Project are less than significant.

Mitigation Measure 4.9-8: None required.

4.9.5 Cumulative Impacts

The cumulative wastewater flows from the Modernization Project process units and stormwater flows from point and non-point sources within the vicinity of the Project could potentially increase the mass load of pollutant discharges to the Bay. Given the uncertainties in the amounts of the increases in the Modernization Project toxic metal and chemical loading, and in the ability of the receiving waters to carry those increases, if any, the Modernization Project could

potentially contribute to a cumulative adverse impact in the receiving water bodies. Considering the negligible incremental contribution from the Modernization Project, together with continued compliance with the discharge requirements of the Facility's NPDES permit, this impact would be less than significant.

The waste streams at the Facility are treated by the wastewater treatment plant prior to discharge, and are required to comply with NPDES discharge limitations. The effluent discharges into the San Pablo Bay resulting from the Modernization Project in combination with other projects at the Facility, such as the East Bay Municipal Utility District's Richmond Advanced Recycled Expansion water project (described in *Section 4.17, Utilities and Service Systems*), would be regulated by Chevron's NPDES permit (RWQCB, 2011).

Cumulatively, these discharges are assimilated into the receiving surface water resources. Discharges from point sources to the waters of the United States are regulated by the RWQCB through the establishment of limitations in the NPDES permit that are required to be followed by dischargers to manage effluent and emission concentrations of contaminants. The applicable discharge and emission limits and requirements are derived from various applicable plans, policies, and regulations including the Federal Clean Water Act, Federal Code of Regulations: Title 40, San Francisco Bay Region Water Quality Control Plan (Basin Plan), CTR, NTR, State Implementation Policy (also referred to as the State Implementation Plan), EPA Quality Criteria for Water, and Ambient Water Quality Monitoring. The water quality criteria set in these plans, policies, and regulations provide both numeric water quality objectives and narrative objectives for toxicity and bioaccumulation in order to protect beneficial uses. The narrative objective for toxicity states: "All waters shall be maintained free of toxic substances in concentrations that are lethal to or produce other detrimental responses in aquatic organisms." The NPDES permit also provides the means for implementing more stringent effluent limitations as necessary to protect beneficial uses.

The State Implementation Plan prescribes the plans for implementing the water quality standards in the CTR. The CTR establishes numeric criteria for aquatic life and human health for toxic pollutants and provides a compliance schedule that authorizes the State to issue new or revised NPDES permit limits based on the federal criteria. Combined with the Basin Plan and the other plans, policies and regulations listed above, the NPDES permit is the principal tool used in protection of aquatic sensitive species and other "beneficial uses" of State water resources such as San Pablo Bay. The Basin Plan states that "the Water Board will consider establishing more stringent limitations as necessary to meet water quality objectives and protect beneficial uses in particularly sensitive areas" (RWQCB, 2013). The Modernization Project's discharge could contribute to an

increase in the cumulative chemical loading to the receiving waters of the San Pablo Bay. The Facility's contribution is controlled by the discharge limits in the NPDES permit and eventually will be considered by the RWQCB under the regional TMDL programs, because discharges by Chevron contribute pollutants to the overall hydrologic system of the Bay. Either under the NPDES or TMDL program, the RWQCB would have the authority to modify the discharge limits in order to protect water quality from any sudden changes or significant deviations.

The combined changes in the constituents and mass loading of the final effluent discharge from the Modernization Project, Richmond Advanced Recycled Expansion water project, and other Facility projects, into the San Francisco and San Pablo Bays would be minimal. The final effluent discharge would be regulated by Chevron's NPDES permit. The combined totals would represent less-than-significant increases in discharges to the receiving waters. The Modernization Project's contribution to this cumulative adverse impact would be less than cumulatively considerable. The impact of the combined discharges from the Project, together with the other projects considered under the cumulative analysis, would be substantially controlled by discharge requirements established by the RWQCB.

The State 303(d) listing of impaired water bodies indicates that the pollutants impairing San Pablo Bay are primarily contributed by non-point sources, atmospheric deposition and historic mining practices, not current industrial discharges. For this reason, as the State Water Resources Control Board has found, "the refineries' discharges of impairing pollutants are insignificant" and even eliminating all refinery discharges would have "no demonstrable water quality effect" (SWRCB, 2001).

Because the Bay Area refineries' total discharges are judged to have "no demonstrable water quality effect" and the Modernization Project would not increase total wastewater discharge and would not be expected to result in significant changes to the pollutant load entering the wastewater treatment plant, the Project would not make a cumulatively considerable contribution to the cumulative impact on water quality. In addition, both the NPDES permit limitations and the TMDL programs are designed to consider cumulative impacts by establishing criteria that consider the beneficial uses of the receiving waters.

4.9.6 References—Hydrology and Water Quality

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4.10 LAND USE, PLANS, AND POLICIES

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) changes to relevant plans and policies, including the adoption of a new Richmond General Plan. These revisions do not change the 2008 EIR's conclusions that there are no significant adverse land use impacts for the Modernization Project.

IMPACT SUMMARY

- Construction or operation of the Modernization Project would result in less-than-significant impacts related to land use as it would not physically divide a community.
- The Modernization Project would not conflict with established land use plans, policies, ordinances, or any applicable habitat conservation plan or natural community plan.

4.10.1 Introduction

This section addresses land use impacts associated with the Modernization Project at the Facility. This section describes and discusses the existing land uses and analyzes potential impacts caused by both the construction and the operation of the Modernization Project.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities. For

example, as described in *Chapter 3, Project Description, Section 3.3,* construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

4.10.2 Setting

4.10.2.1 Regional and Project Setting

4.10.2.1.1 *Regional Land Uses*

Contra Costa County encompasses approximately 480,000 acres located along the eastern edge of San Francisco Bay and the southern edge of San Pablo Bay and the Carquinez Strait, and is one of the nine counties that comprise the Bay Area (ABAG, 2013).[1] Nearly 75% of the land area in Contra Costa County remains undeveloped, and most of the existing development consists of residential and commercial development, as well as streets and highways (Contra Costa County, 2005). The County is divided into three primary planning areas: West Contra Costa County, Central Contra Costa County, and East Contra Costa County. The Project site is located in West Contra Costa County (West County) which includes the cities of Richmond, El Cerrito, Hercules, Pinole, and San Pablo and the unincorporated urbanized areas of North Richmond, Rodeo, Crockett, and Port Costa.

West County is partially located along the San Francisco Bay, and with the exception of the cities of El Cerrito and San Pablo, all of the incorporated cities in West County include land along the waterfront. (The unincorporated areas of North Richmond, Rodeo, Crockett, and Port Costa also include shoreline areas along the Bay.) Most of the waterfront areas continue to serve heavy industrial uses and marine and port-based operations. However, as heavy industrial uses have moved away, there has been a trend toward providing more recreational and residential uses along the waterfront. These waterfront areas now include regional open space preserves, public hiking and bicycle trails, public plazas and piers, public marinas, parks, restaurants, stores and shops, and multi-family residential complexes. Regional open spaces along West County waterfront include the 2,315-acre Point Pinole Regional Shoreline Park, the 295-acre Miller/Knox Shoreline Park, and the 2,795-acre Carquinez Regional Shoreline

[1] The following counties comprise the Bay Area: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties.

Park, and other smaller regional or municipal parks and marinas (Contra Costa County, 2005).

Contra Costa County is also home to four of the Bay Area's five refineries, two of which are located in West County in the City of Richmond and in the unincorporated community of Rodeo. The development of refineries in Contra Costa County resulted from a combination of undeveloped agricultural land and marshes, natural deep water ports, the development of the railroad, local and national demand for refined oil products, access to San Francisco, the Sacramento and San Joaquin valleys, the Pacific Ocean, and the proximity of available workers. In many cases, the refineries were established at or near long-standing ferry routes, existing ports, or trading posts that preceded the development of nearby cities. In almost every case, refineries were one of several waterfront industrial land uses that included shipbuilding, commercial and agricultural shipping, assembling and processing plants, ferry transit, and military use.

4.10.2.1.2 *City of Richmond*

The City of Richmond encompasses 18,792 acres of land[2] along the eastern edge of the San Francisco Bay and the western edge of Contra Costa County (City of Richmond, 2012a). The City of Richmond borders unincorporated land to the north, northeast, west, including the community of Rodeo, and the cities of San Pablo to the northeast, El Cerrito to the west, and Albany to the south. The City of Richmond has over 32 miles of shoreline (City of Richmond, 2012b).

Land uses in the City of Richmond were primarily agricultural or related to fishing and maritime use until the arrival of the Santa Fe Railroad in 1900 and the construction of the Standard Oil refinery soon thereafter in 1901-1902.[3,] The Standard Oil refinery provided housing for its workers in nearby Point Richmond and, in its efforts to provide employee amenities, developed an infrastructure that included roadways, and other facilities such as the Rod and Gun Club. Located near the Richmond-San Rafael ferry line, the Facility originally occupied approximately 600 acres. Other industries along the waterfront came to include the Ford Motor Company, shipbuilders (especially during World War II), iron and metal factories, other facilities that processed raw materials, and military

[2] The City's boundary also encompasses open waters.

[3] When built, the Standard Oil refinery was reportedly the largest on the Pacific coast and the third largest in the world (Fridell, 1954). In 1977, Standard Oil became Chevron and the corporate identity became Chevron in 1984.

facilities. Most of these industries are no longer located along the San Francisco Bay.

Land uses in the western section of the City of Richmond now include a mixture of remaining industrial uses, open space, single-family and medium-density residential, commercial, military, and port/maritime-related uses. The Richmond General Plan 2030 (General Plan 2030) designates approximately 3,360 acres of the City (or approximately 18% of its land) for Industrial, Port, Marine and Waterfront Commercial, and Business/Light Industrial Uses. Of the 3,360 acres, approximately 986 acres are designated Industrial (City of Richmond, 2012b).

4.10.2.1.3 *Site Vicinity*

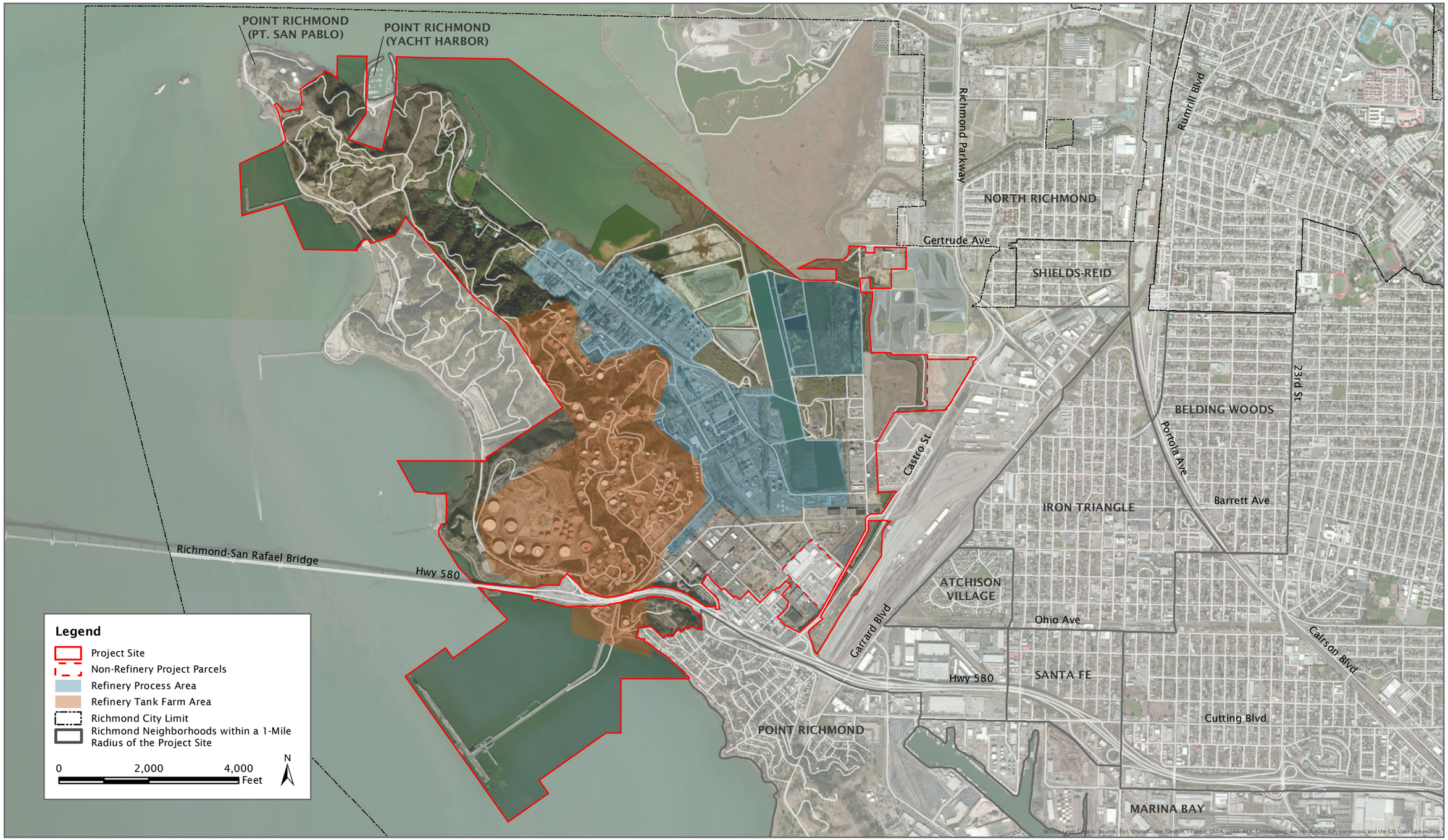
The Facility, located in west Richmond at 841 Chevron Way near the eastern terminus of the Richmond-San Rafael Bridge, is the largest refinery in the Bay Area, and occupies an estimated 2,153 acres, including a substantial portion of the Point San Pablo Peninsula. Most of the remainder of the Point San Pablo Peninsula is used as open space or for recreation, and includes the Point San Pablo Yacht Harbor, Red Rock Marina, undeveloped marsh lands, Point Molate Beach Park (a 15-acre site), portions of the Bay Trail, Point Pinole Regional Park, the Winehaven Historic District, Chinese Shrimp Camp, and the former Point Molate Naval Fuel Depot. Southeast of the Facility lies Miller-Knox Regional Shoreline Park.

With the exception of the Point Richmond area and marsh lands, in general, land uses immediately adjacent to the Facility are industrial and recreational, as listed in Table 4.10-1.[4] The Facility is bordered by Interstate 580 (I-580)[5] to the south, the former Point Molate Naval Fuel Supply Depot and the San Francisco Bay to the west, San Pablo Bay to the north, an active landfill transfer station to the northwest, industrial developments including the Santa Fe Intermodal Facility and rail yards (also to the north and east), and Castro Street to the east.

Portions of six residential neighborhoods are located within a 1-mile radius of the Facility (see Figure 4.10-1). These are:

[4] Biological resources, such as creeks and marsh, are discussed in detail in *Section 4.4, Biological Resources*.

[5] I-580 links western Contra Costa County with Marin County and US 101 via the Richmond-San Rafael Bridge.



Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T38r1 and T54)

Figure 4.10-1
Chevron Refinery Modernization Project EIR
Richmond Neighborhoods within a 1-Mile Radius of the Project Site

TABLE 4.10-1 LAND USES ADJACENT TO THE FACILITY

Name	Address	General Land Use Type	Proximity to Facility
General Chemical Company	500 Castro Street	Industrial	East (adjacent)
West Contra Costa County Sanitary Landfill	Foot of Parr Boulevard	Industrial	North (adjacent)
Terminal Four	Northern tip of Point San Pablo Peninsula	Industrial	North (adjacent)
Point Molate	Western edge of Point San Pablo Peninsula	Former military fuel depot	West (adjacent)
San Pablo Yacht Harbor	Northern edge of Point San Pablo Peninsula	Recreation	North (adjacent)
Point Molate Beach Park	Western edge of Point San Pablo Peninsula (adjacent to Point Molate and the Facility)	Recreation	West (adjacent)
Santa Fe Intermodal Facility	East	Industrial	East (adjacent)
Point Richmond	South (south of I-580)	Residential and Commercial	South (adjacent)
Richmond-San Rafael Bridge toll plaza	East	Institutional	East (adjacent)

Source: Urban Planning Partners, 2013.

4.10.2.1.3.1 *Shields-Reid (North Richmond)*

The Shields-Reid neighborhood is located adjacent to the unincorporated North Richmond area, east of the Richmond Parkway and the Facility, and includes single-family and medium-density housing; industrial uses, open space, and undeveloped land.

Major land uses located in North Richmond (including the unincorporated area) include commercial nurseries, Verde Elementary School, West Contra Costa County Sanitary Landfill, portions of Wildcat Creek, San Pablo Creek, and the Shields-Reid Community Center and Park.

4.10.2.1.3.2 *Iron Triangle and Atchison Village*

The Iron Triangle and Atchison Village neighborhoods, located east of the Facility, include single-family, low-, medium- and high-density housing units; commercial, open space and industrial uses. Major land uses include Atchison

Village,[6] Atchison Park, a portion of the Richmond Greenway, the Richmond Museum of History, Nevin Park and Community Center, Richmond Intermodal BART Station, Peres Elementary School, Lincoln Elementary School, Gompers High School, and Triangle Court. The Santa Fe Intermodal Rail facility and Richmond Parkway separate these two neighborhoods from the Facility.

4.10.2.1.3.3 *Point Richmond and Point San Pablo Yacht Harbor*

The Point Richmond[7] neighborhood, located south of I-580 and most of the Facility, encompasses a mix of single-family, low- and medium-density residential units, and commercial, open space and industrial land uses. I-580 separates most of the Facility from the Point Richmond neighborhood, except the Long Wharf which abuts the single-family residential area east and south of Western Drive and Golden Gate Avenue. Major land uses in the area include Washington Elementary School, Washington Park, Richmond Fire Station 61, Westside Branch Library, Miller Knox Regional Shoreline Park, and the Richmond Natatorium.

The Point San Pablo Yacht Harbor, located northwest of the Facility, is a small community with approximately 30 residents living in boats and stilt houses. The hills surrounding the neighborhood are undeveloped. Major land uses include the Point San Pablo Marina and Yacht Club and Point San Pablo Beach.

4.10.2.1.3.4 *Santa Fe*

The Santa Fe neighborhood, located southeast of the Facility, is primarily a single-family, low density residential area. The southern portion of the neighborhood located south of I-580 is comprised of industrial uses. The Santa Fe Neighborhood is located directly adjacent to Nystrom Elementary School and Martin Luther King Jr, Park.

4.10.2.1.3.5 *Belding Woods*

The Belding Woods neighborhood, located east of the Facility, includes single-family, low-, medium-, and high-density housing units with pockets of commercial, open space, and institutional land uses. Major land uses include Chavez Elementary School, Belding-Garcia Park, and the 23rd Street commercial corridor.

[6] Atchison Village is listed on the National Register of Historic Places.
[7] Portions of the Point Richmond area are listed on the National Register of Historic Places.

4.10.2.1.3.6 *Marina Bay*

The Marina Bay neighborhood, located southeast of the Facility, has approximately 3,000 housing units in 11 subdivisions, four parks, and commercial and industrial uses. Major land uses include Marina Bay Yacht Harbor, portions of the San Francisco Bay Trail, Port of Richmond, the Rosie the Riveter monument, and Rosie the Riveter/World War II Homefront National Historical Park Visitor and Education Center.

4.10.2.1.4 *New Development in Richmond*

Below is a discussion of anticipated future development within the vicinity of the Facility which includes reasonably foreseeable projects. For purposes of this discussion, "reasonably foreseeable projects" are those projects for which: (1) an application has been submitted; (2) environmental review is underway; and/or (3) projects that are partially completed. There are very few reasonably foreseeable projects expected in the areas immediately north, south, and east of the Facility.

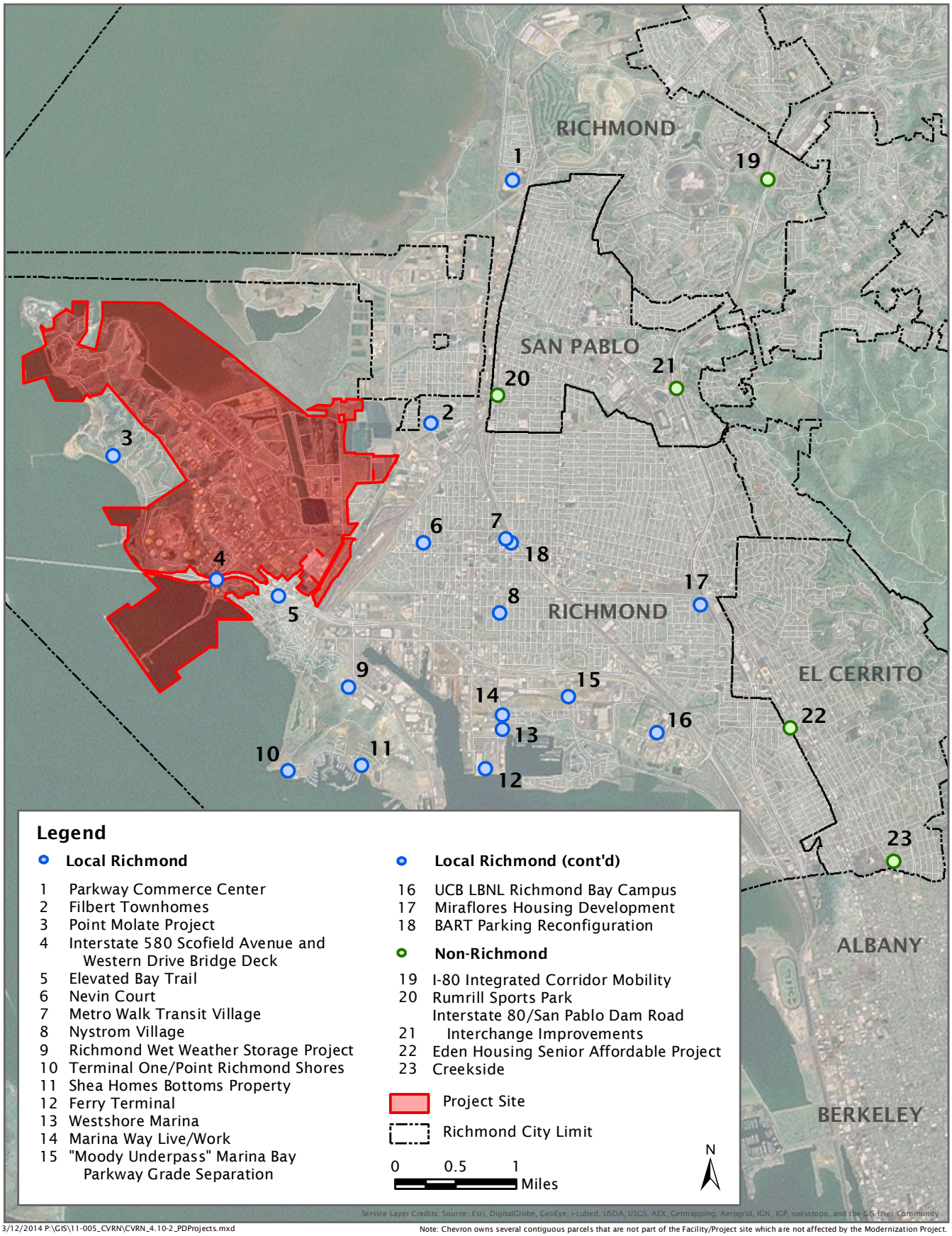
Reasonably foreseeable projects within approximately 1 to 2 miles of the Project site are listed in Table 4.10-2 and shown on Figure 4.10-2.

There is potential for development at the Point Molate site, immediately west of the Facility. An EIR was certified in 2011 for a proposed project that consisted of a resort and casino for the Point Molate site (City of Richmond, 2014). However, the Richmond City Council adopted Resolution No. 23-11 in 2011 to discontinue consideration of a casino use at Point Molate. There is currently pending litigation over the City's determination to discontinue consideration of a casino use at Point Molate, as well as the Federal Government's denial of the Guidiville Tribe's application for gaming authorization. In light of the pending litigation, any future development scenario is speculative. Therefore, development of the Point Molate site immediately west of the Facility is not analyzed as a reasonably foreseeable project.

4.10.2.1.5 *Land Use within the Facility*

Existing operations and facilities within the Project site are discussed in detail in *Chapter 3, Project Description, Section 3.3*, and *Appendix 3, Overview of Oil Refining Process*. The Facility consists of several plants that process crude oil and gas oil into a variety of products, including liquefied petroleum gas, gasoline, aviation gasoline, jet fuel, diesel fuel and lube oils. The Facility also produces steam, electricity, fuel gas and hydrogen, primarily for its own use.

Within the Facility, related facilities and operations are concentrated in specific centralized portions of the site. Most of the Tank Farm Area is situated to the west of the center of the property along the north-south axis of the hills. Some



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T38r1)

Figure 4.10-2
Chevron Refinery Modernization Project EIR
Planned Development Projects

TABLE 4.10-2 PLANNED DEVELOPMENT

Area	Lead Agency	Project/Plan	Project Name	Project Location	Description	Filed/Status	Environmental Review Status
City of Richmond	City of Richmond	Project	Parkway Commerce Center	Giant Hwy/Richmond Pkwy	11 lots-industrial use	Approved in 2005.	MND adopted
City of Richmond	City of Richmond	Project	Point Molate Project	Waterfront north of Richmond/San Rafael bridge.	Alternative D: Hotel Conference Center, Residential and Commercial Development, Parkland, Ferry Terminal	No significant historical connection found for Guidiville Tribe 9/2/2011	FEIR Certified
City of Richmond	Caltrans	Project	I-580 Scofield Avenue and Western Drive Bridge Deck	Western Drive	Caltrans project east of Richmond-San Rafael Bridge toll plaza to replace concrete decks for three under crossings	In contract award phase	(CE/CE) determination was issued on 3-16-2009
City of Richmond	City of Richmond	Project	Elevated Bay Trail	Castro Street to Richmond-San Rafael Bridge	Elevated, multi-use, ADA accessible trail	Caltrans approval process and final design in 2013	Under review
City of Richmond	City of Richmond	Project	Filbert Townhomes	Fred Jackson Way (formerly Filbert Street)	43 low/mod townhomes	Estimated Completion in 2014	Categorical Exemption
City of Richmond	City of Richmond	Project	Nevin Court	Nevin and First	20-30 low/mod rental units	Estimated Completion in 2014	Under Review
City of Richmond	City of Richmond	Project	Metro Walk Transit Village	West Macdonald	Transit-oriented mixed-use with housing, retail and parking garage	Phase I: Complete- 132 housing units Phase II: 10,750 sq.ft. of retail complete, garage for BART station complete, 99 housing units not yet constructed	MND adopted
City of Richmond	Richmond Housing Authority	Project	Nystrom Village	222 Marina Way South	Phase I: Rehabilitation of 48 units (24 duplex buildings) and 1 management office.	Phase I Date of Completion June 2015	Categorical Exemption
City of Richmond	City of Richmond	Project	Richmond Wet Weather Storage Project	601 Canal Boulevard	Construction of a new diversion box, pump station, pipeline, and an above ground, circular, pre-stressed concrete tank with storage volume of approximately 5 million gallons (MG). The tank will be approximately 150 feet in diameter and approximately 53 feet tall. Water Pollution Control Plant effluent will be used to supply water to the wash down system used to clean the tank. The tank will be covered to contain odors.	Under review by City	Final MND issued December 2013
City of Richmond	City of Richmond	Project	Westshore Marina	Marina Way South	300 residential condos	4/2006 Approved	FEIR 2005
City of Richmond	City of Richmond	Project	Terminal One/Point Richmond Shores	Point Richmond Waterfront/Dornan Drive	258 residential units	Approved 2006; City seeking new developers.	FEIR Completed
City of Richmond	City of Richmond	Project	Shea Homes Bottoms Property	Seacliff Drive	60 Residential Units on 25.27 Acres, 15.1 acres submerged in water. Units developed on 6.23 acres.	Under review by City	NOP issued October 2013
City of Richmond	Water Emergency Transportation Authority	Project	Ferry Terminal	Ford Peninsula, adjacent to Ford Building along an existing wharf	Floating gangway and dock adjacent to Craneway. No new buildings. Generally replacing existing facility. Parking for 266 vehicles.	MND Scoping Session on June 21, 2012 11/15/2012	IS/MND anticipated to be released 3rd Quarter 2014
City of Richmond	City of Richmond	Project	Marina Way Live /Work	900 Marina Way South	64 industrial live/work	Approved in 2005 –Phase 1 under construction	MND adopted October 2007
City of Richmond	City of Richmond	Transportation Project	"Moody Underpass" Marina Bay Parkway Grade Separation	845 Marina Bay Parkway	Construction of a roadway undercrossing at the intersection of Marina Bay Parkway and Burlington Northern Santa Fe/Richmond Pacific Railroad Corporation railroad tracks	Approved 4/11/2012 Under construction	CEQA Exemption Filed
City of Richmond	City of Richmond	Project	University of California, Berkeley and Lawrence Berkeley National Laboratory (UCB LBNL) Richmond Bay Campus	Richmond Field Station: 1301 South 46th Street	University of California, Berkeley "Richmond Bay Campus" consolidates biosciences activities managed by Lawrence Berkeley National Laboratory. 134 acres with 5.4 million square feet over 40 years starting in 2017-2020. Estimated daily population of 10,000	Draft EIR released for public comment NOP filed January 4, 2013	Draft EIR completed

TABLE 4.10-2 PLANNED DEVELOPMENT

Area	Lead Agency	Project/Plan	Project Name	Project Location	Description	Filed/Status	Environmental Review Status
City of Richmond	City of Richmond	Project	Miraflores Housing Development	Bound 45th St. and Wall Ave, I-80 and BART	110 affordable rental units for seniors; 226 market-rate detached/attached single-family units.	Approved 12/09. Agreements with for-profit and non-profit developers proceeding. Est. completion 2014 (according to CHDC July 2011).	FEIR certified on 12/14/2009
Regional	Caltrans	Transportation Project	I-80 Integrated Corridor Mobility	19.5-mile portion of I-80 from Carquinez Bridge to Bay Bridge		San Pablo Corridor and Arterial Improvements expected completion is Spring 2014.Adaptive Ramp Metering and Active Traffic Management construction expected completion is Summer 2014. Active Traffic Management expected completion is Winter 2014-15. Software and Systems Integration will continue through Summer 2015. Specialty Materials Procurement was awarded in 2012 and work is underway.	IS/MND (No Significant Impact)- July 2011
City of San Pablo	City of San Pablo	Project	Rumrill Sports Park	Rumrill Boulevard and Chesley Avenue	Former BNSF Corporation yard to be developed as three youth soccer fields and smaller practice field	Design 35% complete. Expect construction start in summer 2014.	IS/MND (No Significant Impact) - Dec. 2012 RAW was submitted to the City in May 2013. The City of San Pablo applied for an EPA Clean-up grant in January 2014.
City of Richmond/Regional	Caltrans	Project	Interstate 80/San Pablo Dam Road Interchange Improvements	Interstate-80/San Pablo Dam Road Interchange	Reconstruct the existing interchange and provide improved pedestrian and bicycle facilities	Construction to begin late 2014/early 2015	IS/MND and EA, July 2009
City of El Cerrito	City of El Cerrito	Project	Eden Senior Housing Mixed-Use Apartments	10848 – 10860 San Pablo Avenue	63 senior housing units on 40,000-sq. ft. site; 1,156-square-foot retail/cafe space; 1,906-square-foot community clinic	Use permit approved 12/13. Application approved 1/14	EIR certified 12/13
City of El Cerrito	City of El Cerrito	Project	Ohlone Garden Mixed-Use Residential	6431-6495 Portola Drive	57 affordable rental apartments	Assembling financing; planning & design approvals received. Anticipated construction start date is March 2014	
City of El Cerrito	City of El Cerrito	Project	801 Bates Avenue	801 Bates Avenue	4-lot subdivision		ISMND complete 2010
City of El Cerrito	City of El Cerrito	Project	Creekside	SE Corner of El Cerrito Plaza	Transit-oriented mixed-use development, 128 units on 3 acres	Entitled and a building permit has been submitted.	

Source: City of Richmond, 2014; City of El Cerrito, 2014; City of San Pablo, 2014.

storage tanks and the marine terminal called the Long Wharf, lie south of I-580. Since the 1970s, Chevron has been systematically removing petroleum processing units from areas near public land uses. As a result, the Refinery Process Area of the Project site contains the bulk of Chevron's oil refining process equipment and supporting infrastructure. See *Chapter 3, Project Description,* for a figure depicting the Refinery Process Area at the Facility.

Chevron characterizes the resulting vacant land areas near the Facility's southern and eastern perimeter as an "internal refinery buffer area." The rail terminal located near the center of the Facility is used for importing and exporting liquefied petroleum gas, and a separate rail spur in the Facility is used for importing and exporting lubricant base oils. These rail facilities are not currently capable of importing crude oil, and the Modernization Project would not construct any facilities that would enable import of crude oil by rail (Chevron Data Transmittal #36G (Rev #1), 2013). The truck loading terminal is located on the southeastern edge of the property.

4.10.2.2 Regulatory Setting

The Richmond shoreline has been the subject of numerous planning studies and plans aimed at establishing guidelines for development along the shoreline. A brief summary of the applicable land use plans, policy documents, and regulations and their relevance to the Modernization Project follows.

4.10.2.2.1 *Richmond General Plan 2030*

Adopted in April 2012, the General Plan 2030 establishes the policy framework that serves as the City's basis for both public and private decision-making, and guides the community's long-range development. The goals and policies of the plan reflect the City's philosophy on public and private development and provide guidance for making decisions on related issues.

The current General Plan 2030 land use designations for the Project site are Industrial, Open Space, and Marine and Waterfront Commercial as shown in Figure 4.10-3 (see also General Plan 2030, Map 3.14).

The majority of the Project site is designated as Industrial. The Land Use Element of the General Plan 2030 states that the industrial category "Includes uses such as manufacturing and assembly in areas near freeways and freight rail. Office and warehousing are allowed" (General Plan 2030, Table 3.4).

The northern portions of the Project site, which house storage tanks and related infrastructure, are designated Open Space and Marine and Waterfront Commercial (see Figure 4.10-3; see also General Plan 2030, Map 3.14). The

majority of the northern portion of the Facility is designated Open Space with a small portion of the northeast coast designated Marine and Waterfront Commercial.

The Land Use Element of the General Plan 2030 states that the Open Space land use designation includes wetlands, mudflats, creek corridors and other natural preservation areas, as well as private lands deed-restricted for open space preservation. Public access should be allowed where appropriate (General Plan 2030, Table 3.5).

The Marine and Waterfront Commercial land use category includes water-oriented uses such as boat repair, recreation equipment rentals, water transit, marinas, services, restaurants and water-related storage and office uses. Development character should complement shoreline natural resources (General Plan 2030, Table 3.4).

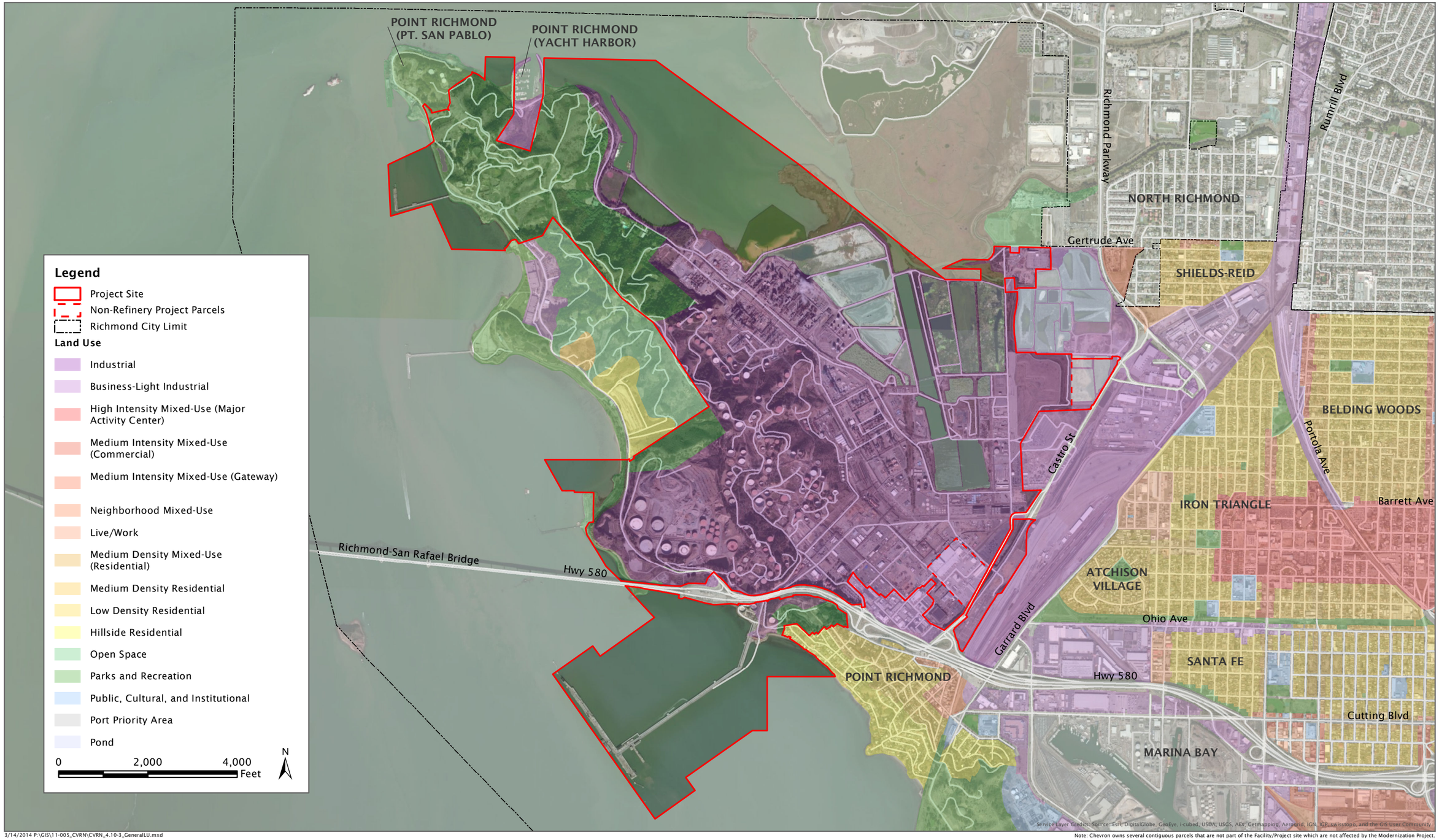
In addition to assigning land use designations, the General Plan 2030 identifies "Change Areas" that represent a small portion of the City where changes in land use and development character are expected. The General Plan 2030 outlines development strategies for these Change Areas that are intended to guide physical and economic revitalization.

The San Pablo Peninsula Area is identified as a Change Area District in the General Plan 2030 (see General Plan 2030, Map 3.15). The Facility is within this Change Area. The General Plan 2030 states that the San Pablo Peninsula Area is characterized by vacant and underutilized land adjacent to heavy and light industrial uses, open space, and the Point San Pablo Yacht Harbor. The General Plan 2030 envisions the San Pablo Peninsula as a place that augments and respects the historic and natural resources through more water-oriented retail and commercial uses and ecologically sensitive development

Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions describes the Modernization Project's relationship to the relevant goals, policies, and actions of the General Plan 2030.

4.10.2.2.2 *City of Richmond Zoning Ordinance*

The majority of the Project site is zoned M-3 (Heavy Industrial) as shown in Figure 4.10-4. The Zoning Ordinance states that "[t]he M-3 zone is intended to create, preserve and enhance areas containing a wide variety of industrial uses including but not limited to manufacturing and related establishments which are potentially incompatible with most other establishments, and is generally found



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T38r1)

Figure 4.10-3
Chevron Refinery Modernization Project EIR
General Plan 2030 Land Use Designations: Project Site and Vicinity

in areas which are distant from residential areas and which provide a wide variety of sites with good rail and highway access" (Section 15.04.330.010).

Other zoning designations within the Project site (see Figure 4.10-4) include M-2 (Light Industrial), M-4 (Marine Industrial), and CRR (Community and Regional Recreation District). The primary Project components are located on M-3 zoned lands. The existing Tank T-3189, which includes a dome, is located on CRR zoned land. The CRR zoning designation allows storage tank farms adjacent to industrial uses as a conditional use (Section 15.04.420.030).

Under the existing Zoning Ordinance, petroleum refining is a conditional use because of the potential for obnoxious or offensive emission of odor, dust, smoke, gas, noise, vibration, etc. In approving a conditional use pursuant to Section 15.04.910 of the Zoning Ordinance, the Planning Commission has the authority to impose permit conditions it deems necessary to protect the best interests of the neighborhood property or neighborhood and to carry out the purposes of the Zoning Ordinance and General Plan 2030.

As illustrated in Figure 4.10-4, zoning districts immediately adjacent to the Facility include CRR, MFR-1 (Multi-Family Residential), M-4, and PC (Public and Civic Uses).

4.10.2.2.3 *City of Richmond Industrial Safety Ordinance*

The City of Richmond has adopted an industrial safety ordinance (Municipal Code Chapter 6.43) that is identical to the County's industrial safety ordinance. The Richmond Industrial Safety Ordinance is discussed in greater detail in *Section 4.13, Public Safety*.

4.10.2.2.4 *Association of Bay Area Governments*

4.10.2.2.4.1 *Bay Trail Plan*

As mandated by Senate Bill (SB) 100, the Association of Bay Area Governments (ABAG) prepared the Bay Trail Plan, which proposes the development of a planned, 500-mile regional hiking and bicycling trail around the perimeter of San Francisco and San Pablo Bays. In Richmond, completed portions of the Bay Trail intermittently follow the shoreline south of I-580 until reaching Washington Park, at the corner of Cutting Boulevard and Garrard Boulevard. As a part of the 15-year implementation plan for the Bay Trail Plan, an alignment for a Bay Trail spur has been proposed along the western shoreline, running from the Point Richmond neighborhood to the Richmond/San Rafael Bridge, continuing north along Western Drive through Point Molate and Point San Pablo to the Point San Pablo Yacht Harbor. This 5.5-mile trail spur relies on closing several gaps that

involve Caltrans participation and access to lands either solely or partially controlled by Chevron (see Figure 4.15-1).[8]

4.10.2.2.4.2 *Plan Bay Area*

ABAG and the Metropolitan Transportation Commission adopted the Plan Bay Area in July 2013. Plan Bay Area is the Bay Area's first integrated long-range transportation and land-use/housing plan pursuant to SB 375. Plan Bay Area includes a Sustainable Communities Strategy as required by SB 375. The Sustainable Communities Strategy promotes compact, mixed-use commercial and residential development that is walkable and bikable and close to mass transit, jobs, schools, shopping, parks, recreation and other amenities, and is designed to demonstrate how the Bay Area will meet greenhouse gas targets established for the region by the California Air Resources Board (ABAG and MTC, 2014). Furthermore, Plan Bay Area recognizes the importance of including adaptation measures for sea level rise and climate change. An "Adapting to Rising Tides" study was recently completed in December, 2013 by the San Francisco Bay Conservation and Development Commission (BCDC) in partnership with the National Oceanic and Atmospheric Administration Coastal Services Center. The study assesses the impacts of sea level rise, provides a range of strategies applicable to climate change adaptation and sea level rise preparedness, and offers processes for integrating these strategies into local and regional planning and decision-making. For further discussion of the Plan Bay Area Sustainable Communities Strategy, see *Section 4.8, Greenhouse Gases*.

4.10.2.2.5 *Bay Conservation and Development Commission San Francisco Bay Plan*

The San Francisco Bay Plan was prepared by the BCDC in January 1969 and amended in July 1988 (BCDC, 2006a). The Plan establishes policies that guide development along San Francisco Bay within 100 feet of the shoreline extending from the mean high tide line inland. BCDC has permit authority over filling, dredging, and shoreline development along the Bay. Any person or government agency wishing to place fill, extract materials, or make any substantial change in use to any land, water or structure within BCDC's jurisdiction requires a permit from BCDC. A permit is issued if a proposed project is consistent with the

[8] On June 26, 2012, the Richmond City Council directed city staff to proceed with design and permiting work and to contract for Caltrans participation for completion of the 5.5-mile portion of the Bay Trail from Point Richmond to Point San Pablo. On October 16, 2012, the East Bay Regional Park District awarded a contract for development of a preferred alignment and legal description required to finalize with Chevron two trail easements totalling 1.6 miles.



Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T38r1)

Figure 4.10-4
Chevron Refinery Modernization Project EIR
Zoning Districts: Project Site and Vicinity

McAteer-Petris Act and the provisions of the San Francisco Bay Plan (BCDC, 2006a).

Additionally, as outlined in the San Francisco Bay Plan, the federal Coastal Zone Management Act requires that non-federal applicants for federal authorizations and funding be consistent with enforceable policies of the San Francisco Bay Plan. Under the Coastal Zone Management Act (CZMA), applicants for federal permits, licenses, other authorization, or federal financial assistance for activities affecting any land or water use or natural resource of the coastal zone of California must certify that the proposed activity complies with enforceable policies of the San Francisco Bay Plan. BCDC then has the opportunity to review the consistency determinations and certifications and to either concur with them or object to them.

A substantial portion of Richmond's shoreline has been designated as Priority Use Areas for: (1) Port; (2) Water-Related Industry; (3) Waterfront Park, Beach; and (4) Tidal Marsh (BCDC, 2006b). Water-related industry is defined as "certain industries requiring a water-front location on navigable, deep water to receive raw materials and distribute finished products by ship, thereby gaining a significant transportation cost advantage." The Chevron Facility is shown as a water-related industry, which is a consistent use under the Plan (BCDC, 2006a).

In order to address sea level rise in the San Francisco Bay, BCDC adopted Bay Plan Amendment No. 1-08 in October, 2011, amending the findings and policies in four sections of the Bay Plan—Tidal Marshes and Tidal Flats, Safety of Fills, Protection of the Shoreline, and Public Access—and to develop additional findings and policies in an entirely new section to the Plan entitled Climate Change.

The Modernization Project components are not within 100 feet of the shoreline and are therefore not within BCDC's jurisdiction or subject to the Bay Plan Amendment.

4.10.2.2.6 *Richmond Bicycle Master Plan*

In November 2011, the Richmond City Council adopted a new Bicycle Master Plan (City of Richmond, 2011a). It was developed in coordination with the Richmond Pedestrian Plan to strengthen connectivity, safety, and convenience for bicyclists and pedestrians. The Bicycle Master Plan focuses on improving access to major destinations, safe connections to the Bay Trail and Richmond Greenway, and completing an on-street bicycle network for the City.

4.10.2.2.7 *Richmond Pedestrian Plan*

The Richmond Pedestrian Plan was adopted in November 2011 by the Richmond City Council (City of Richmond, 2011b). The goals of the Pedestrian Plan include improving health, equity, sustainability, connectivity, and security in addition to neighborhood and downtown revitalization. The Pedestrian Plan also provides strategies for improving access to the Bay Trail and Richmond Greenway for commute and recreational use.

4.10.2.2.8 *Richmond Parks Master Plan*

The Richmond City Council adopted the Parks Master Plan in December 2010 as an implementation tool to achieve goals in the General Plan 2030 (City of Richmond, 2010). The Parks Master Plan provides a long-term strategy for park system improvements and maintenance in addition to specific policies to address more immediate needs.

4.10.2.2.9 *East Bay Regional Park District Master Plan*

The East Bay Regional Park District Master Plan (EBRPD) recently updated its Master Plan, approved July 16, 2013. The 2013 Master Plan states that future acquisition plans could include Point Molate. Point Molate, located adjacent to the Facility, is identified as a potential regional shoreline park that would provide "significant recreational, interpretive, natural, or scenic values on land, water, and tidal areas along the San Francisco Bay, San Pablo Bay, and Sacramento/San Joaquin Delta" (EBRPD, 2013). In addition, the 2013 Master Plan classifies the San Francisco Bay Trail running along the shoreline lands of the Facility as a potential major regional trail route.

4.10.2.2.10 *San Pablo Peninsula Open Space Study*

The San Pablo Peninsula Open Space Study was completed in May 2005 (LSA, 2005). The Study was prepared for the San Pablo Peninsula Open Space Committee, a collaboration of government and regulatory agencies, property owners, and citizens with an interest in open space.[9] The study area is roughly bound by the San Francisco Bay shoreline on the west, Potrero Ridge on the east, the Richmond-San Rafael Bridge on the south, and Point San Pablo on the north. The study presents a broad vision, recommendations, and conceptual plans for future uses of the Peninsula. The Study's Preferred Alternative incorporates the following recommendations:

[9] Participants in the Study included the City of Richmond, California State Coastal Conservancy, East Bay Regional Park District, Muir Heritage Land Trust, Chevron Richmond Refinery, and Trails for Richmond Action Committee.

- Developing Point San Pablo (Terminal 4) for public recreational use,
- Establishing a park along the Point Molate shoreline,
- Preserving the western slopes of the Peninsula as protected open space, providing interpretive facilities to highlight the Peninsula's unique amenities, and establishing the Bay Trail along the shoreline.

The Project site comprises a substantial portion of the southwestern portion of the study area. The Open Space Study's plans for this property include provision of recreational trails through the property (LSA et al., 2005). Homeland security and Coast Guard requirements are also applicable to some of these areas, and have the effect of restricting some public access activities.

4.10.3 Significance Criteria and Methodology

4.10.3.1 Significance Criteria

Based on Appendix G of the CEQA Guidelines, a project may be deemed to have a significant impact on the environment with respect to land use if it would:

(A) Physically divide an established community;

(B) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental impact and result in a physical change in the environment; or

(C) Conflict with any applicable habitat conservation plan or natural community conservation plan.

4.10.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of land use, plans, and policy impacts is explained in the context of each impact, as discussed further below.

4.10.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

Review and comparison of the Modernization Project to the environmental setting shows that the Project would create no impacts related to the following environmental topic listed in CEQA Guidelines Appendix G.

(C) Potential of the Project to conflict with any applicable habitat conservation plan or natural community conservation plan

There are no adopted habitat conservation plans or natural community conservation plans applicable to the Project site. The Modernization Project would have no impact on habitat conservation plans or natural community conservation plans. Therefore, this topic shall not be discussed further in this EIR.

4.10.4 Impacts and Mitigation Measures

Impact 4.10-1: The Modernization Project would be constructed within the existing Facility boundaries and would not divide an established community. This impact would be less than significant and no mitigation is necessary. (LTS)

As discussed above, the Facility occupies a major portion of the San Pablo Peninsula; the remainder of the San Pablo Peninsula is used as open space or for recreation. In general, land uses immediately adjacent to the Facility are industrial and recreational. The primary components of the Modernization Project would be constructed within the Refinery Process Area. See *Section 4.8, Greenhouse Gases* and *Section 4.3, Air Quality* for a discussion of certain mitigation measures and Project features designed to reduce Project impacts located outside the Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program, Chevron's participation in Marin Clean Energy for some Chevron facilities, and the proposed ship/vessel upgrades. Since the Modernization Project would not physically alter any land uses outside of the perimeter of the Facility, and since the land uses adjacent to the Project site are industrial and recreational, the Project would not physically divide an established community and no impact would occur.

Mitigation Measure 4.10-1: None required.

Impact 4.10-2: The Modernization Project would not conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental impact and result in a physical change in the environment. This impact would be less than significant and no mitigation is necessary. (LTS)

4.10.4.1.1 *Richmond General Plan 2030 and City of Richmond Zoning*

The Modernization Project components would be located in the Refinery Process Area of the Facility designated by the General Plan 2030 as Industrial and zoned M-3 Heavy Industrial or CRR Community and Regional Recreational (existing T-3189 tank dome) as shown in Figure 4.10-4. The proposed uses of the Modernization Project are consistent with the types of uses that both the General Plan 2030 land use designation and the zoning districts permit. *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions* describes the Project's relationship to all applicable General Plan 2030 goals, policies, and actions.

As described in *Chapter 3, Project Description, Section 3.3,* in 2008 the City certified an EIR and approved design review and conditional use permits for the Chevron Hydrogen and Energy Renewal Project (2008 Project). After the court decision invalidating the 2008 EIR and permits, Chevron submitted a new application to the City for the smaller, revised Modernization Project. As with the previous review process for the 2008 Project application, the Planning Commission could impose conditions that would specify how the Modernization Project would comply with the applicable Commercial and Industrial provisions in Section 15.04.820 of the Richmond Zoning Ordinance. This is part of the Conditional Use Permit review process required by the City prior to the issuance of building permits. Further, the City of Richmond Design Review Board could recommend that the Planning Commission impose conditions specifying how the Modernization Project would comply with Performance Standards in Section 15.04.840 of the Zoning Ordinance related to screening of mechanical equipment, landscaping, and buffering the facilities on site from neighboring properties. Adoption of any specific screening, landscaping and buffering requirements by the Planning Commission as part of the Modernization Project approval, and implementation of the conditions by Chevron, would help further ensure that the Project would not conflict with any applicable policies.

4.10.4.1.2 *San Francisco Bay Trail Plan and East Bay Regional Park District Master Plan*

Near the Facility, a designated Bay Trail segment is planned from the Point Richmond neighborhood to the Richmond/San Rafael Bridge and north along the shoreline of Point San Pablo Peninsula passing through Point Molate and the Winehaven District to Point San Pablo. This land is owned by Chevron and the City of Richmond with the exception of Caltrans' I-580 corridor. Caltrans has built a Bay Trail segment under the Richmond/San Rafael Bridge that connects the south side of the toll plaza with Western Drive on the north side of I-580.

4.10.4.1.2.1.1 *North of Richmond/San Rafael Bridge*

In November 2009, by Resolution No. 2009-11-291, the EBRPD Board of Directors authorized an agreement with Chevron to donate a recreational easement across the parcels of Chevron-owned lands, north of the Richmond/San Rafael Bridge, to accommodate the designated Bay Trail segments. The 20-foot-wide, 1.6-mile-long easement is planned to generally follow the former Richmond Beltline Railroad corridor across Chevron parcels along the shoreline. The agreement required EBRPD to develop an alignment for the trail as close to the original corridor as possible and to develop the legal descriptions required to finalize and to record the easement documents. On October 16, 2012, EBRPD awarded a contract to Nichols Consulting Engineers to develop a preferred alignment and the legal descriptions necessary to finalize and record the easements donated by Chevron. Nichols Consulting Engineers have completed their work, which is currently under review by Chevron (Townsend, 2013).

4.10.4.1.2.1.2 *South of the Richmond/San Rafael Bridge*

In 2001, the Feasibility Study of Bay Trail Routes to the Point San Pablo Peninsula was completed to study the Bay Trail segment between the Point Richmond neighborhood and the constructed Bay Trail segment under the Richmond/San Rafael Bridge. The Steering Committee for the Feasibility Study reached a consensus that the Option 2 alignment, which ran from the end of Tewksbury Avenue over Chevron property bordering the I-580 corridor to reach the south side of the Richmond/San Rafael Bridge toll plaza area, represented the best route across Chevron-owned land (TRAC, 2013). At the time of publication of the 2008 EIR, enhanced security requirements imposed on the Facility (including the Long Wharf) as a result of the 9/11 terrorist attacks precluded further consideration of the project. In 2008, Chevron agreed to provide a public easement over a portion of its property for this segment of the Bay Trail as part of the Community Benefits Agreement for the Renewal Project. Subsequently, Chevron entered into a separate letter agreement with the California State Lands Commission affirming its commitment to the City for the Bay Trail easement south of the Richmond/San Rafael Bridge.

On July 21, 2009, the Richmond City Council voted to award a contract to Questa Engineering to prepare a Project Study Report, looking at alternative alignments for this Bay Trail segment. On July 10, 2012, the Richmond City Council adopted Resolution No. 85-12 to support the local consensus alignment for this Bay Trail segment and authorize the City Manager to execute the required Cooperative Agreement for Caltrans Project Initiation Document Assistance and CEQA/National Environmental Policy Act clearance. The local consensus alignment is the result of additional considerations related to enhanced post-

9/11 security at the Facility, Caltrans Highway Design Standards and encroachment policies, and Americans with Disabilities Act design standards over the existing steep topography.

Completion of a Project Initiation Document approved by Caltrans represents consensus between Caltrans and the City of Richmond on the conceptual design so the City of Richmond can develop a funding plan to construct the Modernization Project. The City of Richmond is currently working with Caltrans on the Project Initiation Document (Camacho, 2013).

4.10.4.1.2.1.3 *Relationship to Modernization Project*

Because the Modernization Project would be constructed entirely on Facility property (except for off-site greenhouse gas reduction measures and ship/vessel upgrades) and well away from the public shoreline of the Bay, the shoreline area would not be directly or indirectly affected. Furthermore, the Project would not cause off-site noise or significant risk to health or safety that would prevent public use of the shoreline. The Modernization Project would not alter the Bay Trail segments planned along the shoreline. For these reasons, the Project would not conflict with EBRPD's Master Plan or the Bay Trail Plan.

For additional discussion of the impacts of the Project on the Bay Trail Plan, see *Section 4.15, Parks and Recreation*.

4.10.4.1.2.1.4 *San Francisco Bay Plan*

The Facility is shown as a water-related industry, a priority use, in the Bay Plan. One of the Bay Plan's major plan proposals is to preserve land for water-related industry; it states that waterfront land now used by industries that require access to deep water shipping should be continued in this use. One of the findings in the Bay Plan related to water-related industry is that the expansion of water-related industry can be accommodated at existing water-related industries. The Modernization Project is consistent with this finding as the Project is within the Facility boundaries, continuing the Facility's current water-related industry uses.

Bay Plan policies also require that water-related industry be planned and managed so as to avoid wasteful use of the limited supply of the waterfront land. The Project is consistent with this policy as the Project components are located within the Refinery Process Area, away from the waterfront.

The Modernization Project, which includes replacements and modifications to the existing facilities, represents no change with respect to the Facility's conformance with the San Francisco Bay Plan water-related industry priority use designation.

4.10.4.1.2.1.5 *Contra Costa Countywide Bicycle and Pedestrian Plan*

The Contra Costa Transportation Authority Countywide Bicycle and Pedestrian Plan is coordinated with other regional agencies and plans, including the EBRPD Master Plan, the San Francisco Bay Trail (ABAG), and Metropolitan Transportation Commission. The plan shows a bicycling trail near the Facility also identified by the Bay Trail Plan. Because the Modernization Project would be constructed entirely on Facility property (except for certain mitigation measures and Project features designed to reduce Project impacts located outside the Process and Tank Farm areas, which would not affect shoreline areas as discussed in *Section 4.3, Air Quality* and *Section 4.8, Greenhouse Gases*), and well away from the public shoreline of the Bay, the shoreline area would not be directly or indirectly affected. The Modernization Project would not alter the Bay Trail segments planned along the shoreline, and would not affect any bicycling trails. For these reasons, the Project would not conflict with the Contra Costa Transportation Authority Countywide Bicycle and Pedestrian Plan.

4.10.4.1.2.1.6 *San Pablo Peninsula Open Space Study*

As described above, the San Pablo Peninsula Open Space Study was a collaborative effort of interested citizens, government agencies, and property owners, including the City of Richmond and Chevron. The study recommends preserving certain open space on the San Pablo Peninsula, including establishing the Bay Trail along the shoreline. Chevron land comprises a substantial portion of the southwestern portion of the study area and the Open Space Study's plans for this property include provision of recreational trails through the property. Because the Modernization Project would be constructed entirely on Facility property (except for off-site greenhouse gas reduction measures, which would not affect shoreline or other open space areas), and well away from the public shoreline of the Bay, the shoreline area and other open space areas would not be directly or indirectly affected. The Project would not alter the Bay Trail segments planned along the shoreline. For these reasons, the Project would not conflict with the San Pablo Peninsula Open Space Study.

Mitigation Measure 4.10-2: None required.

4.10.5 Cumulative Impacts

The geographic area considered for land use cumulative impacts analysis is the City of Richmond and the North Richmond area, which is within an unincorporated area of Contra Costa County.

The Richmond General Plan 2030 EIR did not identify any cumulative land use or planning policy impacts, and the Modernization Project would be consistent with

the General Plan 2030. The Project would not divide an established community or conflict with any other plans adopted for the purpose of avoiding or mitigating environmental impacts. Given the Modernization Project would have no adverse impacts to land use under the Appendix G CEQA thresholds, the Project has no cumulative considerable land use or planning policy impacts. Accordingly, the Modernization Project, together with past, present, existing, pending and reasonably foreseeable future projects, would not result in significant cumulative impacts to land use. No mitigation measures would be required.

See *Section 4.0, Introduction to Chapter and Methodology* for a detailed discussion of the approach and methods of the cumulative analysis.

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4.11 NOISE

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) changes to relevant plans and policies, including the adoption of a new Richmond General Plan. These revisions do not change the 2008 EIR's conclusions that significant adverse noise impacts for the Modernization Project would be mitigated to a less-than-significant level.

IMPACT SUMMARY

- Construction of the Modernization Project would result in noise impacts that either would be less than significant or would be reduced to a less-than-significant level with the implementation of the identified mitigation measures.
- The Modernization Project would not result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.
- The Modernization Project would not result in a substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project.
- The Modernization Project could result in a substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project, but potential impacts would be reduced to a less-than-significant level by mitigation measures.
- The Modernization Project is not located within an airport land use plan, within 2 miles of a public airport, or within the vicinity of a private airstrip, and therefore would not expose people to airport-related noise.

4.11.1 Introduction

This section establishes existing conditions and identifies and evaluates potential impacts related to noise that could result from construction and operation of the Modernization Project. This section first provides basic information on environmental sound, including some definitions of the terms commonly used in noise analysis and regulation. It then describes and discusses existing noise conditions and City of Richmond noise policies and regulations. Finally, the section analyzes potential noise impacts caused by both the construction and the operation of the Modernization Project and presents measures to mitigate significant adverse noise impacts.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities that could potentially affect noise. For example, as described in *Chapter 3, Project Description, Section 3.3,* construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

4.11.2 Setting

4.11.2.1 Background

4.11.2.1.1 *Sound and Noise*

Sound is mechanical energy transmitted by pressure waves through a medium such as air. Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level. Sound pressure level is measured in decibels (dB), with zero dB corresponding roughly to the threshold of human hearing, and 120 to 140 dB corresponding to the threshold of pain.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad band of frequencies varying in levels of magnitude (sound power). When all the audible frequencies of a sound

are measured, a sound spectrum is plotted consisting of a range of frequency spanning 20 to 20,000 Hz. The sound pressure level, therefore, constitutes the additive force exerted by a sound corresponding to the sound frequency/sound power level spectrum.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ears decreased sensitivity to low and extremely high frequencies instead of the frequency mid-range. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA).[1] Frequency A-weighting follows an international standard methodology of frequency de-emphasis and is typically applied to community noise measurements.

4.11.2.1.2 *Noise Exposure and Community Noise*

Noise is defined as unwanted sound. An individual's noise exposure is a measure of the noise experienced by the individual over a period of time. A noise level is a measure of noise at a given instant in time. However, noise levels rarely persist consistently over a long period of time. Rather, community noise varies continuously with time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors being unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources such as traffic and atmospheric conditions. What makes community noise constantly variable throughout a day, besides the slowly changing background noise, is the addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual.

These successive additions of sound to the community noise environment change the community noise level from instant to instant requiring the measurement of noise exposure over a period of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts. This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are summarized below:

L_{eq}: The equivalent sound level is used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value.

[1] All noise levels reported herein reflect dBA unless otherwise stated.

The L_{eq} is the constant sound level that would contain the same acoustic energy as the varying sound level during the same time period (i.e., the average noise exposure level for the given time period).

L_{max}: The instantaneous maximum noise level measured during the period of interest.

L_{min}: The instantaneous minimum noise level measured during the period of interest.

Lx: The sound level that is exceeded x% of a specified time period. L90 is typically considered representative of the background noise level.

DNL: The day-night noise level (DNL) or the energy average of the A-weighted sound levels occurring during a 24-hour period, and which accounts for the greater sensitivity of most people to nighttime noise. Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.

CNEL: Similar to the DNL, the community noise equivalent level adds a 5-dBA "penalty" for the evening hours between 7:00 p.m. and 10:00 p.m. in addition to a 10-dBA penalty between the hours of 10:00 p.m. and 7:00 a.m.

4.11.2.1.3 *Impacts of Noise on People*

The impacts of noise on people can be placed into three categories:

- Interference with activities such as speech, sleep, and learning. The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors, the thresholds are about 15 dBA higher. Interior residential standards for multi-family dwellings are set by the State of California at 45 DNL. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses.
- Subjective impacts of annoyance, nuisance, and dissatisfaction. Based on attitude surveys used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas, the main causes for annoyance are interference with speech, radio and television, house vibrations, and interference with sleep and rest. The DNL as a measure has been found to provide a valid correlation of noise level and the percentage of people annoyed. Three aspects of community noise are most important in determining subjective response—the level of sound, the

frequency composition or spectrum of the sound, and the variation of sound level with time.

- Physiological impacts such as hearing loss or sudden startling. While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise, but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

Environmental noise typically produces impacts in the first two categories. Workers in industrial plants generally experience noise in the last category. There is no universal measure for the subjective impacts of noise, nor does a measure exist for the corresponding human reactions from noise annoyance. This is due to the wide variation in the individual thresholds of annoyance, and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so called "ambient noise" level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it. Therefore a new noise source will be judged more annoying in a quiet area than it would be in a noisier area. With regard to increases in A-weighted noise level, the following relationships occur:

- Except in controlled laboratory experiments, a change of 1 dBA cannot be perceived;
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference;
- A change in level of at least 5 dBA is required before any noticeable change in human response would be expected; and
- A 10-dBA change is subjectively heard as approximately a doubling in loudness, and can cause adverse community response.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion hence the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, rather logarithmically. For example, if two identical noise sources of 50 dBA are combined, their doubled sound level would be 53 dBA, not 100 dBA.

4.11.2.1.4 *Noise Attenuation*

Point sources of noise, including fixed noise sources as defined in the Richmond Municipal Code (9.52.030) and stationary mobile sources such as idling vehicles, attenuate (lessen) at a rate of 6 dBA per doubling of distance from the source. Additional factors, including topography, atmospheric conditions, ground impacts, noise barriers, and vegetation can result in even greater reductions over large distances. Linear sources, such as a street with moving traffic, would typically attenuate at a lower rate, approximately 3 dBA per distance doubled due to distance attenuation plus additional reductions due to the other factors described above.

4.11.2.1.5 *Vibration*

In addition to generating noise, heavy construction equipment can generate groundborne vibration. Pile driving and similar activities, because they result in blows or impacts on the ground surface, produce vibrational waves that radiate along the surface of the earth and downward into the earth, potentially resulting in impacts that range from annoyance to structural damage. As vibrations travel outward from the source, they excite the particles of rock and soil through which they pass and cause them to oscillate by a few ten-thousandths to a few thousandths of an inch. Differences in subsurface geologic conditions and distance from the source of vibration will result in different vibration levels characterized by different frequencies and intensities. In all cases, vibration amplitudes will decrease with increasing distance. The maximum rate or velocity of particle movement is the commonly accepted descriptor of the vibration "strength." This is referred to as the peak particle velocity and is typically measured in inches per second.

Vibration energy spreads out as it travels through the ground, causing the vibration level to diminish with distance away from the source. High-frequency vibrations reduce much more rapidly than low frequencies, so that low frequencies tend to dominate the spectrum at large distances from the source. Discontinuities in the soil strata can also cause diffractions or channeling impacts that affect the propagation of vibration over long distances. When vibration encounters a building, a ground-to-foundation coupling loss will usually reduce the overall vibration level, however, under certain circumstances, the ground-to-foundation coupling may also amplify the vibration level due to structural resonances of the floors and walls.

Human response to vibration is difficult to quantify. Vibration can be felt or heard well below the levels that produce any damage to structures. The duration of the event has an impact on human response, as does frequency. Generally, as the duration and vibration frequency increase, the potential for adverse human response increases. While people have varying sensitivities to vibrations at

different frequencies, in general they are most sensitive to low-frequency vibration. Vibration in buildings caused by construction activities may be perceived as motion of building surfaces or rattling of windows, items on shelves, and pictures hanging on walls. Vibration of building components can also take the form of an audible low-frequency rumbling noise, which is referred to as groundborne noise. Groundborne noise is usually only a problem when the originating vibration spectrum is dominated by frequencies in the upper end of the range (60 to 200 Hz), or when the structure and the construction activity are connected by foundations or utilities, such as sewer and water pipes.

Table 4.11-1 summarizes the average human response to vibration that may be anticipated when a person is at rest in quiet surroundings. If the person is engaged in any type of physical activity, vibration tolerance increases considerably.

4.11.2.1.6 *Sensitive Receptors*

Human response to noise varies considerably from one individual to another. Impacts of noise at various levels can include interference with sleep, concentration, and communication; physiological and psychological stress; and hearing loss. Given these impacts, some land uses are considered more sensitive to ambient noise levels than others. Land uses are considered noise "sensitive receptors" where low noise levels are necessary for these uses in order to preserve their intended goals such as relaxation, recreation, education, health, and general state of well-being. Residential uses are considered most sensitive to noise because people spend extended periods of time and sleep at home. Other noise sensitive receptors typically include hotels/motels, churches, schools, libraries, and hospitals.

4.11.2.2 Regional and Project Setting

4.11.2.2.1 *Project Site Location and Surrounding Land Uses*

The Project site is located within the City of Richmond. It is bordered by Interstate 580 (I-580) to the south; the Point Molate Naval Fuel Supply Depot and San Francisco bay to the west; San Pablo Bay, the Paktank area and an active landfill site to the northwest; industrial developments including the Santa Fe Intermodal Facility and rail yards to the south and east; and Castro Street to the east. The Project site is situated at the eastern terminus of the Richmond-San Rafael Bridge.

Portions of five residential neighborhoods are within a 1-mile radius of the Facility (see Figure 4.11-1). To the northeast is the Shield-Reid neighborhood (North Richmond). East of the Facility, across Castro Street and Garrard Boulevard, are the communities of Atchison Village, Iron Triangle, and Santa Fe.

TABLE 4.11-1 IMPACTS OF CONSTRUCTION VIBRATION

Peak Particle Velocity (in/sec)	Impact on Humans	Impact on Buildings
<0.005	Imperceptible	No impact on buildings
0.005 to 0.015	Barely perceptible	No impact on buildings
0.02 to 0.1	Barely to distinctly perceptible	No impact on buildings
0.1 to 0.5	Distinctly perceptible to strongly perceptible; vibrations considered unacceptable for people exposed to continuous or long-term vibration	Minimal potential for damage to weak or sensitive structures
0.5 to 1.0	Strongly perceptible to mildly unpleasant; vibrations considered bothersome by most people, however, tolerable if short-term in length	Threshold at which there is a risk of architectural damage to buildings with plastered ceilings and walls. Some risk to ancient monuments and ruins.
1.0 to 2.0	Mildly unpleasant to distinctly unpleasant; vibrations considered unpleasant by most people	U.S. Bureau of Mines data indicate that blasting vibration in this range will not harm most buildings. Most construction vibration limits are in this range.
>2.0	Distinctly unpleasant to intolerable	Potential for architectural damage and possible minor structural damage.

Source: Bender, 1996.

To the south is the Point Richmond neighborhood. Refer to the *Section 4.10, Land Use, Plans, and Policies* of this document for more detail on the types and locations of land uses in the vicinity of the Facility.

4.11.2.2.2 *Existing Noise Sources and Ambient Noise Levels*

Transportation sources, such as automobiles, trucks, trains, and aircraft, are the principal sources of noise in most urban environments. Along major transportation corridors noise levels can reach 70 to 80 DNL, while along arterial streets noise levels typically range from 60 to 70 DNL. Industrial and commercial equipment and operations also contribute to ambient noise in their vicinities.

The ambient noise environment at the Project site is dominated by existing operations at the Facility, traffic on I-580, and adjacent rail activity.



3/14/2014 P:\GIS\11-005_CVRN\CVRN 4.11 Noise.mxd

Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: California Dept of Education, 2013; California Dept of Social Services, 2013; CA OSHPD, 2013; Chevron (T38r1 and 54); Google, 2013

Figure 4.11-1
Chevron Refinery Modernization Project EIR
Sensitive Land Uses within a Mile of the Facility Boundary

To establish a baseline sound level to evaluate Project-related increases in noise levels at sensitive uses around the Facility, noise measurements were taken at representative locations around the Facility in 2005. Operations at the Facility have not varied substantially in any way that would adversely affect operation-related noise since 2005. In addition, by 2016, daily traffic volumes on area roadways are expected to have increased by less than 24% since 2005 on all area roadways, and much less than that on most other area roadways, resulting in a less than 1-dBA increase in noise due to traffic (Fehr & Peers, 2014). A 1-dBA increase in noise is minimal and would be within a normal daily variation for active outdoor environments, so the existing sound level measurements taken in 2005 are still relevant to this assessment. The noise monitoring locations have varying views of the Facility, and therefore varying direct exposures to those noise sources, due to the surrounding topography. The ambient noise survey focused on monitoring noise levels at the nearest sensitive receptors (SLM 1) as well as noise levels at the Facility boundary (SLM 3).

Noise monitoring was conducted for 24 hours on a weekday beginning in the afternoon of Thursday, September 8, 2005 and ending 24 hours later on Friday, September 9, 2005. Figure 4.11-1 shows the location of the noise measurement sites and the nearby residential sensitive receptors. Sound level measurements were made using Metrosonics dB-308 sound level meters. The meters were calibrated before and after the surveys with a Metrosonics acoustical calibrator. The nearest sensitive land uses are primarily located to the south and southeast of the Facility. Therefore, noise monitoring focused on locations in these areas. The long-term measurement locations are described in the following paragraphs.

4.11.2.2.2.1 *Sound Level Measurement 1 (SLM 1)*

The first long-term measurement was taken in the residential neighborhood of Point Richmond at the corner of Tewksbury Avenue and Marine Street. Since this community is located right next to I-580, ambient noise levels in this area are already generally high. Being at an elevation greater than the elevation of the Facility, this location has an unobstructed line of sight (and exposure) to the Facility's operations and its noise-producing equipment. The new hydrogen plant would be approximately 5,000 feet from SLM 1.

The noise environment at SLM 1 is mainly dominated by traffic on I-580, which is located to the north/east at a lower elevation. Noise from the Facility was barely audible to the monitoring technician over the traffic noise at SLM 1. However, while the Facility noise is fairly constant, noise from the freeway changes over the day. Therefore, long-term measurements were taken to capture this variation. The monitored DNL at SLM 1 was 72 dBA. The monitored DNL, daytime L_{eq} and nighttime L_{eq} values are shown in Table 4.11-2.

TABLE 4.11-2 EXISTING AMBIENT NOISE LEVELS AT MONITORED LOCATIONS, DBA

Site	Location	Measurement Period (Sept., 2005)[a]	Noise Level in dBA		
			Daytime L_{eq}	Nighttime L_{eq}	DNL
SLM1[b]	Near corner of Tewksbury Avenue and Marie Street	24-hour	62–81	44–78	72
SLM2	At the northeast corner of the reclamation area, near Gertrude Avenue	24-hour	55–69	40–52	59
SLM3	Along the eastern property line of the Facility next to Castro Street and just south of the General Chemical Plant	24-hour	61–76	53–70	67

[a] Sound levels measured in 2005 are still representative of the current noise environment in the Project vicinity, as discussed in the text above.

[b] SLM = sound level measurement.

Source: ESA, 2005.

4.11.2.2.2.2 *Sound Level Measurement 2 (SLM 2)*

The second long-term measurement was taken at the northeastern corner of Chevron's reclamation area, near West Gertrude Avenue. This monitoring point is approximately 4,800 feet from the location of the new hydrogen plant. The noise environment at this site is dominated by noise from activity at the reclamation yard (primarily vehicles from the Facility) and traffic on West Gertrude Avenue. The Shields-Reid residential neighborhood is located approximately 1,200 feet to the east. The monitored DNL at SLM 2 was 59 dBA. The DNL, daytime and nighttime L_{eq} values are shown in Table 4.11-2.

4.11.2.2.2.3 *Sound Level Measurement 3 (SLM 3)*

The third long-term measurement was taken at the Facility's eastern fence line, underneath the elevated Castro Street/Richmond Parkway. The residential communities of Atchison Village and Iron Triangle are located to the east of Richmond Parkway, approximately 1,800 feet to the east. This monitoring point is located approximately 4,500 feet from the proposed new hydrogen plant. The noise environment at this site is dominated by noise from traffic on Castro Street, noise from the General Chemical Plant and intermittent noise from rail activity along the Union Pacific tracks that are approximately 100 feet to the east. The monitored DNL at SLM 3 was 67 dBA. The DNL, daytime and nighttime L_{eq} values are shown in Table 4.11-2.

4.11.2.3 Regulatory Setting

Noise issues applicable to the Modernization Project are addressed in Richmond General Plan 2030 (General Plan 2030) policies and local noise ordinance standards.

4.11.2.3.1 *Richmond General Plan 2030*

The Public Safety and Noise Element of the General Plan 2030 contains goals, policies, and actions to reduce or eliminate the impacts of excessive noise in the community when implementing changes in land use. Consistency with the City of General Plan 2030, including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use, Plans, and Policies* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

The General Plan 2030 has adopted the State's noise compatibility matrix for determining the compatibility of various land uses with different noise environments (City of Richmond, 2012). The compatibility guidelines recognize that some land uses are more sensitive to ambient noise levels than others, due to the amount of noise exposure (in terms of both exposure duration and insulation from noise) and the types of activities typically involved. For Residential uses, the most sensitive land use, a noise environment of DNL 60 dBA or less is considered "normally acceptable," while a noise environment between DNL 60 and 70 dBA is considered "conditionally acceptable," a DNL of 70 to 75 dBA is considered "normally unacceptable" and a DNL 75 dBA and above is considered "clearly unacceptable."

For commercial and office uses, which are generally less noise-sensitive, a noise environment of DNL 70 dBA or less is considered "normally acceptable," while a noise environment between DNL 70 and 75 dBA is considered "conditionally acceptable," and a DNL 75 dBA and above is considered "normally unacceptable." For Industrial and manufacturing uses, a noise environment of DNL 70 dBA or less is considered "normally acceptable," while a noise environment between DNL 70 and 75 dBA is considered "conditionally acceptable," and a DNL 75 dBA and above is considered "normally unacceptable."

In this context, "normally acceptable" is defined as satisfactory for the specific land use, assuming that normal conventional construction is used in buildings. "Conditionally acceptable" means that new construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh-air supply systems or air conditioning will normally suffice. "Normally unacceptable" means that new construction or development should generally be discouraged. If new

construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

4.11.2.3.2 *Richmond Noise Ordinance*

The City of Richmond also regulates exterior noise levels through enforcement of the Community Noise Ordinance (Chapter 9.52 of the Richmond Municipal Code). Table 4.11-3 presents the maximum allowable exterior noise levels for long-term operational sources contained in the Community Noise Ordinance. The noise ordinance regulates only operational noise from fixed sources because cities and counties do not have regulatory authority over noise from mobile sources (transportation noise). Transportation noise is regulated at the state and federal level by noise limits placed on vehicle manufacturers. The factors that are considered when determining whether the ordinance is violated include: a) the level, intensity, character, and duration of the noise; b) the level, intensity, and character of the background noise; and c) the time when, and the place and zoning district where, the noise occurred.

The Richmond noise ordinance does not specifically restrict the hours of general construction or demolition work. However, where technically and economically feasible, construction activities are required to be conducted in such a manner that the maximum sound levels at affected properties will not exceed those listed in Table 4.11-4.

In addition to meeting the noise limits in Table 4.11-4, Section 9.52.060 of the Richmond Municipal Code requires the following measures be applied to construction activities and equipment:

- All construction equipment powered by internal combustion engines shall be properly muffled and maintained.
- Unnecessary idling of internal combustion engines is prohibited.
- All stationary noise-generating construction equipment such as tree grinders and air compressors are to be located as far as is practical from existing residences.
- Quiet construction equipment, particularly air compressors, is to be selected whenever possible.
- Use of pile drivers, sources of impulsive sound and jack hammers shall be prohibited on Sundays and holidays, except for emergencies or as approved in advance by the Building Official.

TABLE 4.11-3 MAXIMUM ALLOWABLE EXTERIOR NOISE STANDARDS FOR SPECIFIED LAND USES, DBA

	Maximum Noise Level, in dBA, Not to be Exceeded More than 30 Minutes in any Hour		Maximum Noise Level, in dBA, Not to be Exceeded More than 5 Minutes in any Hour
Zoning District	Measured at Property Line or District Boundary	Measured at Any Boundary of a Residential Zone	Measured at Any Boundary of a Residential Zone Between 10 p.m. & 7 a.m.[a]
Single-Family Residential	60	--	--
Multi-Family Residential	65	--	--
Commercial	70	60	50 or ambient noise level
Light Industrial and Office[b]	70	60	50 or ambient noise level
Heavy and Marine Industrial[b]	75	65	50 or ambient noise level
Public Facilities and Community Use	65	60	50 or ambient noise level
Open Space and Recreational Districts	65	60	50 or ambient noise level

Notes:

1. The standard limits set forth above shall be reduced by 5 dB if the noise contains a steady, pure tone such as a whine, screech or hum, or is an impulsive sound such as hammering or riveting, or contains music or speech.
2. The exterior noise limits for any source of noise within a residential zone shall be reduced by 10 dBA between 10:00 p.m. and 7:00 a.m. The exterior noise limits for any noise source in any other zone other than a residential zone shall be reduced between 10:00 p.m. and 7:00 a.m. so that when measured at the property line of a "noise-sensitive use," the noise does not exceed 50 dBA.

[a] Restricted hours may be modified through condition of an approved conditional use permit.

[b] For M-1 and M-2, the measurement would be at property lines. For M-3 and M-4, the measurement would be at the boundary of the district.

Source: Section 9.52.100 of the Community Noise Ordinance, Richmond Municipal Code.

TABLE 4.11-4 MAXIMUM ALLOWABLE RECEIVING NOISE STANDARDS FOR TEMPORARY CONSTRUCTION OR DEMOLITION ACTIVITIES, DBA

Receiving Land Use	Weekdays 7 a.m. to 7 p.m.	Weekends Including Legal Holidays, 9 a.m. to 8 p.m.
Short-Term Construction (less than 15 days)		
Single-Family Residential	75	60
Multi-Family Residential	80	65
Commercial and Industrial	85	70
Long-Term Construction (15 days or more)		
Single-Family Residential	60	55
Multi-Family Residential	65	60
Commercial and Industrial	70	65

Source: Section 9.52.110 of the Community Noise Ordinance, Richmond Municipal Code, 2011.

4.11.3 Significance Criteria and Methodology

4.11.3.1 Significance Criteria

Consistent with Appendix G of the CEQA Guidelines and the General Plan 2030, a significant adverse impact on the environment with respect to noise would occur if the Project would result in any of the following:

(A) Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

(B) Exposure of persons to, or generation of excessive groundborne vibration or groundborne noise levels;

(C) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(D) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

(E) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, exposure of people residing or working in the project area to excessive noise levels; or

(F) For a project within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels.

4.11.3.2 Impact Assessment Methodology

For the assessment of construction noise impacts, this analysis considers both compliance with the noise standards codified in the Richmond noise ordinance (Section 9.52.110 of the Richmond Municipal Code) and the potential changes in the ambient noise environment due to construction of the Modernization Project. Estimated sound levels during construction of the Project would first be compared to the City of Richmond construction noise limits identified in Table 4.11-4. Estimated sound levels exceeding the applicable construction noise limits would be identified as resulting in significant adverse noise impacts.

In addition, consideration was given to the potential for construction of the Modernization Project to increase ambient sound levels at the nearest sensitive receivers. However, because of the large distances involved between the Project construction sites and the nearest residences, only a particular combination of many relatively loud noise sources operating together would be loud enough to be readily perceived outside of the Facility. Construction and operation of the various components of the Modernization Project would be 5,000 feet or farther from the nearest sensitive receivers, with the exception of certain mitigation measures and Project features designed to reduce Project impacts located outside the Refinery Process and Tank Farm areas as discussed further below. A change in noise levels of less than 3 dBA is not discernible to the general population; an increase in average noise levels of 3 dBA is considered barely perceptible, while an increase of 5 dBA is considered readily perceptible to most people. Therefore, an increase of 5 dBA over ambient levels due to construction activities would be considered a significant adverse noise impact.

For the assessment of operational noise impacts, this analysis considers both compliance with the General Plan 2030, compliance with the noise limits established by the City of Richmond and the potential changes in the ambient noise environment due to the Modernization Project. Sound levels from operation of Project-related equipment would first be compared to the City of Richmond noise limits identified in Table 4.11-3. Estimated sound levels exceeding the applicable noise limits would be identified as resulting in significant adverse noise impacts.

In addition, the following significance criteria take into account both the absolute change in noise levels due to a project and the relationship between the resultant noise level and the City's noise/land use compatibility standards. Where the resultant noise level would remain "normally acceptable" for the affected land use, a change of 5 DNL or more would be considered significant. Where the

resultant noise level would be in the range described as "conditionally acceptable" or "normally unacceptable," a change of 3 DNL or more over existing noise levels would be considered significant, and where the resultant noise level would be "clearly unacceptable," any increase in noise over existing levels would be considered significant.

4.11.3.1 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

Review and comparison of the Modernization Project to the environmental setting clearly shows that the Project would create no impacts related to the following environmental topics listed in CEQA Guidelines Appendix G.

(B) Exposure of persons to, or generation of excessive groundborne vibration or groundborne noise levels

Construction and operation of the various components of the Modernization Project would be 5,000 feet or farther from the nearest sensitive receivers. Groundborne vibration (and related groundborne noise) dissipate rapidly over distance and would be minimal to non-existent at a distance of 5,000 feet. Therefore, the Project would not expose persons to or generate excessive vibration or groundborne noise levels, and there would be no impact in relation to this criterion.

(E) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, exposure of people residing or working in the project area to excessive noise levels

(F) For a project within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels

There are no public use airports or private airstrips located within a 2-mile radius of the Project site, nor is the Project site located within an airport land use plan. Therefore, the Modernization Project would not expose people to excessive noise levels associated with aircraft operations. There would be no impact.

4.11.4 Impacts and Mitigation Measures

<u>Impact 4.11-1</u>: Daytime construction activities associated with the Modernization Project would be required to comply with City of Richmond noise limits applied to activities longer than 15 days, and are unlikely to generate noise levels substantially above existing ambient levels in the Project vicinity. Therefore, daytime construction activities would result in less-than-significant noise impacts, even during the most intense construction period. Additionally, if weekend or nighttime construction were to occur,

construction noise could exceed City of Richmond noise limits and/or substantially exceed ambient noise levels during the quietest nighttime hours. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Most of the construction for the Modernization Project has already occurred, but the remaining construction activities would recommence if the Project is approved and last approximately 2 years. Construction noise levels at and near locations within the Facility would fluctuate depending on the particular type, number, and duration of use of various types of construction equipment. The impact of construction noise would depend upon how much noise would be generated by construction, the distance between construction activities and the nearest noise-sensitive uses, and the existing noise levels at those uses.

Specific data on the types and numbers of pieces of construction equipment that might operate on-site during different phases of the remaining Modernization Project construction were provided (Chevron Data Transmittal #36O (Rev #3), 2014). Construction noise levels associated with construction of the major new Project components, including the Hydrogen Plant Replacement hydrogen tie-ins, sulfur removal improvements, and existing hydrogen plant dismantling are considered here. Construction activities and equipment associated with the storage tank domes and water reuse components would produce negligible levels of noise when compared to construction of the other elements of the Modernization Project, and were not included in the overall construction noise assessment. Similarly, noise associated with the staging areas is expected to be negligible. The highest level of simultaneous construction activity is expected to occur in the first quarter of construction, and Table 4.11-5 shows numbers and sound levels of construction equipment expected to be used during the first quarter of construction. Intermittent vehicles (e.g., pickup trucks, water trucks) are not typically a substantial noise source and are not included in this evaluation.

The sound levels identified in Table 4.11-5 are typical noise levels for the individual pieces of equipment at a distance of 50 feet from that piece of equipment. Using these sound levels, construction-related sound levels at the nearest residential receivers (conservatively estimated to be approximately a minimum of 5,000 feet from the boundary of the Refinery Process and Tank Farm areas) were predicted using the CadnaA noise model and a simple model setup.[2] The model primarily considered distance attenuation (i.e., noise from construction activity generally attenuates at a rate of 6 dBA per doubling of

[2] CadnaA industrial noise calculation procedure enables complete noise modeling of complex facilities using sound propagation factors as adopted by International Organization for Standardization. (i.e., ISO 9613)

TABLE 4.11-5 TYPICAL NOISE LEVELS OF EQUIPMENT ANTICIPATED TO BE USED FOR REMAINING PROJECT CONSTRUCTION

Construction Equipment	Equipment Counts	Noise Level[a] (dBA, Hourly L_{eq} at 50 feet)
Hydrogen Plant		
Excavator	2	77
Backhoe	2	74
Dump Truck	2	73
Water (Sump) Pump	2	74
Large Crane (300-600 ton)	1	77
Small Crane (50-200 ton)	2	73
Forklift	4	72
Impact Pile Driver	1	92
Vacuum Truck	1	81
Concrete Pump Truck	5	74
Manlift	6	68
Welding Machine	20	70
Power Generator	15	70
Air Plant (Compressed Air)	4	74
Light Plants (Small Generator)	10	70
Hydrogen Tie-Ins		
Excavator	1	77
Backhoe	2	74
Dump Truck	2	73
Compactor	2	76
Water (Sump) Pump	2	74
Small Crane (50-200 ton)	5	73
Forklift	3	72
Vacuum Truck	1	81
Concrete Pump Truck	1	74
Manlift	6	68
Welding Machine	12	70
Power Generator	10	70

TABLE 4.11-5 TYPICAL NOISE LEVELS OF EQUIPMENT ANTICIPATED TO BE USED FOR REMAINING PROJECT CONSTRUCTION

Construction Equipment	Equipment Counts	Noise Level[a] (dBA, Hourly L_{eq} at 50 feet)
Air Plant (Compressed Air)	4	74
Light Plants (Small Generator)	5	70
Sulfur Removal Improvements		
Excavator	3	77
Backhoe	3	74
Dump Truck	3	73
Compactor	3	76
Water (Sump) Pump	2	74
Small Crane (50-200 ton)	3	73
Forklift	6	72
Impact Pile Driver	1	92
Vacuum Truck	2	81
Concrete Pump Truck	3	74
Manlift	2	68
Welding Machine	8	70
Power Generator	4	70
Air Plant (Compressed Air)	6	74
Light Plants (Small Generator)	10	70
Old Hydrogen Plant Dismantling		
Excavator	4	77
Dump Truck	2	73
Small Crane (50-200 ton)	1	73
Forklift	1	72
Vacuum Truck	1	81
Manlift	4	68
Power Generator	2	70
Air Plant (Compressed Air)	2	74
Light Plants (Small Generator)	2	70

[a] Noise level shown is for individual pieces of equipment.
Source: FHWA, 2008 and ENVIRON archived data.

distance), atmospheric absorption, and ground impacts. Intervening structures, terrain, or vegetation were not included in the model setup and were not considered in the modeled sound levels.

Next, the noise model assumed that all of the equipment identified in Table 4.11-5 was operating concurrently during the most concentrated construction period (i.e., first quarter of construction). The model predicted construction sound levels at the nearest residential locations south, northeast, and east of the site represented by receptor locations R1, R2, and R3, respectively (see Figure 4.11-1). The resulting modeled sound levels are displayed in Table 4.11-6.

TABLE 4.11-6 CONSTRUCTION SOUND LEVELS AT NEAREST SENSITIVE RECEIVERS, ASSUMING CONCURRENT OPERATION (DBA, HOURLY L_{EQ})

Location	Lowest Measured Existing Ambient Sound Level [a] (Day/Night)	Estimated Construction-Related Sound Level[b] (Day/Night)	Overall Level (Existing Plus Project Construction)[c] (Day/Night)	Estimated Increase[d] (Day/Night)
R1 (South)	62/44	55/53	63/54	1/10
R2 (Northeast)	55/40	52/51	57/51	2/11
R3 (East)	61/53	52/50	61/55	1/2

[a] Existing ambient sound levels are those taken in 2005, as shown in Table 4.11-3 above. To be conservative, the lowest existing ambient measurements are used for comparison against estimated Modernization Project construction noise levels.

[b] Modeled daytime construction sound levels include pile driving activities at the hydrogen plant, sulfur removal improvements, and sulfur project sites. Modeled nighttime construction sound levels include all concurrent construction activities except pile driving.

[c] Overall levels are the existing plus construction-related sound levels.

[d] The calculated increase is determined by subtracting the lowest measured ambient level from the overall (existing plus project construction) [bb]

Source: Environ, 2013.

As shown in Table 4.11-6, the modeled levels of construction equipment during the first quarter would comply with the strictest noise standard of 60 dBA identified in the Richmond Noise Ordinance for weekday (7:00 a.m. to 7:00 p.m.) construction activities greater than 15 days (see Table 4.11-4). The modeled levels would also comply with the stricter noise limit of 55 dBA applicable on weekends between 9:00 a.m. and 8:00 p.m. The modeled levels would not,

however, comply with the 50-dBA limit applicable to nighttime operations between 10:00 p.m. and 7:00 a.m. (Table 4.11-3).[3]

When assessing how construction noise might affect the existing ambient sound levels, daytime construction activities could increase ambient sound levels by 1 to 2 dBA, which would not constitute a significant adverse noise impact. Nighttime construction activities, however, could result in increases of up to 11 dBA, which would constitute a significant adverse noise impact.

Construction of the Modernization Project would primarily take place during the day. There are no plans to work a night shift to construct the Project. However, in the event that weather or other factors significantly impact the Project construction schedule, Chevron may decide some work activities would be necessary at night. Because there are cost increase and logistics issues raised by performing work at night, plus additional worker safety considerations and precautions that must be taken, the decision to work at night is a significant one, and Chevron would only undertake work at night if absolutely necessary, and for only as long as necessary and in consultation with the City.

In the event that such night work would be performed for the Modernization Project, there would potentially be a temporary increase in nighttime noise levels at the nearest sensitive receivers to the Facility during the construction period, which could result in a significant adverse impact. However, the construction scenario modeled was very conservative, assumed concurrent operation of all equipment, and did not include likely reductions due to intervening structures, terrain, or vegetation. Therefore, overall levels and impacts would likely be lower than modeled here. In addition, because nighttime construction activities would be less intensive than the daytime construction activities considered in this analysis, there would be lower increases, even during the quietest nighttime hours. Therefore, implementation of the following mitigation measures would reduce any impacts to a less-than-significant level.

> Mitigation Measure 4.11-1a: If nighttime construction is required, no pile driving shall be allowed and the types and intensity of any construction activities shall be limited to ensure noise generation does not exceed the City's nighttime noise limit of 50 dBA or cause an increase greater than 5 dBA.
>
> Mitigation Measure 4.11-1b: If nighttime construction is required and the City of Richmond or the construction compliance and complaint manager receive verified complaints due to noise from the use of backup alarms,

[3] Richmond's construction noise limit applies to construction-related noise only, not to the overall sound level.

Chevron shall implement feasible measures to reduce this noise at the Facility boundary. Measures may include the use of alarms with ambient sensing/broadband technology instead of the traditional fixed level/ narrowband alarms or the use of administrative controls such as using a spotter or flagger and prohibiting all foot traffic in the work area.

Implementation of Mitigation Measures 4.11-1a and 4.11-1b above would reduce the impact to a less-than-significant level.

Impact 4.11-2: Increased vehicle traffic to and from the Facility during the construction period would increase ambient noise levels at receptors along the travel route. However, the change in roadside noise level due to Modernization Project construction-related traffic would not be perceptible over existing conditions. This impact would be less than significant and no mitigation is necessary. (LTS)

The traffic study for the Modernization Project analyzed impacts of Project construction on the traffic conditions at nearby intersections (see *Appendix 4.16, Traffic – Technical Data*). Traffic conditions at 11 intersections in the area were studied for existing conditions and for the peak construction period (2016) with and without Project construction traffic. The majority of the intersections and roads used to access the site are along I-580 at interchanges that are far from residences or other sensitive receivers, and additional traffic on these roads would not result in significant adverse noise impacts. However, there are numerous residences adjacent to Richmond Parkway just north of West Gertrude Avenue, and these are the focus of this analysis. The primary time of interest for noise impacts is during the AM peak hour, when additional truck trips could occur. No heavy trucks are expected to access the site during the PM peak hour (see *Section 4.16, Transportation and Traffic*). Therefore, the remainder of this analysis focuses on the increase of construction-related vehicles during the AM peak hour at residences north of West Gertrude Avenue and adjacent to Richmond Parkway.

On Richmond Parkway near Gertrude Avenue, peak construction activities in 2016 could result in an increase of eleven trucks and 102 passenger vehicles traveling southward to the refinery site during a single AM peak hour.[4] Using 2011 existing peak-hour traffic volumes identified in *Section 4.16, Transportation and Traffic*, the overall increase in traffic over existing conditions would be approximately 4% north of the intersection of Richmond Parkway/Gertrude Avenue during the morning peak hour. Due to the logarithmic

[4] These truck and vehicle estimates are derived from the traffic estimates and noted assumptions found in Tables 4.16-4 and 4.16-5 of *Section 4.16, Transportation and Traffic*.

nature of sound, a doubling of traffic volume (a 100% increase) results in an increase of 3 dBA, which would be just perceptible. A 4% increase in traffic volume would result in traffic noise level increases well below 1 dBA. For that reason, the change in roadside noise level due to Project construction- related traffic would not be perceptible over existing conditions, and this impact would be less than significant.

Mitigation Measure 4.11-2: None required.

Impact 4.11-3: Operational noise from the equipment to be installed as part of the Modernization Project, and from additional transportation associated with Refinery Operations after installation of the Project, could produce noise at nearby sensitive noise receivers. However, any increase in noise levels compared to existing ambient levels would be at less-than-significant levels. This impact would be less than significant and no mitigation is necessary. (LTS)

Operational activities associated with the Modernization Project that would generate noise primarily include additional transportation activities associated with Refinery Operations and the replacement of existing equipment and installation of additional noise-generating equipment that would be installed to modernize and optimize the operation of the Facility.

4.11.4.1 Noise from Transportation Related to Refinery Operations

In the long term (i.e., Project buildout), the Modernization Project operations would result in the creation of approximately 29 new permanent jobs (Chevron Data Transmittal 5 (Rev #3), 2014), and therefore only a few additional employee trips to the Facility would be generated. Daily truck trips under both the 93% and 100% Utilization Scenarios were estimated using scaling methodologies on the baseline truck volumes identified in Chevron Data Transmittal #18 (Rev #2), 2013. The estimated increase in daily Facility truck trips under the 93% Utilization Scenario is 63 daily trips (a 20% increase), which would result in a less than 1-dBA increase in average daily truck noise associated with Refinery Operations. The 100% Utilization Scenario would result in 94 daily truck trips related to Refinery Operations (a 30% increase), which would result in a 1-dBA increase in average daily truck noise associated with the Facility. With the inclusion of existing traffic on area roadways not related to the Facility, the average daily increase in traffic noise due to the Modernization Project would be much less than 1 dBA for both the 93% and 100% Utilization Scenarios. Therefore, no significant adverse traffic noise impacts are expected during operation.

Similar to truck trips, the Modernization Project would result in an increase in noise due to rail deliveries, but only at a greater than 93% utilization rate (Chevron Data Transmittal #36G (Rev #1), 2013). The largest estimated increase in railcars (both inbound and outbound) with the Project was 18%, which would result in a less than 1-dBA increase in annualized average rail noise. This would be considered a minimal increase, and no significant adverse noise impacts are expected from rail shipments associated with the Project.

Shipping volumes would increase under the Modernization Project. Additional shipping volumes could result in an increase in noise levels associated with shipping at the Long Wharf. However, the Chevron Long Wharf EIR determined that 900 or fewer vessel calls would not result in significant noise impacts. Since the overall number of vessel calls at the Long Wharf with the Modernization Project would be less than 900, the Modernization Project would not create any new impacts above and beyond those analyzed and mitigated in the Long Wharf EIR. Therefore, no significant adverse noise impacts are expected from vessel shipments associated with the Project.

4.11.4.2 Noise from Operation of Equipment to be Installed with the Modernization Project

The types and numbers of equipment that would be installed, replaced or modified at the Facility as part of the Modernization Project are shown in Table 4.11-7. This equipment would be similar to units already in operation at the Facility. Table 4.11-7 also shows the estimated sound power levels for each piece of equipment associated with a plant, as well as the total sound power level for that plant, based on information provided by Chevron (Chevron Data Transmittal #45F, 2013).[5]

Using the sound levels generated by each piece of equipment identified in Table 4.11-7, the sound levels at the nearest residential receivers were predicted using the CadnaA noise model.[6] The noise model assumed that all of the equipment identified in Table 4.11-7 was operating concurrently. No reductions due to topography or intervening structures were considered in the model, so the primary reductions in noise at a distance were due to distance attenuation,

[5] As explained above, the Project would be constructed and operated within the boundaries of the existing Refinery with the exception of certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section, 4.3 Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

[6] CadnaA industrial noise calculation procedure enables complete noise modeling of complex facilities using sound propagation factors as adopted by International Organization for Standardization (i.e., ISO 9613).

TABLE 4.11-7 OPERATING EQUIPMENT TO BE INSTALLED AS PART OF THE PROJECT

Type of Equipment	Number of Units	Horsepower Rating Per Unit	Estimated Sound Power Level Per Unit (dBA)
Hydrogen Plant			
Pressure Swing Adsorption 3 Feed/Tail Gas/ Steam Methane Reformer Feed Compressors/Motors	3	8,500	113
Lube Oil Pump Motors	3	25	83
Induced Draft Fan/Motor	2	2,000	102
Forced Draft Fan/Motor	2	2,000	102
Flue Gas Recirculation Fans	2	75	95
High Pressure Boiler Feed Water Pumps/Motors	2	1,000	104
Medium Pressure Boiler Feed Water Pumps/Motors	1	600	104
Reformed Gas Air Cooled Heat Exchanger Motors	8	50	87
Cooling Water Pumps/Motors	1	700	108
Glycol Air Cooled Heat Exchanger	2	15	95
Glycol Pumps/Motors	1	50	92
Nitrogen Recirculation Compressor/Motor	1	700	108
Cooling Tower	3	250	105
Ammonia Pump	1	10	85
Turbine Lube Oil Pumps	1	60	93
Turbine Condensate Pumps	1	75	93
Steam Turbine Generator	1	24,000	108
Hydrogen Plant Sound Power Level Total			**121**
FCC FHT			
FCC FHT Charge Pumps (Replacement)	1	6,000	106
FCC FHT Charge Pumps	1	5,000	106
Vacuum Gas Oil Cold Feed Booster Pumps	2	250[a]	102
Fractionator Bottoms Pumps	2	800	103
Fractionator Overhead Stripped Water Recycle Pumps	2	5	82
Fractionator Pump Around Pumps	2	200	102
Fractionator Reflux Drum Vapor Cooler	4	15	87

TABLE 4.11-7 OPERATING EQUIPMENT TO BE INSTALLED AS PART OF THE PROJECT

Type of Equipment	Number of Units	Horsepower Rating Per Unit	Estimated Sound Power Level Per Unit (dBA)
Hydrogen Sulfide Absorber Feed Cooler	4	20	95
Cold Medium Pressure Separator Vapor Cooler	4	20	95
FCC FHT Recycle Compressor	1	5,000	113
Lean DEA Booster Pumps	2	3,000	108
Power Recover Turbine	1	930	108
Sour Water Degasser Pumps	2	100	98
FCC FHT Sound Power Level Total			**117**
New No. 6 Hydrogen Sulfide Plant			
Lean DEA Transfer Pumps	2	500	103
Sour Water Pumps	2	3	79
Regenerator Reflux Pumps	2	10	85
Skimmed Oil Pump	1	7.5	83
Amine Sump Pump	1	20	88
Fresh Amine Transfer Pump	1	7.5	83
Makeup Amine Transfer Pump	1	7.5	83
Antifoam Injection Pump	1	8	84
DEA Fin-Fan Cooler	8	15	95
Regenerator Condenser Fin-Fan Cooler	8	20	95
Caustic Circulation Pump	2	15	86
Spent Caustic Transfer Pump	1	30	89
Spent Caustic Loading Pump	1	15	86
Caustic Transfer Pump (fluid catalytic cracker)	2	40[a]	91
New No. 6 Hydrogen Sulfide Plant Sound Power Level Total			**110**
Sulfur Recovery Unit Area			
Degassing System Sulfur Pumps (No. 1 & 2 **Sulfur Recovery Units**)	2	50	92
Degassing System Sulfur Pumps (No. 3 **Sulfur Recovery Unit**)	2	75[a]	93
Sulfur Transfer Pump	1	15	86
Degassing System Steam Ejectors	3	[c]	NA

TABLE 4.11-7 OPERATING EQUIPMENT TO BE INSTALLED AS PART OF THE PROJECT

Type of Equipment	Number of Units	Horsepower Rating Per Unit	Estimated Sound Power Level Per Unit (dBA)
Sulfur Dioxide Circulation Pumps	6	25[a]	89
Condensate Pumps	2	60	93
High Pressure Boiler Feed Water Pumps	2	125[b]	104
Low Pressure Boiler Feed Water Pumps	2	150[b]	104
Sulfur Loading Rack Pumps	2	50[a]	92
Sulfur Loading Rack Vent Gas Blower	1	10	101
Sulfur Loading Rack Caustic Scrubber Bottoms Pump	1	5	82
Sulfur Loading Rack Caustic Scrubber Feed Pump	1	5	82
Sodium Bisulfite Loading Rack Pumps	1	15	86
Sulfur Recovery Unit Area Sound Power Level Total			**111**
Sulfur Recovery Unit Sour Water Concentrator			
Sour Water Feed Pumps	2	75[a]	93
Stripped Water Pumps	2	100[a]	101
Scrubber Recycle Pumps	2	3	79
Stripped Water Cooler	6	15	95
Sulfur Recovery Unit Sour Water Concentrator Sound Power Level Total			**107**

Notes: In most instances involving pumps with spares, only the pump or the spare would run at any one time.

FCC FHT = fluid catalytic cracker feed hydrotreater

DEA = diethanolamine

[a] Replace existing pump motor with larger motor.

[b] Replace existing pump motor with smaller motors but add one motor.

[c] Replace existing ejector with larger ejector. Ejector has no moving parts, noise when venting.

Source: Chevron Data Transmittal #45F, 2013; Environ, 2013.

atmospheric absorption, and ground impacts. The predicted levels at the nearest residential locations south (R1), northeast (R2), and east (R3) of the facility, displayed in Figure 4.11-1, are shown in Table 4.11-8.

The modeled hourly sound levels shown in Table 4.11-8 are less than the 50-dBA noise limit specified in the noise ordinance for residential uses during nighttime

TABLE 4.11-8 PROJECTED HOURLY SOUND LEVELS (HOURLY L_{EQ}, DBA)

Location	Project Level	Noise Limit
R1 (South)	47	60/50
R2 (Northeast)	45	60/50
R3 (East)	44	60/50

Source: Environ, 2013.

hours and well below the 60-dBA limit specified for daytime hours (see Table 4.11-3). Therefore, the Project-related operational sound levels would comply with the Richmond noise ordinance.

As shown in Table 4.11-9, there would be virtually no increase in sound levels at the southern or eastern residential areas represented by R1 and R3 due to operation of the Project. Although the existing and future sound levels fall into the "normally unacceptable" and "conditionally acceptable" ranges for residences at the southern and eastern residential areas, respectively, there would be no significant adverse noise impact since the Modernization Project would not result in an increase.

TABLE 4.11-9 PROJECTED DAILY SOUND LEVELS (DNL, DBA)

Location	Measured Existing Ambient Sound Level[a]	Estimated Project-Related Sound Level[b]	Overall Level (Existing Plus Project)[c]	Estimated Increase[d]
R1 (South)	72	60	72	0
R2 (Northeast)	59	57	61	2
R3 (East)	67	57	67	0

[a] Existing ambient sound levels are those taken in 2005, as shown in Table 4.11-3 above.
[b] Calculated DNL assuming hourly L_{eq} displayed in Table 4.11-8 would occur 24-hours a day
[c] Overall levels are the existing plus project-related sound levels.
[d] The calculated increase is determined by subtracting the measured ambient level from the overall (existing plus project) level.
Source: Environ, 2013.

At the nearest receivers northeast of the Facility, the projected increases in DNL are 2 dBA and the overall levels would be considered "conditionally acceptable" for residential uses. Therefore, no significant adverse noise impacts would be expected.

In addition to the noise generated by the operation of new equipment, noise generated by flaring events due to release from the Facility relief and blowdown system was also considered. (See *Chapter 3, Project Description* for a description of the Facility's flaring system.) Because the Modernization Project is expected to result in fewer overall flaring events due to equipment improvements, no significant adverse noise impacts due to flaring are expected. (See *Section 4.3, Air Quality,* for further discussion of flaring events.)

Mitigation Measure 4.11-3: None required.

4.11.5 Cumulative Impacts

Cumulative impacts are only addressed for those thresholds that have a Project-related less-than-significant or significant adverse impact. For thresholds with "no impact," no cumulative analysis is provided as the Project would have no cumulatively considerable impact under these thresholds.

The geographic context for the analysis of cumulative noise impacts depends on the impact being analyzed. For construction impacts, only the area around a project site where noise associated with the Modernization Project could be perceived at sensitive receptors would be included in the cumulative context.

For operational/roadway-related impacts, the context is the increase in roadway volumes as a result of existing and future development in the city.

4.11.5.1 Cumulative Construction Noise Impacts

The analysis of cumulative construction noise impacts considers the impacts of the Modernization Project together with past, present, existing, pending and reasonably foreseeable future projects within the Facility and in the Project vicinity. Potential cumulative noise impacts from construction of the Modernization Project and other projects could occur primarily from construction activities similar to those of the Project (i.e., pile driving, grading, operation of construction of heavy equipment, etc.). However, as described above, the increase in ambient noise levels due to Project construction noise would not be perceptible at sensitive receptors because of the distances involved (5,000 feet or more).

Because Project construction noise could not be readily perceptible, there is a minimal potential for cumulative noise impacts with other construction projects. Therefore, construction-related noise from equipment would not be significant.

Increased traffic due to construction of the Modernization Project, all other projects, and a major facility turnaround would result in up to a 14% increase in traffic volumes during the AM peak period on area roadways near sensitive

receivers (see *Section 4.16, Transportation and Traffic*). Such an increase in overall traffic volumes would result in less than a 1-dBA increase in noise, which would not be perceptible over existing conditions.

As is discussed in Impact 4.11-1, Mitigation Measures 4.11-1a and 4.11-1b would be applied to the Modernization Project to reduce construction-related noise impacts to less-than-significant levels. For all of these reasons, the Modernization Project would not contribute to a cumulatively considerable construction noise impact.

4.11.5.2 Cumulative Operational Noise Impacts

Increased operational noise from cumulative development in Richmond would primarily occur from increases in motor vehicle traffic. The estimated operational increase in the number of truck round trips per day due to the Modernization Project is a total of 63 new truck trips with 93% utilization and 94 new truck trips with 100% utilization.[7] In addition, the Project would result in a maximum of 29 new automobile round trips per day from new permanent employees. An increase in noise levels of 3 dBA would be perceptible and potentially significant. The cumulative increases in traffic along the roadway segment most affected by noise from the Modernization Project (i.e., Richmond Parkway north of Gertrude Street) would be about 6 and 13%, for the 93 and 100% Utilization Scenarios, respectively. Such an increase in traffic volumes on city streets would result in less than a 3-dBA increase in noise level, and this impact would not be cumulatively considerable.

In addition, as described above, the Modernization Project would not result in any readily-perceptible increase in existing operational noise levels associated with Refinery Operations, and therefore, would have no cumulatively considerable noise impact due to operation of equipment.

4.11.6 References—Noise

Bender, W.L. 1996. *Report on Estimated Airblast and Blast-Related Vibration at the Lincoln Project, Placer County, California*. Green Valley, AZ.

Beranek, Leo L. and Istvan L. Ver. 1988. *Noise and Vibration Control.*

Caltrans. 1998. *Traffic Noise Analysis Protocol for New Highway Construction and Reconstruction Projects.*

[7] Daily truck trips under both the 93% and 100% Utilization Scenarios were estimated using scaling methodologies on the baseline truck volumes identified in Transmittal #18 (Rev #2), 2013.

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Chevron Data Transmittal #5 (Rev #3): Cumulative Projects Traffic & Construction, 2014.

Chevron Data Transmittal #18 (Rev #2): Baseline and Future Trucking Data, 2013.

Chevron Data Transmittal #36G (Rev #1): Rail Transportation Data, 2013.

Chevron Data Transmittal #36O (Rev #3): Construction Equipment Information, 2014.

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4.12 EMPLOYMENT, POPULATION, AND HOUSING

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) changes to relevant plans and policies including the adoption of a new Richmond General Plan. These revisions do not change the 2008 EIR's conclusions that there are no significant adverse employment, population, or housing impacts for the Modernization Project.

IMPACT SUMMARY

- The Modernization Project would not induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure).
- The Modernization Project would not displace substantial numbers of existing housing and would not necessitate the construction of replacement housing elsewhere.
- The Modernization Project could result in direct population growth in the City of Richmond but would not displace substantial numbers of people and would not necessitate the construction of replacement housing elsewhere.

4.12.1 Introduction

This section sets forth existing regional and local employment, population, and housing conditions and analyzes potential direct and indirect impacts related to construction and operation of the Modernization Project.

The Modernization Project includes new equipment and modifications of existing equipment which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section, 4.3 Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities. For example, as described in *Chapter 3, Project Description*, *Section 3.3,* construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

4.12.2 Setting

4.12.2.1 Regional and Project Setting

4.12.2.1.1 *Population Growth*

From 2000 to 2010, the population of the City of Richmond grew by 4.5% to a total of 103,701 (U.S. Census Bureau, 2010). This population increase was slightly lower than the 13.5% growth the City experienced in the previous decade (1990-2000). The City of Richmond's steady population growth over the last 30 years resulted from residential development in the El Sobrante, Hilltop, Brickyard Cove, and Marina Bay planning areas. The growth rate in Richmond[1] from 2000 to 2010 was lower than in Contra Costa County as a whole, which experienced a 10.6% increase during that decade. The Project site is located within census tract 3780, which had a population of 3,435 in 2010 (U.S. Census Bureau, 2010).

The Association of Bay Area Governments (ABAG) projects that the population of the City of Richmond will grow from approximately 105,000 in 2010 to 118,700 in 2020, an increase of 13.0%. ABAG projects a lower growth rate of about 8.0% for Contra Costa County during the same 10-year span (2010 to 2020), from 1,090,300 in 2010 to 1,177,400 in 2020. ABAG projects that the population of the City of Richmond will reach 132,600 (a 26.3% increase from 2010) and that the population of the County will increase to 1,273,700 (a 16.8% increase from 2010) by 2030 (ABAG, 2009).

[1] Richmond currently ranks as the third most populous city in Contra Costa County, behind Concord and Antioch. Increases in Richmond's current and anticipated population from 2000 through 2030 will likely remain steady. In absolute numbers, the current and anticipated population increases in Richmond total 27,600 persons between 2010 and 2030 (inclusive).

4.12.2.1.2 *Household Size and Number*

The average household size in Richmond in 2010 was 2.83 persons per household, which was slightly higher than the Contra Costa County average of 2.77 persons per household (U.S. Census Bureau, 2010). Average household size has increased in both Richmond and in Contra Costa County since 2000, when it was 2.82 and 2.72, respectively (U.S. Census Bureau, 2010).

There are currently approximately 36,093 households in the City of Richmond, and 375,364 households in Contra Costa County (U.S. Census Bureau, 2010). ABAG projects a steady increase in the total number of households in the City of Richmond to 41,930 in 2020, and 47,320 in 2030 (ABAG, 2009).

4.12.2.1.3 *Employment*

Richmond had 40,660 jobs in 2010, according to ABAG. ABAG projects that the number of jobs in Richmond will increase to 54,000 by the year 2020 (32.8% growth from 2010) and 64,120 in 2030 (57.7% growth since 2010) (ABAG, 2009). According to the 2011 American Community Survey (3-year estimate), there were 46,002 employed Richmond residents in 2011.

The Facility currently employs approximately 1,200 full-time permanent employees and 400 contract workers (Chevron Data Transmittal #41, 2013). During regularly scheduled maintenance turnarounds, the number of employees on site increases by an additional 1,791 workers (Chevron Data Transmittal #5 (Rev #3), 2014).

4.12.2.2 Regulatory Setting

4.12.2.2.1 *Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan 2030), including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.12.3 Significance Criteria and Methodology

4.12.3.1 Significance Criteria

Consistent with Appendix G of the CEQA Guidelines and the General Plan 2030, a significant adverse impact on population, employment and housing would occur if the Modernization Project would do any of the following:

(A) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure).

(B) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere.

(C) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

4.12.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of employment, population, and housing-related impacts is explained in the context of each impact, as discussed further below.

4.12.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

Review and comparison of the Modernization Project to the environmental setting shows that the Project would create no impacts related to the following environmental topics listed in CEQA Guidelines Appendix G.

(B) Potential of the Project to displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere

No housing would be displaced by the Modernization Project because the Project would be built almost entirely within the existing Project site boundaries where no housing is located. There would be no impact.

(C) Potential of the Project to displace substantial numbers of people, necessitating the construction of replacement housing elsewhere

Because the Modernization Project would be built almost entirely within the existing Project site boundaries, where no people reside, no people would be displaced by the Project. There would be no impact.

4.12.4 Impacts and Mitigation Measures

Impact 4.12-1: The Modernization Project could result in direct population growth within the City of Richmond. This impact would be less than significant and no mitigation is necessary. (LTS)

The Modernization Project could result in direct population growth in Richmond because the Project would create both temporary and permanent new jobs. The

Modernization Project would result in an approximate average of 500 workers per day over the 2-year construction period, with a peak of 1,002 workers per day during the peak 6-month construction period (Chevron Transmittal #36O (Rev#2), 2014). Greenhouse gas reduction measures will also generate jobs, such as the Community Greenhouse Gas Reduction Program, but these are anticipated to be largely filled by Richmond residents, with others coming from nearby Contra Costa and Alameda Counties, and are not anticipated to result in any significant direct population growth within the City.

It is anticipated that the construction workforce would be drawn primarily from the construction labor pool available in Richmond and the rest of the Bay Area. With respect to the Facility's employment of the local labor pool, Chevron currently contributes to existing programs in the City of Richmond that provide employment development and training for Richmond residents, including a $15.5 million Community Revitalization Initiative to create jobs, grow small businesses, expand job training opportunities and improve schools in Richmond and West County, and Chevron has partnered with the Contra Costa College to implement two regional occupational programs for process operator and maintenance mechanic entry level training.

A Modernization Project Labor Agreement was approved between with the Contra Costa Building and Construction Trade Union and Chevron in July 2013. This agreement specifies that Chevron and the Building Trades are committed to hire qualified local residents.

All current Bay Area residents who would be employed by the project would be anticipated to commute rather than move. Therefore, the portion of the new construction jobs that would be filled by current Bay Area residents would not have a significant adverse impact on population or housing in Richmond because Modernization Project construction workers living in the Bay Area would not be anticipated to relocate.

In addition, a fraction of the construction workforce would be drawn from outside the Bay Area on a temporary basis. Because it would be temporary and minimal given the total population of the area, this potential temporary population growth would be a less-than-significant impact, even if it were to occur entirely in Richmond. It is expected that any construction workers that temporarily relocate would prefer rental housing due to the temporary nature of the work. Additionally, as described in *Chapter 3, Project Description,* construction of significant components of the Modernization Project were completed prior to issuance of the writ, so net remaining demand for construction-related temporary housing is lower. The General Plan 2030 reported that Richmond had a rental vacancy rate of approximately 12%, and Contra

Costa's vacancy rate was 6%, during 2006-2008 (General Plan 2030 Table 5.18). The greater Bay Area had a housing vacancy rate of 6.4% in 2010, meaning that 177,925 units were unoccupied (ABAG, 2010). Thus, housing in the Bay Area would generally be available to meet the temporary increase in housing demand related to the Modernization Project construction workers that could be drawn from outside the Bay Area on a temporary basis. Therefore, the impact on housing resulting from the temporary population increase associated with the Modernization Project construction workers would be less than significant.

The Modernization Project would also result in the addition of 29 new permanent full-time jobs at the Facility (Chevron Data Transmittal #5 (Rev# 3), 2014). Even if all of those permanent employees move to the Bay Area or to Richmond specifically, that population growth is minimal and could be accommodated by existing housing as described above. Therefore, the impact on housing resulting from permanent population increase associated with the Modernization Project's new permanent employees would be less than significant.

The potentially significant environmental impacts of Modernization Project construction, including traffic generated by construction workers commuting to the Project site, are analyzed in the other sections of *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures* of this EIR.

Mitigation Measure 4.12-1: None required.

4.12.5 Cumulative Impacts

The cumulative impacts of the Modernization Project in relation to existing employment, population, and housing, when considered together with past, present existing, pending, and reasonably foreseeable future projects on the Project site and in the region of the Project site, would not be significant. Therefore, the Modernization Project would not make a considerable contribution to a significant cumulative employment, population, or housing impact. The Richmond General Plan 2030 EIR did not identify any cumulative employment, population, or housing impacts.

As discussed above, the Modernization Project could result in a very small increase in population due to additional temporary and permanent jobs at the Facility. However, the Modernization Project would not displace people or housing. The temporary addition of this construction workforce to the Facility would not be considered a significant adverse impact of the Modernization Project in combination with other projects because it is anticipated that the majority of the construction workforce for all the projects would be drawn from the construction labor pool available in Richmond and the rest of the Bay Area.

All current Bay Area residents would be anticipated to commute rather than move to Richmond. Therefore, that portion of the new construction jobs that would be filled by current Bay Area residents would have no impact on population or housing in Richmond. A fraction of the construction workforce for the Modernization Project and other cumulative construction projects would be drawn from outside the Bay Area on a temporary basis, but as discussed above there is sufficient existing housing supply to accommodate these workers.

Operationally, 29 new permanent employees would be added as a result of the Modernization Project (Chevron Data Transmittal #5 (Rev#3), 2014). However, as discussed in Impact 4.12-1, the housing vacancy rate in the Bay Area and in Richmond specifically would be sufficient to meet the potential increase in demand resulting from the Modernization Project for both temporary and permanent housing.

Because the Modernization Project would have no significant adverse employment, population, or housing impacts under the Appendix G thresholds, the Project would have no cumulatively considerable employment, population, or housing impacts. Accordingly, the Modernization Project, together with past, currently existing, pending, and reasonably foreseeable future projects, would not result in cumulatively considerable employment, population, or housing impacts.

See *Section 4.0, Introduction to Chapter and Methodology,* for a detailed discussion of the approach and methods of the cumulative analysis.

4.12.6 References—Employment, Population, and Housing

Association of Bay Area Governments (ABAG). 2009. *Building Momentum: Projections and Priorities 2009.*

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4.13 PUBLIC SAFETY

This section was not challenged in court and is not a subject of the Appellate Court decision issued in 2011 or the Superior Court's Writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the Modernization Project objectives description, such as the Reliability Program and safety upgrades; (2) the current Baseline and new circumstances, including the August 2012 crude unit fire at the Facility; (3) revisions to applicable law on this topic area, including (a) adoption of a new Richmond General Plan and (b) planned adoption of a revised Industrial Safety Ordinance by the City. These changes have resulted in Public Safety impacts being elevated to significant impacts, which are reduced to less-than-significant impacts through implementation of recommended mitigation measures.

IMPACT SUMMARY

The Public Safety impacts related to the construction and operation of the Modernization Project are summarized below:

Construction:

- There would be no new significant hazard risks from the transportation of hazardous materials and hazardous waste during Modernization Project construction. This would be a less-than-significant impact.
- The use of hazardous materials during the construction phase of the Modernization Project would result in a potentially significant adverse impact requiring mitigation. However, with mitigations requiring construction materials storage only in authorized locations and implementing training and safety requirements for construction workers, the use of these materials would have a less-than-significant impact.
- The management and disposal of hazardous wastes, and demolition and construction wastes, generated during Modernization Project construction could result in a potentially significant adverse impact requiring mitigation. However, with mitigation this impact would be less than significant.

Operation:

- The Modernization Project is not within an airport land use plan and is not within 2 miles of a public airport. There would be no resulting hazard, and therefore no impacts.
- The Modernization Project is not located within 2 miles of a private airstrip. There would be no resulting hazard, and therefore no impact.
- Additional quantities of hazardous materials would be used and hazardous wastes generated during the operation of the Modernization Project relative to the Baseline; however, no new types of hazardous materials would be introduced and no new types of hazardous wastes would be generated. Hazardous materials quantities that are specific to the Modernization Project

would be lower than the maximum quantities of hazardous materials currently stored at the Facility. With mitigation, this impact would be less than significant.

- Additional quantities of hazardous materials and wastes would be transported during the operation of the Modernization Project relative to the Baseline; however, no new types of hazardous materials or wastes would be transported, nor is the acceptance of crude oil by rail being authorized as part of the Modernization Project. This would be a less-than-significant impact after mitigation.
- The Modernization Project's physical equipment changes could increase the risks of accidental releases of acutely hazardous substances. As mitigated, this risk would be less than significant.
- The Modernization Project has the potential to increase the risk of accidental releases of acutely hazardous materials due to Modernization Project-related operational changes resulting in increases in sulfur content of feedstock, increased hydrogen purity produced by the new hydrogen plant, and increased hydrogen sulfide (H_2S) partial pressures in hydroprocessing plant's recycle stream. With mitigation, this impact would be less than significant.
- The hazard risks of accidental releases of acutely hazardous substances from Modernization Project-related storage quantities were evaluated and none were found to cause an increased risk beyond the existing potential Facility impacts from currently stored acutely hazardous substances, but H_2S and anhydrous ammonia were found to have a potential for off-site impacts in non-residential areas. With mitigation, this impact would be reduced to less than significant.
- The Modernization Project facilities would lie entirely within the existing Facility and would not be within 0.25-mile of an existing or proposed school. However, past incidents resulting in releases of hazardous substances triggering shelter-in-place alerts have occurred when schools were in session. With mitigation, this risk is reduced to less than significant.
- The Modernization Project would be located within the Facility which is listed on the Envirostor list of hazardous waste and substance sites compiled pursuant to Government Code Section 65962.5. With mitigation, the known hazardous materials releases on the site (all of which have been the subject of remediation activities under the oversight of the San Francisco Bay Regional Water Quality Control Board), would not cause any impact warranting further mitigation. If unexpected contamination is discovered during Modernization Project construction, impacts will be mitigated to less-than-significant levels.

- The Modernization Project is located within the existing Facility and is not introducing any hazardous materials not currently used at the Facility and thus would not interfere with existing emergency plans for areas located outside of the Facility. Mitigation would include requiring the Modernization Project to be integrated into the Facility's emergency plan. With mitigation, this impact is less than significant.
- The Modernization Project is located in close proximity to areas of urbanized, non-native vegetated areas that are susceptible to fires. Potential accidents associated with the Modernization Project could cause a fire or explosion that can result in ignition of vegetation in these areas. Smoke generated from fires in these vegetated areas could also result in health impacts to people. Fires in the vegetated areas can be mitigated through the development and implementation of a fire protection plan for vegetated areas within the Facility that would include fuel management measures, construction and maintenance of fire breaks, and coordination of emergency response efforts. Implementation of these measures would make this impact less than significant.

Cumulative:

- The Modernization Project, in conjunction with existing and reasonably foreseeable future activities within the Facility, and nearby industrial and transportation facilities, could lead to a cumulative increase in the risks of accidental release of acutely hazardous substances. This risk could be potentially significant within the Facility, but is unlikely to extend to any off-site industrial or transportation operations and is thus not cumulatively considerable with respect to such off-site uses. With mitigation, this risk is less than significant.

4.13.1 Introduction

The public safety portions of the Chevron Hydrogen and Energy Renewal Project EIR Consolidated Volume (2008 EIR) were not challenged in court, and in that EIR the topic of public safety was discussed only briefly and relied on compliance with applicable public safety laws and building codes to conclude that the larger Chevron Hydrogen and Energy Renewal Project (2008 Project) would not pose any significant public safety impact risks:

> "The risks to Public Safety from implementation of the Project were evaluated in the context of possible accidental releases of acutely hazardous substances, explosions or fire. As long as the Project components are designed to applicable codes and industry guidelines, and as long as the

> facility operators maintain the strict safety practices required by the California Accidental Release Prevention (CalARP) Program, the Industrial Safety Orders [sic] (ISO) and the appropriate industry recommended practices, the impacts from plausible accidents would be less than significant. No additional mitigation measures would be needed."

Since the 2008 EIR, new facts have arisen that have indicated that regulatory compliance obligations may need to be supplemented to protect public safety, thereby warranting additional protective measures to ensure that the Modernization Project does not result in significant public safety risks. Specifically, on August 6, 2012, a 5-foot-long pipe component in the Facility's crude unit, which is not being physically modified by the Modernization Project, developed a leak resulting in a release of hydrocarbon that subsequently ignited. The leak was the result of high-temperature sulfidation corrosion, accelerated by the low-silicon content of the failed piping component. There had been a fire at this crude unit in 2007 that was also attributed to corrosion.

The August 6, 2012 fire at the Facility, Chevron's response, the agency investigations, regulatory and enforcement actions resulting from that incident, and Chevron's corresponding implementation of enhancements to its safety program, are considered new information for purposes of this EIR. This section replaces the Public Safety of the 2008 EIR in its entirety.

This section describes the existing regulatory setting governing hazardous materials transport, storage and use at the Facility, as well as federal, state, and local regulations governing process safety, including actions that have been taken following the August 6, 2012 fire to enhance process safety and mechanical integrity at the Facility and to strengthen the regulatory regime. In addition to the description in this section, these matters are described in greater detail in *Appendix 4.13-DET*. This section then analyzes the potential impacts that could result from the Modernization Project's physical changes, as well as changes in hazardous materials use, storage, disposal and transport, including operational and feedstock changes, included as part of the Modernization Project.

This section also includes information relating to the Modernization Project's enhanced sulfur management components, proposed increase in sulfur content of crude and gas oils, and the measures undertaken and underway to expand corrosion risk analyses and safety management upgrades associated with these Modernization Project changes. As a result of investigations into the August 6, 2012 fire, and in part as a Project Design Feature of the Modernization Project, the Facility is implementing a Reliability Program with an enhanced sulfidation

corrosion inspection program, damage mechanism reviews, an improved process for process hazard analyses by incorporating damage mechanism reviews, record-keeping, reporting requirements, and is reporting the results of its implementation of these actions as part of the August 5, 2013 probation terms entered into with the State of California. The Chevron Modernization Project Reliability Program is included as a Project Design Feature, but implementation of this program is also required as a mitigation measure, as discussed further below. The Chevron Modernization Project Reliability Program is included in its entirety in *Appendix 4.13-PROG*.

Finally, this section identifies thresholds of significance, analyzes the potentially significant adverse impacts of the Modernization Project on public safety, and proposes mitigation measures to reduce public safety impacts to less-than-significant levels.

4.13.2 Setting

4.13.2.1 Project Site Location and Proximity to Sensitive Receptors

The Project site is configured to include unoccupied lands or open water as buffer zones around the Refinery Processing, Tank Farm, and Long Wharf areas where the largest volumes of feedstocks, refined products, and other potentially hazardous or hazardous materials are managed (see Figure 1-1 in *Chapter 1, Introduction*). As described in detail in *Section 4.10, Land Use, Plans, and Policies*, the lands immediately surrounding the Facility are nearly all open space, open water, or industrial lands except for the residential communities of Point Richmond to the southwest, the Point San Pablo Yacht Harbor (part of the larger Point Richmond neighborhood) to the northwest, Atchison Village and the Iron Triangle to the southeast, and North Richmond to the northeast. The closest distances from the sources of acutely hazardous materials to off-site residents (sensitive receptors) range from 2,100 to 5,000 feet. Major thoroughfares include Interstate 580 (I-580), which cuts through the Facility's southern border, and Castro Street, which cuts through the southeastern border.

4.13.2.2 General Refinery Hazards

Oil refineries handle, store, and process large quantities of flammable materials and acutely hazardous materials. Accidents related to these materials can result in public exposure to heat radiation from a fire, blast overpressure from an explosion, or airborne exposure to acutely hazardous materials. These hazards can result from operations at the Facility, including accidents, or during transportation of hazardous materials to and from the Facility.

- **Fires**, which are caused by ignition of flammable materials, can result in exposure to heat radiation (EPA, 2009) and smoke. The heat decreases rapidly with distance from the flame. In many cases fires are confined to the vicinity of the equipment from which the flammable release would occur.
- **Explosions** can occur if flammable vapors and gases are ignited or when a flammable substance is released at high temperatures, and usually under elevated pressure (CCPS, 2010). Impacts of an explosion are expressed in terms of a sudden increase in pressure above ambient pressure, resulting from a blast or shock wave. The types of explosions associated with refineries can include a vapor cloud explosion and a boiling liquid expanding vapor explosion (CCPS, 2010). A vapor cloud explosion occurs when a flammable gas is mixed with air and then encounters an ignition source. Vapor cloud explosions are very rare, because they require that sufficient air be combined with the flammable gas before ignition, thus resulting in an explosive mixture. Instead, a more common event would be a flash fire in which ignition occurs before mixing with atmospheric air. Flash fires do not result in an explosion that could cause damaging overpressure. A boiling liquid expanding vapor explosion would occur when a confined flammable liquid vessel ruptures from excess pressure because of heating. The result is a rapid expansion of the material as it is exposed to ambient pressure and subsequent ignition of the released liquid aerosol and vapors. Such an event can occur if there is an external fire that engulfs a vessel containing a flammable liquid. Boiling liquid expanding vapor explosions are also very rare (EPA, 2009).
- **Airborne exposure** can occur with a release of a substance from a facility that is acutely hazardous, such as ammonia (NH_3), hydrogen sulfide (H_2S) or sulfur dioxide, or any harmful byproducts in smoke that may occur from a fire (EPA, 2009). A release can be a threat if a harmful concentration of the gas reaches off-site receptors.

Risks from these hazards are measured in terms of the likelihood or probability of an accident and the severity of the consequences of an accident involving hazardous materials. Due to the hazards presented by the use, storage, transportation, and disposal of hazardous materials in industrial oil refining operations, including those relating to accidental release or upset conditions, an extensive body of laws and regulations has developed to minimize risk and mitigate harm in the event of incidents.

4.13.2.3 Regulatory Setting

Petroleum refineries are subject to complex and often overlapping regulatory requirements regarding industrial safety under federal, state, and local laws. The

regulations discussed below share common themes for prevention of, and appropriate response to, industrial process accidents including the protection of worker health and safety, reporting and disclosure, performance specifications, maintenance and inspections, and other related requirements. *Appendix 4.13-DET* provides a much more detailed description of these regulatory programs, as well as industry standards and related policy initiatives that currently apply or are under consideration and may potentially serve to further enhance public safety.

4.13.2.3.1 *Agency Regulatory Programs*

4.13.2.3.1.1 *Federal*

4.13.2.3.1.1.1 *Emergency Planning and Community Right-to-Know Act*

The objective of the Emergency Planning and Community Right-to-Know Act (EPCRA)—created by the Superfund Amendments and Reauthorization Act of 1986 (Title 42 of the United States Code [U.S.C.] Chapter 116; Title 40 of the Code of Federal Regulations [CFR] Part 370)—is to:

- Allow state and local planning for chemical emergencies.
- Provide for notification of emergency releases of chemicals.
- Address communities' right-to-know about toxic and hazardous chemicals.

All information submitted pursuant to EPCRA is publicly available, unless it is a protected trade secret.

EPCRA Section 302 (Emergency Planning and Notification). Facilities must notify their State Emergency Response Commission[1] and Local Emergency Planning Committee of the presence of any extremely hazardous substances (EHS) (40 CFR Part 355, Appendices A and B) if the EHS exceeds the threshold planning quantity. The facility must also appoint an emergency response coordinator.

EPCRA Section 304 (Emergency Release Reporting). A facility must notify the State Emergency Response Commission for any area likely to be affected by the release and Local Emergency Planning Committee in the event of a release exceeding the reportable quantity of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substance (40 CFR Part 302)

[1] The EPCRA program is implemented and administered in California by the California Office of Emergency Services, a State Emergency Response Commission, Local Emergency Planning Committee, and Certified Unified Program Agency). State Emergency Response Commission directives and memberships are specified in Executive Order W-40-93 (OES, 2011).

or an EPCRA EHS (40 CFR Part 355). The National Response Center must also be notified of spills of CERCLA hazardous substances.

EPCRA Sections 311-312 (Hazardous Chemical Storage Reporting Requirements). Facilities must maintain a safety data sheet for each hazardous chemical used or stored in the workplace. The material safety data sheets (or list of chemicals) must be submitted to the State Emergency Response Commission and Local Emergency Planning Committee and to the local fire department with jurisdiction over that facility. Facilities must also report an annual inventory of the chemicals by March 1 of each year to the State Emergency Response Commission, Local Emergency Planning Committee, and local fire department, if certain thresholds are met. The information must also be made available to the public. Compliance with federal EPCRA requirements is achieved through compliance with the California Hazardous Materials Business Plan Program (California Health and Safety Code [HSC] 25504(a-c)) (see below).

EPCRA Section 313 (Toxic Chemical Release Inventory Reporting). Manufacturing facilities included in Standard Industrial Classification Codes 20-39 must submit an annual toxic chemical release report if they have 10 or more employees and if they manufacture, process, or use specified chemicals in amounts greater than threshold quantities. Standard Industrial Classification Code 29 includes petroleum refining (OSHA, 2014). Data reported pursuant to Section 313 is included in the national Toxic Release Inventory database, which is available to the public (42 U.S.C. Section 11023(h)).

4.13.2.3.1.1.2 *U.S. Environmental Protection Agency Accidental Release Prevention/Risk Management Plan Rule*

The U.S. Environmental Protection Agency's (EPA) Risk Management Plan (RMP) Rule implements Clean Air Act Section 112(r). The RMP Rule established a nationwide emergency planning and response program and imposed reporting requirements for businesses that store, handle, or produce regulated substances in amounts over specified threshold quantities. Substances regulated by the RMP Rules are listed at 40 CFR Section 68.130, and include H_2S, NH_3, and flammable hydrocarbons. The RMP Rule also requires the states to implement a comprehensive system to inform local agencies and the public when a significant quantity of such materials is stored or handled at a facility. The RMP Rule requires facilities that use regulated substances to develop an RMP that includes:

- Hazard assessment that details the potential impacts of an accidental release, an accident history of the past 5 years, and an evaluation of worst-case and alternative accidental releases.

- Release prevention planning that includes safety precautions and maintenance, monitoring, and employee training measures.
- Emergency response program that spells out emergency health care, employee training measures, and procedures for informing the public and response agencies (e.g., the fire department) should an accident occur.

California's version of the RMP Rule, which implements Section 112 of the Clean Air Act with additional provisions, is the CalARP Program (see HSC Section 25531 et seq.) A summary of these overlapping regulations is included in Table 4.13-1, below. The Facility's RMP is updated when there are changes that would affect the use or storage of regulated substances. Within 30 days after commencement of Project operations the RMP would be updated.

4.13.2.3.1.1.3 *Process Safety Management*

In 1970, Congress enacted the Occupational Safety and Health Act (Public Law 91-596), which created the Occupational Safety and Health Administration (OSHA), an agency of the U.S. Department of Labor, and which mandates safety requirements in the workplace. Implementing regulations are codified in 29 CFR (including the General Industry Standards – Sections in 1910.1–1910.1450), and these regulations define procedures for conducting inspections to implement and enforce safety and health procedures to protect workers, particularly in the industrial sector. The regulations include requirements for facilities exceeding threshold quantities of certain chemicals to comply with the Act's Process Safety Management (PSM) Standard.

In California, OSHA has delegated the authority to implement worker safety regulations to the state's Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA), which has issued its own set of PSM standards. The Cal/OSHA PSM standard for Acutely Hazardous Materials contains requirements for preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals (Title 8 of the California Code of Regulations [CCR] Section 5189), as detailed below. The Cal/OSHA PSM regulations were established to reduce or eliminate employee exposure risks in petroleum refineries, chemical plants, and other facilities. Many of the Cal/OSHA PSM standards overlap with other local, state, and federal regulations—i.e., the EPA's RMP Rule, the CalARP Program, and the City of Richmond Industrial Safety Ordinance (RISO). A summary of these overlapping legal requirements is included in Table 4.13-1.

Additionally, OSHA issued Directive No. CPL 03-00-010, effective August 18, 2009, which provided guidance to its national, regional, and area offices, as well as to state agencies (e.g., Cal/OSHA), in implementing a National Emphasis

TABLE 4.13-1 CALIFORNIA PROCESS SAFETY REGULATORY OVERVIEW

Element	Cal/OSHA PSM Standards (8 CCR)	EPA RMP Rule (40 CFR Part 68)	CalARP Program (19 CCR)	RISO (RMC)
Process Safety Information	§ 5189(d)	Subpart D § 68.65	§ 2760.1	§ 6.43.090(a)(1)
Process Hazard Analysis	§ 5189(e)	Subpart D § 68.67	§ 2760.2	§ 6.43.090(d)
Operating Procedures	§ 5189(f)	Subpart D § 68.69	§ 2760.3	§ 6.43.090(a)(2)
Training	§ 5189(g)	Subpart D § 68.71	§ 2760.4	§ 6.43.090(a)(4)
Contractors	§ 5189(h)	Subpart D § 68.87	§ 2760.12	§ 6.43.090(a)(11)
Pre-Startup Safety Review	§ 5189(i)	Subpart D § 68.77	§ 2760.7	§ 6.43.090(a)(7)
Mechanical Integrity	§ 5189(j)	Subpart D § 68.73	§ 2760.5	§ 6.43.090(a)(5)
Hot Work Permit	§ 5189(k)	Subpart D § 68.85	§ 2760.11	§ 6.43.090(a)(10)
Management of Change	§ 5189(l)	Subpart D § 68.75	§ 2760.6	§ 6.43.090(a)(6)
Incident Investigation	§ 5189(m)	Subpart D § 68.81	§ 2760.9	§ 6.43.090(a)(9)
Emergency Planning and Response	§ 5189(n)	Subpart E § 68.95	§ 2765.2	§ 6.43.090(a)(12)
Injury and Illness Prevention Program	§ 5189(o)	NA	NA	NA
Employee Participation	§ 5189(p)	Subpart D § 68.83	§ 2760.10	§ 6.43.090(a)(3)
Compliance Audits	NA	Subpart D § 68.79	§ 2760.8	§ 6.43.090(a)(8)

Note: Cal/OSHA = California Department of Industrial Relations, Division of Occupational Safety and Health; CCR = California Code of Regulations; PSM = Process Safety Management; RISO = Richmond Industrial Safety Ordinance; RMC = Richmond Municipal Code

Program for inspecting petroleum refineries to reduce or eliminate workplace hazards associated with catastrophic releases of highly hazardous chemicals (OSHA, 2009).

4.13.2.3.1.1.4 *Resource Conservation and Recovery Act Hazardous Waste Program*

The Resource Conservation and Recovery Act (RCRA) Hazardous Waste Program (RCRA Subtitle C) (42 U.S.C. Section 6901 et seq.; 40 CFR Part 260) controls hazardous waste "from-cradle-to grave"—including generation, transportation, treatment, storage, and disposal. In 1992, the EPA authorized the California Department of Toxic Substances Control (DTSC) to implement RCRA Subtitle C requirements. Thus, DTSC is the primary authority that enforces RCRA hazardous waste requirements in California.

4.13.2.3.1.1.5 *U.S. Pollution Prevention Act and Oil Pollution Prevention Act*

The Oil Pollution Prevention Act (33 U.S.C. Section 2701 et seq.) of 1990 sets forth requirements for prevention of, preparedness for, and response to oil discharges at specific non-transportation-related facilities. To prevent oil from reaching navigable waters and adjoining shorelines, and to contain discharges of oil, the regulation requires these facilities to develop and implement Spill Prevention, Control, and Countermeasure (SPCC) Plans and establishes procedures, methods, and equipment requirements (Subparts A, B, and C). Also in 1990, the Oil Pollution Act (40 CFR Part 112) amended the Clean Water Act to require some oil storage facilities to prepare Facility Response Plans. On July 1, 1994, the EPA finalized the revisions that direct facility owners or operators to prepare and submit plans for responding to a worst-case discharge of oil (Subpart D).

The Oil Pollution Prevention regulation applies to any owner or operator of a non-transportation-related onshore or offshore facility engaged in drilling, producing, gathering, storing, processing, refining, transferring, distributing, using, or consuming oil and oil products, which due to its location, could reasonably be expected to discharge oil in quantities that may be harmful, into or upon the navigable waters of the United States or adjoining shorelines, or into or upon the waters of the contiguous zone, or in connection with activities under the Outer Continental Shelf Lands Act or the Deepwater Port Act of 1974, or that may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States (including resources under the Magnuson Fishery Conservation and Management Act) that has oil in: (1) any aboveground container; (2) any completely buried tank; (3) any container that is used for standby storage, for seasonal storage, or for temporary storage, or not

otherwise "permanently closed"; and/or (4) any "bunkered tank" or "partially buried tank" or any container in a vault, each of which is considered an aboveground storage container (40 CFR Section 112(b)); exceptions to applicability are set forth at 40 CFR Section 112(d).

Spill Prevention, Control, and Countermeasure Rule. The owner or operator of an onshore or offshore facility subject to the Oil Pollution Prevention regulation must prepare an SPCC Plan, in accordance with 40 CFR Section 112.7 (40 CFR Section 112.3).[2]

Facility Response Plan Rule. The owner or operator of any non-transportation-related onshore facility that, because of its location, could reasonably be expected to cause substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines shall prepare and submit a Facility Response Plan to the Regional Administrator, according to certain requirements (40 CFR Section 112.20(a)).

4.13.2.3.1.2 *State*

4.13.2.3.1.2.1 *California Accidental Release Prevention Program*

The CalARP Program (HSC Sections 25531 et seq.; 19 CCR Division 2, Chapter 4.5) includes the federal program for prevention of accidental releases of regulated substances adopted by the EPA pursuant to Clean Air Act Section 112(r), with the additional provisions specified in the HSC (19 CCR Section 2735.1). The CalARP Program directs facility owners storing or handling regulated substances in excess of applicable threshold quantities to develop a RMP and submit it to appropriate local authorities, the EPA, and the designated local administering agency for review and approval. The plan must include an evaluation of the potential impacts associated with an accidental release, the likelihood of an accidental release occurring, the magnitude of potential human exposure, any preexisting evaluations or studies of the materials, the likelihood of the substance being handled in the manner indicated, and the accident history of the material. The CalARP Program is similar to the federal program, with the following key differences:

- The list of toxic chemicals is larger (276 vs. 77).
- The threshold quantities for some chemicals is lower (e.g., chlorine federal threshold quantity is 2,500 pounds; California's threshold quantity is 100 pounds).

[2] The California Aboveground Petroleum Storage Act encompasses requirements of the SPCC Rule (DCD, 2011).

- Requires an external events analysis be performed, including a seismic analysis.
- Provides for more interaction with the public and agencies.

The CalARP Program applies to the owner or operator of a stationary source with more than a threshold quantity of a regulated substance in a process (19 CCR Section 2735.4(a)).[3] The CalARP Program defines three program levels with different requirements applicable to each (19 CCR Section 2735.4(b)).

The purpose of the CalARP Program is to prevent accidental releases of substances that can cause serious harm to the public and the environment, to minimize the damage if releases do occur, and to satisfy community right-to-know laws. This is accomplished by requiring businesses that handle more than a threshold quantity of a regulated substance listed in the regulations to develop an RMP. An RMP requires engineering analysis of the potential accident factors present at a business and the mitigation measures that can be implemented to reduce this accident potential. The RMP contains:

- Process Safety Information;
- Process Hazard Analysis;
- Operating Procedures.
- Training;
- Contractors;
- Pre-Startup Safety Review;
- Mechanical Integrity;
- Hot Work Permit;
- Management of Change;
- Incident Investigation;
- Emergency Planning and Response;
- Injury and Illness Prevention Program;
- Employee Participation;
- Compliance Audits.

The CalARP Program is implemented at the local government level by Certified Unified Program Agencies (CUPAs) (also known as administering agencies). The CalARP Program is designed so these agencies work directly with the regulated businesses. The CUPAs determine the level of detail in the RMPs, review the RMPs, conduct facility inspections, and provide public access to most of the information. Confidential or trade secret information may be restricted. Contra

[3] See also 19 CCR Section 2770.5 (threshold lists of regulated substances).

Costa Health Services Hazardous Materials Program (CCHSHMP) is the CUPA for Contra Costa County (the County), including the City of Richmond.

4.13.2.3.1.2.2 *California Hazardous Materials Business and Area Plan Program*

The purpose of the Hazardous Materials Business Plan (HMBP) Program (HSC Sections 25500–25520; 19 CCR Sections 2729–2732) is to prevent or minimize the damage to public health and safety and the environment from a release or threatened release of hazardous materials, and also to satisfy community right-to-know laws. The program requires facilities that handle hazardous materials in quantities equal to or greater than 55 gallons of a liquid, 500 pounds of a solid, or 200 cubic feet of compressed gas, or extremely hazardous substances above the threshold planning quantity (40 CFR Part 355 Appendix A) to prepare and submit to the local CUPA a hazardous materials business plan that contains:

- A hazardous materials inventory.
- Site maps.
- Emergency Response Contingency Plans.
- An Employee Training Plan.

CCHSHMP is the CUPA for all businesses within Contra Costa County (CCHS, 2014). The CUPA verifies the information included in the HMBP and provides it to agencies responsible for the protection of public health and safety and the environment. These agencies may include:

- Fire departments.
- Hazardous materials response teams.
- Local environmental regulatory groups.
- The public also has a right to review most of this information, subject to legal protection of certain confidential and trade secret information.

Businesses must amend the HMBP and submit to CCHSHMP within 30 days if:

- There is a 100% or more increase in quantity of the previous disclosed amount.
- Any handling of a previously undisclosed hazardous material in a reportable quantity.
- Change of business address.
- Change of business ownership.
- Change of business name.

- Significant change in business operations affecting handling of hazardous materials.

Additionally, CCHSHMP is required by statute to establish an area plan for emergency response to a release or threatened release of a hazardous material within its jurisdiction (HSC Section 25503(c)). The Contra Costa County Hazardous Materials Area Plan describes the overall hazardous materials emergency response organization within Contra Costa County (CCHS, 2009).

4.13.2.3.1.2.3 *California OSHA Standards and Regulations*

4.13.2.3.1.2.3.1 *California Refinery and Chemical Plant Worker Safety Act of 1990 (California Labor Code (CLC) Sections 7850 et seq.); Cal/OSHA PSM Standard (8 CCR Section 5189).*

The statute is intended to ensure that workers in petroleum refineries, chemical plants, and other related facilities are thoroughly trained and that adequate process safety management (PSM) practices are implemented (CLC Section 7851). Under the statute, "process safety management" means the application of management programs, which are not limited to engineering guidelines, when dealing with the risks associated with handling or working near hazardous chemicals. PSM is intended to prevent or minimize the consequences of catastrophic releases of acutely hazardous, flammable, or explosive chemicals (CLC Section 7853).

Cal/OSHA's PSM regulations contain requirements for preventing or minimizing the consequences of catastrophic releases of toxic or flammable chemicals. PSM regulations are intended to eliminate to a substantial degree, the risks to which employees are exposed in petroleum refineries, chemical plants, and other facilities (8 CCR Section 5189(a)). The regulations apply to a process that involves a chemical at or above the specified threshold quantities listed in Appendix A to Section 5189 or a process that involves a flammable[4] liquid or gas (8 CCR Section 5189(b)(1)) (Cal/OSHA, 1984).

4.13.2.3.1.2.3.2 *Injury and Illness Prevention Program*

Employers in California are required to have an effective written Injury and Illness Prevention Program (IIPP) (CLC Section 6401.7; 8 CCR Section 3203) to identify workplace hazards and communicate them to its employees through a formal employee training program. There are eight required elements for an IIPP:

1. Responsibility

[4] "Flammable" is defined as liquids or gases, as defined in Section 5194(c), that are on-site (in one location) in quantities of 10,000 pounds or more.

2. Compliance
3. Communication
4. Hazard assessment
5. Accident/exposure investigation
6. Hazard correction
7. Training and instruction
8. Recordkeeping

Employers are required to correct unsafe and unhealthy conditions and work practices in a timely manner, based on the severity of the hazard (CLC Section 6401.7(b)). Cal/OSHA has issued a guidance document entitled Guide to Developing Your Workplace Injury and Illness Prevention Program (DIR, 2005).

4.13.2.3.1.2.4 *DTSC Regulation of Hazardous Wastes*

The DTSC has adopted extensive regulations governing the generation, transportation, treatment, storage, and disposal of hazardous wastes in California (22 CCR Division 4.5). The program includes permitting requirements and corrective action for solid waste management units, including historical disposal sites within the Facility boundary. The primary purpose of these regulations is to prevent hazards to human health and the environment from mismanagement of hazardous wastes. Like RCRA (see above), the state regulations establish a cradle-to-grave system for management of hazardous waste. However, the state regulations are broader and more stringent than the corresponding federal regulations in many significant respects, including the regulation of refining wastes that are not regulated under the federal program.

4.13.2.3.1.3 *Local*

4.13.2.3.1.3.1 *City of Richmond Industrial Safety Ordinance*

The City of Richmond has an Industrial Safety Ordinance (RISO) that supplements the CalARP requirements described above by requiring additional measures to prevent and reduce the probability of accidental releases of regulated substances from industrial facilities. The RISO mirrors the Contra Costa County Industrial Safety Ordinance (County Ordinance Chapter 450-8).

Two facilities are currently subject to the RISO: the Chevron Richmond Refinery and Chemtrade (formerly General Chemical West: Richmond Works) (CCHS, 2012b).

The RISO imposes requirements designed to improve industrial safety, by requiring reviews, inspections, and audits that supplement existing federal and state requirements, as well as imposing additional safety measures to protect

public health and safety from accidental releases. The CCHS enforces the RISO on behalf of the City of Richmond. The County ISO does not apply to the Facility because it is located within the incorporated City of Richmond.

The RISO codifies and expands the federal and state hazardous material and worker safety standards at a local level by:

- Requiring the conduct of process hazard analyses for covered processes handling hazardous materials not covered by the federal or state accidental release prevention programs.
- Requiring the review of action items resulting from process hazard analyses and requiring completion of those action items selected by the stationary source for implementation, within a reasonable time frame (within 1 year, or if the change requires a turnaround, during the next turnaround).
- Requiring the review of accidental release prevention efforts of stationary sources and providing for the conduct of investigations and analyses for the determination of the root cause for certain incidents.
- Providing review, inspection, auditing and safety requirements that are more stringent than those required in existing laws and regulations.
- Providing for public input into the safety plan and safety program and public review of any inspection and audit results.
- Facilitating cooperation between industry, the City of Richmond, the County of Contra Costa, and the public in the prevention and reduction of incidents at stationary sources.
- Expanding the application of certain provisions of the federal and state accidental release prevention programs to processes not covered by the federal or state accidental release prevention programs.
- Requiring the development and implementation of a written human factors program.
- Consider inherently safer systems for new and existing facilities or processes and mitigation items from a Process Hazard Analysis.
- Preventing and reducing the number, frequency, and severity of accidental releases in the City.

The City Council adopted amendments to the RISO on February 5, 2013 (Ordinance No. 1-13). The amendments included the following:

- Revised the human factors program to address maintenance safe work practices and maintenance procedures for specialized equipment, piping, and instructions by June 30, 2011.
- Required the conduct of a management of organizational change for changes in permanent staffing levels and reorganizations in maintenance, health, and safety.
- Added a requirement for completion of a security vulnerability assessment by June 30, 2007 and at least once every 5 years thereafter.
- Added a requirement for completion of a safety culture assessment within 1 year after development of guidance and at least once every 5 years thereafter.

The RISO requires review of accidental release prevention efforts of stationary sources and provides for the conduct of investigations and analyses for the determination of root cause for certain incidents. The RISO mandates incident investigation and root cause analysis by the stationary source, utilizing a specified methodology or methodology approved by the County, for all major chemical accidents or releases and provides for the establishment of a public outreach and information program. Other elements of the RISO address refinery safety training and skills testing, testing of on-site contract workers, drug and alcohol testing, and reporting of contractor safety records.

Consistent with the direction of the U.S. Chemical Safety Board (CSB) recommendations, the City and County are considering amendments to their respective ISOs. The amendments being considered are discussed below in *Section 4.13.2.3.2.3.2.1.*

4.13.2.3.1.3.2 *Certified Unified Program Agency*

As the City's CUPA, CCHSHMP has enforcement authority for the following programs:

- Administrative Enforcement Order, California Health and Safety Code, Chapter 6.11, Section 25404.1.1
- Hazardous Waste and Tiered Permitting, HSC, Chapter 6.5, Section 25180
- Aboveground Petroleum Storage Act, HSC, Chapter 6.67, Section 2570.12
- Underground Storage Tanks, HSC, Chapter 6.7, Section 25299

- Hazardous Materials Release and Response Plans / Hazardous Materials Business Plans, HSC, Chapter 6.95, Section 25514
- Accidental Release Prevention (CalARP), HSC, Chapter 6.95, Section 25540

4.13.2.3.1.3.3 *Richmond Building Regulations Administrative Code / Administration of California Building Code*

Under the City of Richmond's Building Regulations Administrative Code (Building Code), a building permit is required to construct, enlarge, alter, repair, move, improve, remove, convert, or demolish a building, structure, or service equipment (RMC Section 6.02.150(a)). Building design and construction requirements of the Building Code relate to life safety and structural safety. The Building Code also includes the electrical, mechanical, and energy codes applicable to the Modernization Project. Building permit applications are reviewed by the building official, and may be reviewed by other departments to verify compliance with any applicable laws under their jurisdiction (RMC Section 6.02.170(a)).

As mandated by RMC Chapters 6.02 and 6.04, building permit applications are also reviewed for compliance with the California Building Code (CBC) (24 CCR Part 2). This includes codes, standards, and publications adopted as standard reference documents and enforced as part of the CBC (CBC, Sections 1.1.3, 1.1.5, and 1.8.6.1).

If the building official finds that the work described in an application and the plans, specifications, and other data filed with the application conforms to the requirements of RMC Chapter 6.02, including the CBC and associated standard reference documents, and that required building permit fees have been paid, the Building official must issue the requested building permit to the applicant (RMC Section 6.02.170(a)).

Chevron has entered into an Agreement for Building Permit Services with the City to increase efficiency with respect to the Facility's ongoing activities that require building or grading permits, to allow the City to collect compensation for its expenses providing building permit services to Chevron, and to enhance the City's efficiency in managing its day-to-day affairs with respect to providing these Building Permit Services. Building Permit Services provided by the City include all activities relating to reviewing, analyzing, preparing, issuing, extending and closing building and grading permits, and conducting all inspections related to building permits. Under the terms of the Building Permit Services agreement, Chevron funds and the Building Planning Commission provides a full-time (6.5 to 7 hours per day, 5 days per week) City Industrial

Inspector, a full-time Plan Check Engineer, and a part-time (approximately 20 hours per week) Permit Technician.

4.13.2.3.1.3.4 *City of Richmond Administration of California Fire Code*

The Richmond Fire Department administers the California Fire Code (CFC) permit requirements (24 CCR Part 9). National Fire Protection Association (NFPA) standards are published in the CFC. The fire code contains general provisions for fire safety, including but not restricted to: (1) required road and building access; (2) water supplies; (3) installation of fire protection and life safety systems; (4) fire-resistive construction; (5) general fire safety precautions; (6) storage of combustible materials; (7) exits and emergency escapes; and (8) fire alarm systems. The CFC reflects the body of legal requirements published in 24 CCR Part 9 and Health and Safety Code Section 18901 et seq. pertaining to the CFC. In addition, the CFC contains standards of ASTM International and the NFPA. It is updated annually as a supplement and published every third year by the International Fire Code Institute to include all approved code changes in a new edition. The City of Richmond enforces the CFC within the City's boundaries. The Richmond Fire Department also contracts with a third-party contractor located at the Chevron Facility for fire permit plan review and some inspection services.

A fire permit is required under specified conditions to: (1) maintain, store, or handle hazardous materials; (2) conduct processes that produce conditions hazardous to life or property; (3) install equipment utilized in connection with such activities; (4) install or modify any fire protection system or equipment; or (5) engage in other construction, equipment installation, or modification activities where a fire permit is required (CFC Sections 105.3, 105.6, 105.7).

The CFC requires both construction permits as well as annual operating permits for designated activities. Construction permits allow an applicant to install or modify systems and equipment that require a permit under CFC Section 105.7. Operational permits allow an applicant to conduct an operation or business that requires a permit under CFC Section 105.6 (CFC Section 105.1.2).

Fire permit applications are reviewed for conformance with the CFC (and reference standards cited in the CFC), including Chapter 50 (Hazardous Materials), and Chapter 57 (Flammable and Combustible Liquids). If the Fire Code Official (Richmond Fire Marshal) is satisfied that the proposed work or operation conforms to the requirements of the CFC (including codes and standards listed in CFC Chapter 80 that are considered part of the CFC requirements), and laws and ordinances applicable thereto, the Fire Code Official is required to issue a permit as soon as practicable (CFC Sections 1.1.5, 102.7, 105.2.4).

Chevron has entered into a Fire Prevention Services agreement with the City to increase efficiency with respect to the Facility's ongoing operations and activities that require fire prevention services, and to enhance the City's efficiency in managing its day-to-day affairs with respect to providing such fire prevention services. Under the terms of the Fire Prevention Services agreement, Chevron funds and the City's Fire Prevention Services Division provides full-time service (9 hours per day, 4 days per week), and dedicated inspector coverage for the Facility. The inspector conducts regular inspections required by the fire operating permit and for fire construction permits (including the annual fire construction maintenance permit) in accordance with the CFC, coordinates issuance and audits of the fire operating permit, and conducts fire and life safety audits of the Facility, in addition to fulfilling specified documentation and record-keeping responsibilities, providing interpretations of the CFC, and plan checking for all fire construction permit applications and approving work under the annual fire construction maintenance permit.

4.13.2.3.1.4 *Richmond General Plan 2030*

Several goals, policies, and actions in the Richmond General Plan 2030 (General Plan 2030) (City of Richmond, 2012) relate to the Modernization Project's public safety-related impacts. Consistency with the General Plan 2030, including General Plan 2030 elements relevant to this section, is addressed in *Section 4.10, Land Use, Plans, and Policies* and *Appendix 4.10*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.13.2.3.2 *Emerging Developments*

Numerous regulatory and industry initiatives have been undertaken to enhance protection of public and worker safety and health associated with refinery operations, including specific initiatives commenced in the wake of the Facility's August 6, 2012 fire. Many of the investigations conducted by the various federal, state, and local agencies following the August 2012 fire made specific recommendations for legal and regulatory changes, Facility safety program changes, and modifications to industry standards. These are discussed below.

4.13.2.3.2.1 *Chemical Safety Board*

The CSB has identified weaknesses in both federal and California safety regulatory regimes and is evaluating whether a regulatory regime similar to the European safety case framework would be more effective at ensuring safety at high hazard facilities such as petroleum refineries (Holmstrom, 2013). CSB issued a report in January 2014 (*Regulatory Report: Chevron Richmond Refinery Pipe Rupture and Fire*) elaborating on the safety case regulatory regime. The CSB

Board has not approved the report, and has directed further investigation on the safety case framework.

In its April 2013 report, the CSB emphasized the importance of having an independent, competent, and well-funded regulator, which presents ongoing challenges to United States and California regulators due, in part, to resource constraints.

CSB also made numerous other specific recommendations for legislative and regulatory changes to better improve safety at refineries and other high-hazard facilities. These recommendations include: (1) revising Cal/OSHA process safety management regulations to strengthen process hazard analysis and mechanical integrity requirements, including incorporation of damage mechanism reviews and inherently safety systems; (2) requiring the reporting of leading and lagging process safety indicators; (3) establishing a multi-agency process safety regulatory program for all California oil refineries to improve public accountability, transparency, and performance of chemical accident prevention and mechanical integrity programs; (4) requiring that process hazard analyses include more substantiating documentation, as well as methods such as Layers of Protection Analysis (LOPA); and (5) requiring the documented use of inherently safer systems analysis (ISSAs) and the hierarchy of controls to the greatest extent feasible in establishing safeguards for identified process hazards, with the goal of driving the risk of major accidents to as low as reasonably practicable (ALARP), including requirements for ISSAs to be automatically triggered for all management of change and process hazard analysis reviews, prior to the construction of new process, process unit rebuilds, significant process repairs and in the development of corrective actions from incident investigation recommendations.

4.13.2.3.2.2 *California Interagency Working Group on Refinery Safety and Interagency Refinery Task Force*

In February 2014, an Interagency Working Group on Refinery Safety established by Governor Brown, and composed of 13 agencies and departments and the Governor's office, released a report, "Improving Public and Worker Safety at Oil Refineries" outlining findings and making recommendations to improve public and worker safety at and near the state's oil refineries (Cal/EPA, 2014). According to the report, the goal of the Working Group is to evaluate methods for improving public and worker safety by enhancing oversight at refineries and emergency preparedness at various levels. The Working Group has met internally and with stakeholders in industry, the labor force, community members, local emergency response personnel, environmental and academic representatives, and others. The report made conclusions regarding four key areas of concern: (1) oversight and coordination; (2) emergency response and preparedness;

(3) safety and prevention of hazardous events; and (4) community education and alerts. The Working Group's recommendations specifically relating to regulatory changes include:

- Strengthen existing regulations and practices to ensure that more data and information are provided to agencies, workers, and the public.
- Enhance agency enforcement capabilities.
- Improve refinery safety procedures by requiring six prevention strategies, directing refineries to:
    1. Implement inherently safer systems to the greatest extent feasible.
    2. Perform periodic safety culture assessments.
    3. Adequately incorporate damage mechanism hazard reviews into process hazard analyses.
    4. Complete root cause analyses after significant accidents or releases.
    5. Explicitly account for human factors and organizational changes.
    6. Use structured methods such as LOPA to ensure adequate safeguards in process hazard analysis.

In addition, the Working Group identified three areas for further study, including: (1) reporting of leading and lagging indicators; (2) increasing worker and community involvement; and (3) exploring the safety case approach.

Action on several Working Group recommendations is underway, including preparations to finalize the fee structure to be charged to support an additional 15 Cal/OSHA inspector positions, as well as additional ancillary personnel, funded in the current state budget to review refinery operations and other chemical plants under the PSM program.

4.13.2.3.2.3 *State Legislative and Regulatory Initiatives*

There are several emerging legislative and regulatory initiatives intended to address some of the outstanding gaps in safety requirements. These are detailed below.

4.13.2.3.2.3.1 *California Legislation (Proposed)*

Senate Bill (SB) 1300 (Hancock) would require refineries to report annually their schedule for turnarounds, and to provide Cal/OSHA with information regarding safety and infrastructure upon request. Currently, the Bay Area Air Quality Management District (BAAQMD) receives turnaround schedules, but not

Cal/OSHA. The bill cites the August 6, 2012 fire and the Governor's Interagency Working Group as bases for the bill, in addition to data indicating that most refinery incidents occur during turnarounds. This bill is currently under submission in the Assembly Appropriations Committee.

SB 483 (Jackson) proposed technical corrections and clarifications to the existing hazardous materials business plan law. The bill passed in both houses, and was approved by the Governor and chaptered by the Secretary of State on September 28, 2013.

SB 1300 (Hancock), introduced on February 21, 2014, proposes requirements that refineries annually report a full schedule of planned turnarounds. The bill also proposes to authorize the Department of Industrial Relations to fix and collect reasonable fees to cover consultation, inspection, adoption of standards, and participation in interagency efforts to improve refinery safety, and other duties.

4.13.2.3.2.3.2 *Local Regulatory Initiatives*

4.13.2.3.2.3.2.1 *City of Richmond Industrial Safety Ordinance*

The City of Richmond amended the RISO in February 2013 to require an expansion of human factors programs, expanded management of organizational change reviews, security vulnerability analyses, and safety culture assessments. The April 2013 Interim Investigation Report on the Chevron Richmond Refinery Fire by the CSB further recommended revisions to the RISO to require:

- More thorough documentation of PHA methodologies, rationale, and conclusions, and to use established qualitative, quantitative, and/or semi-quantitative methods such as the LOPA recognized under the federal Occupational Safety and Health Act.
- Documented use of ISSAs and the hierarchy of controls to the greatest extent feasible in establishing safeguards for identified process hazards, with the goal of reducing the risk of major accidents to ALARP.
- That ISSA is automatically triggered for all management of change and PHA reviews, prior to the construction of new processes, process unit rebuilds, significant process repairs, and in the development of corrective actions from incident investigation recommendations.

On May 7, 2013, Richmond City Council unanimously adopted a resolution directing the City Manager and City Attorney to take steps to implement all of the recommendations of the CSB, as listed above. Consistent with the direction of the City Council, the City is considering amendments to the RISO. While still

pending, the proposed amendments to the RISO currently being considered would require the reporting of process safety indicators to CCHS, incorporation of inherently safer systems analysis into the Facility's Management of Change procedures, completion of layers of protection analysis or equivalent studies to evaluate the effectiveness of existing safeguards and safeguards recommended in process hazard analyses, implementation of a more robust ISSA program, and funding of additional refinery safety experts to support the County. It is anticipated that the City will adopt the proposed amendments to the RISO in the summer of 2014.

The Draft EIR imposes several mitigation measures that incorporate elements of the proposed RISO amendments, and these mitigation measures would be required if the Project is approved. Irrespective of whether and when the RISO amendments were adopted. These mitigation measures are set forth in Section 4.13.4, and include:

- Mitigation Measures 4.13-4a and 7a require the incorporation of inherently safer systems analysis, layers of protection analyses, and damage mechanism reviews into process hazard analyses;
- Mitigation Measures 4.13-4b requires the incorporation of inherently safer systems analyses, layers of protection analyses, and damage mechanism reviews into updated Risk Management Plans and Site Safety Plans.
- Mitigation Measure 4.13-7b requires Chevron to complete an inherently safer systems analysis (as defined in the RISO), including damage mechanism reviews and layers of protection analyses (LOPAs), with written LOPA reports submitted to the County for review, for new and modified equipment as part of the process hazard analyses revalidations.
- Mitigation Measure 4.13-7c requires Chevron to incorporate damage mechanism review, and layers of protection analyses into its management of change, process hazard analysis, and other programs and procedures.
- Mitigation Measure 4.13-7d and 13 b require Chevron to fund the costs of a third-party qualified expert to assist CCHS and the City in the review of process hazard analyses, inherently safer systems analyses, and LOPAs, and to provide the expert with access to documentation and facilities as needed to complete these reviews. (This funding obligation terminates if and when RISO amendments are adopted requiring similar funding.)
- Mitigation Measure 4.13-13c requires Chevron to fund, upon request by the County or City, the costs of a qualified third-party expert in refinery safety to perform safety or compliance audits that would be provided to the County or City for review.

Additional state and local legislative and regulatory proposals likely will be introduced and adopted to address final recommendations of the CSB and the Interagency Working Group on Refinery Safety.

4.13.2.3.2.3.3 *Industry Standards*

As described in *Appendix 4.13-DET, Section 1.1.1.4.1*, petroleum refinery industry associations such as the American Petroleum Institute (API) also maintain various recommended safety practices for refinery operations. Industry association recommended practices are always being evaluated and updated, and revisions currently being considered include specifications for pipes and vessels coming into contact with crude and gas oils containing higher levels of sulfur, including for example more robust inspection methods and replacement of low-silicon carbon steel pipe.

For example, APIs subcommittee on Corrosion and Materials' Task Group on API 939-C (Guidelines for Avoiding Sulfidation (Sulfidic) Corrosion Failures in Oil Refineries) is considering a new appendix to Recommended Practice 939-C regarding sulfidation corrosion to provide a list of considerations for inspection of sulfidation that could be used by inspectors, as well as an appendix summarizing typical refining process units and the types of sulfidation that could be expected on them and how one might best inspect for that type of corrosion.

As another example of a new API document, API RP 584 is a draft API Recommended Practice (RP) pending publication that outlines the essential elements in defining, monitoring, and maintaining integrity operating windows as a vital component of inspection planning, including risk-based inspection planning (API, 2011b). The new API RP 584 is intended to address the issue that, however well founded and well managed, inspection and mechanical integrity systems alone cannot maintain the integrity of pressure equipment.

4.13.2.4 Existing Conditions

Refining oil into end-products involves intense industrial processes utilizing flammable hydrocarbons and other regulated chemicals. The industrial process involved in producing fuel products also results in wear and tear on the equipment used in those processes. Many of these processes operate at high temperatures and/or pressures and involve the use or processing of hazardous substances that may cause corrosion or other damage to the equipment and associated piping. In addition, the Facility generates hazardous wastes that are subject to regulations covering the safe storage and disposal of these wastes.

If not properly managed and maintained, the mechanical integrity of the process equipment can be compromised. While the use, storage, and transport of hazardous substances, as well as the maintenance of process equipment is strictly regulated under federal, state, and local regulations, there remains a risk to the public from use of these hazardous materials.

This section has been updated to reflect the Facility's safety programs in place as of the date of publication of this EIR, as well as those safety program elements currently under review or development. These updates include both Facility safety program changes that have been implemented since the 2008 EIR that are unrelated to the August 6, 2012 fire, and changes that are being implemented as a result of "lessons learned" from the August 6, 2012 fire incident that occurred at the Facility's crude unit.

4.13.2.4.1 *Facility Safety Management Systems*

The Facility stores and processes materials classified as acutely toxic and flammable, which could pose hazards during loss of containment or other accidental release conditions. Historically, the petroleum industry has addressed concerns about potential accidents by developing and implementing design standards intended to minimize either the likelihood of these events or their consequences. In recent years federal, state, and local regulations have taken an increasingly active role in requiring facilities to assess and document these risks as well as take further action to reduce them. There is significant overlap in the procedural and substantive requirements of the federal, state, and local regulations concerning hazardous materials and worker safety, described further in *Section 4.13.2.3*, above. The Facility implements numerous safety programs to satisfy these regulatory requirements on a facility-level consistent with Chevron Corporate Policy 530 – "Protecting People and the Environment," and utilizing Chevron's Operational Excellence Management System and numerous Refinery Instructions. For purposes of this EIR the Facility's various safety policies, programs, procedures, and instructions are referred to collectively as the Facility's Safety Program. This section outlines the Facility's implementation of the various federal, state, and local standards as a part of its Safety Program.

4.13.2.4.1.1 *Risk Management Plan*

The 1990 Clean Air Act Amendments require that facilities utilizing EHSs in excess of specified threshold quantities prepare a RMP. The Facility has an RMP consisting of three main components: (1) hazard assessment of Refinery Operations covered by this regulation; (2) a discussion of the Facility's Release Prevention Program (OSHA PSM Program, as described below); and (3) the Facility's Emergency Response Plan (ERP). The CalARP Program was finalized in

1997 as California's version of the RMP and contains the same main elements as described above. The RMP is updated when there are changes that would affect the use or storage of EHS. The most recent RMP was prepared for the Facility and submitted to the County in October 2011, with an update concerning the August 6, 2012 fire submitted to the County in February 2013. A revised RMP for the hydrogen plant, and possibly for the Facility, would be required to be submitted to the County 30 days following start-up of the new facilities. In addition, the Hazardous Materials Business Plan (discussed in *Section 4.13.2.3.1.2.2* above (HSC Sections 25500−25520; 19 CCR Sections 2729−2732) would have to be updated.

The 2013 RMP shows that the following EHSs are generated or used at the Facility, and the potential for accidental release of these substances to the environment is evaluated in the RMP:

- H_2S.
- Anhydrous NH_3.
- Flammable substances (e.g., hydrocarbons and hydrogen).
- Sulfuric acid mixed with hydrocarbons.

The RMP assesses the off-site consequences of such releases and describes the safety and emergency response programs and plans that are used by Chevron to ensure safe operation of the Facility.

After the installation of Modernization Project components at the Facility is complete, a revised RMP—or new RMP for the hydrogen plant—must be carried out to satisfy the CalARP Program. The RMP requires that a detailed PHA of the changed components be conducted. The RMP also requires a revised "off-site consequence" analysis of worst-case scenarios and alternative scenarios (EPA, 2009).[5] The new RMP must also include a revised accident prevention and training program as well as pre-startup safety reviews (PSSRs) and safety requirements for contractors conducting hot work activities.

[5] Off-site consequence analyses provide the federal, state, and local governments, as well as the public, with information about the potential consequences that could result from a chemical release at a facility. Off-site consequence analyses consist of both a worst-case release scenario and alternative release scenarios. A worst-case scenario is defined by the EPA as "the release of the largest quantity of a regulated substance from a single vessel or process line failure that results in the greatest distance to an endpoint" or, alternatively, "the distance a toxic vapor cloud, heat from a fire, or blast waves from an explosion will travel before dissipating to the point that serious injuries from short-term exposure will no longer occur" (EPA, 2009).

4.13.2.4.1.2 *Process Safety Management*

The statutory basis and general purpose of Cal/OSHA requirements (the state has delegated authority from OSHA [29 U.S.C. Section 667]) are discussed above. The requirements of the PSM rules are directed primarily at protecting workers within the facility, and particularly in the context of preventing and mitigating the consequences of accidental releases of hazardous substances used in a process.[6] Given that workers are the first to be exposed to a hazard, though, standards that minimize risks to workers often serve to indirectly minimize risks to the public as well. The PSM standard applies to facilities with processes involving any of more than 130 listed hazardous chemicals at or above specified threshold quantities, including four chemicals that are present at the Facility at or above the PSM threshold quantities (Chevron Data Transmittal #87, 2014). The PSM standard establishes a comprehensive management program integrating technologies, procedures, and management practices. The PSM standard consists of provisions addressing process safety information, process hazard analysis, operating procedures, training, contractors, PSSRs, mechanical integrity, hot work permits, management of change, incident investigations, emergency planning and response, and employee participation. Details regarding the Facility's process safety management program with reference to elements that also satisfy CalARP Program requirements are included in *Appendix 4.13-DET*.

4.13.2.4.2 *Emergency Preparedness and Response Program*

The Facility maintains an emergency response program designed to protect workers and public safety as well as the environment. The description below of Chevron's emergency response program features is based on information provided to the City by the Facility. As part of the emergency response program:

- There is a written emergency response procedure for responding to accidental chemical releases, including releases of regulated substances. These are reviewed annually to ensure that they remain accurate and current (Chevron Data Transmittal #87, 2014). Employees receive training in these procedures as necessary to perform their specific emergency response duties.

[6] A "process" is defined as: "any activity involving a highly hazardous chemical including any use, storage, manufacturing, handling, or the on-site movement of such chemicals, or combination of these activities. For purposes of this definition, any group of vessels which are interconnected and separate vessels which are located such that a highly hazardous chemical could be involved in a potential release shall be considered a single process" (29 CFR Section 1910.119(b)).

- There are procedures that address maintenance, inspection, and testing of emergency response equipment.
- The Facility has the Chevron Fire Department, which consists of emergency response teams trained and equipped to respond to fires, rescues, hazardous material releases, and other emergencies that could occur at the Facility. The Facility works closely with local emergency responders (primarily the Richmond Fire Department) in preparing for emergencies.
- There are procedures for notifying the public and local emergency response agencies about accidental releases.

The Facility emergency preparedness and response program is discussed in more detail in the following subsections.

4.13.2.4.2.1 *Emergency Response Plan*

Chevron reports that it's ERP addresses all aspects of emergency response, including proper first-aid and medical treatment for exposures, evacuation plans and accounting for personnel after an evacuation, notification of local emergency response agencies and the public if a release does occur, and post-incident cleanup and decontamination requirements. The ERP is documented in a series of Refinery Instructions (RIs) and the Operational Excellence Emergency Management process, available to all employees. Hard copies of the ERP, included in Manuals of Emergency Plans and Procedures, are also maintained throughout the Facility.

The ERP is required to be reviewed annually by the Manager of Emergency Services or his/her designee and updated to ensure that it remains accurate and current. Every employee must receive training in the emergency response procedures as necessary to perform their specific emergency response duties. The level of emergency response training corresponds to the emergency response duties of the employee. Refresher training is provided annually or as required by management or trainers for thoroughness and accuracy.

The ERP includes the chemical-specific emergency response procedures for releases of RMP- and CalARP-regulated chemicals. The chemical-specific ERPs identify the characteristics of the chemical, emergency response and first aid procedures, and the community notification system. These plans also identify concentrations of chemicals that would trigger specific types of emergency response and when to notify the public.

In addition to the ERP, the Facility states that it also has local Emergency Action Plans (EAPs), which are posted in all buildings and operating area control rooms.

All employees or contractors entering a process area must review the EAP for that area prior to entry. The EAP summarizes the first actions that are to be taken in the event of an emergency (e.g., stay clear of area, call emergency number, move indoors, etc.) and the means for reporting fires and emergencies (a single three digit phone number). The EAP also has guidelines for sheltering-in-place, evacuations, and earthquakes, as well as maps with evacuation routes and meeting places.

Emergency Operating Procedures, which are a part of the CalARP Program, are another critical component of emergency preparedness. These procedures outline the steps to be taken to control or shut down a process unit in the event of an emergency situation (e.g., fire, earthquake, release, etc.). Operators for the process must be trained in these procedures.

Chevron also has various mitigation safeguards in place intended to minimize the impact of chemical or toxic releases. Examples include H_2S scrubbers, emergency deluge systems, and administrative controls to manage NH_3 and liquefied petroleum gas (LPG) inventory, as described further below.

4.13.2.4.2.2 *Chevron Fire Department*

The Facility has a dedicated Chevron Fire Department, which is comprised of both full-time employees and trained employee volunteers. The Chevron Fire Department responsibilities include inspections of fire-related equipment, permit authorization for hot work and confined space entry, security, and a variety of other tasks related to fire prevention and emergency response. Other members of the Chevron Fire Department are volunteers consisting of employees from the Operations, Maintenance, and Technical Divisions. Each volunteer member receives approximately 100 hours of training each year. The Chevron Fire Department is managed by the Manager of Emergency Services or his/her designee, whose responsibility is to ensure that the ERP is implemented and followed in the preparation for and response to plant emergencies.

Unlike other refineries in the area that have separate teams to deal with different types of emergencies, the Chevron Fire Department trains its personnel to handle any emergency that might occur. These emergencies involve all aspects of fire-fighting, including fires in process plants, building fires, storage tank fires, wild land fires, or fires related to transportation modes, including ships, barges, tank cars, and rail cars. Chevron Fire Department personnel are trained in confined space, high angle, and heavy rescue procedures. In addition, all of the full-time members are certified Hazardous Material Technicians, and are qualified to deal with any hazardous material incident including any oil spills at the ship and barge loading facilities. In addition to the hazardous materials

certifications, eight fire department personnel are trained to the specialist level, and all fire brigade volunteers are trained to the industrial technical level. The Chevron Fire Department also responds to medical emergencies; many members are California State-Certified Emergency Medical Technicians. Additionally, the Chevron Fire Department authorizes permits for hot work and confined space entry, oversees security, and conducts a variety of other tasks related to fire prevention and emergency response.

A variety of emergency response equipment exists at the Facility and includes 25 emergency response vehicles (including fire trucks), an emergency response vessel watercraft, 2,500 fire extinguishers, water deluge systems, in-plant stationary fire monitors, fixed foam systems, and a water fog system. The LPG storage vessels and anhydrous NH_3 storage vessels are equipped with firewater deluge systems, which have the ability to cool the vessels and disperse vapor clouds to prevent failure in case of a fire (RTKNet, 2013). All of this equipment is required to be maintained, inspected, and tested as outlined in the Chevron Fire Department's Procedures and Policies, or as defined in the area operating procedure for the in-plant fixed fire equipment.

Additionally, all contractors and employees who are not emergency responders are trained in the Facility EAPs. The EAPs instruct persons who are indoors or near a building to shelter-in-place inside a designated shelter-in-place building; individuals who are not in or near a designated shelter-in-place building are instructed to proceed via a safe route to a designated assembly site. Designated assembly sites for both local area emergencies and for a Facilitywide emergency are located throughout the Facility and surrounding area. The names of the persons present are reported to the Plant Protection Dispatcher by the senior Facility employee at each building or assembly site.

4.13.2.4.2.2.1 *Transportation*

Chevron has a spill prevention program, should a spill of a hazardous material occur to land or water. Its spill prevention programs, including its SPCC Plan, its Hazardous Materials Business Plan, and its Facility Response Plan are captured in several Refinery Instructions. In particular:

- RI – 400: Emergency Plans and Procedures (Chevron, 2013f)
- RI – 410: Marine Oil Spill Emergency Response (Chevron, 2012b)
- RI – 434: Agency and Internal Communications, Notifications, and Reporting (Chevron, 2012d)

In order to ensure the effective use of these plans in the event of an accidental release, Chevron reports that an ongoing training and drills program is carried

out at the Facility including the Long Wharf. In addition to maintaining familiarity with all aspects of the Spill Preparedness and Emergency Response Program (SPERP), the training and drills program is intended to provide members of the Oil Spill Response Team with the basic knowledge, skills, and practical experience necessary to achieve safe and effective spill response operations in accordance with the SPERP.

An OSHA rule, Hazardous Waste Operations and Emergency Response (HAZWOPER), sets minimum training and/or competency requirements for people involved in responding to an oil spill emergency. Chevron reports it has established minimum training requirements for the 16 positions in the Oil Spill Response Organization; from Incident Commander down through the various levels of the command system.

On-site equipment training boom deployment boat operators and deck hands are typically drawn from a personnel pool of terminal operators from the Long Wharf and Transfer and Blending, Plant Protection, the Fire Brigade, and contractors. These boat operators and deck hands are trained to a minimum of HAZWOPER Operations Level, and their training is refreshed annually. As part of their routine job at the dock, terminal personnel are trained in boat operation, safety, and boom deployment. Other personnel are trained during routine boom deployment exercises.

Drills serve to evaluate the emergency response component of the SPERP by testing under simulated conditions. All elements of the SPERP are tested during drills over a 3-year period. The following summarize the individual drill and exercise elements:

- A quarterly drill of the notification procedures for facility personnel, the Qualified Individuals, the response contractors and the oil spill management team.
- An annual unannounced drill (either emergency procedures or spill management team).
- A semi-annual drill to test the deployment of facility equipment. An unannounced emergency procedures drill requiring equipment deployment may be credited toward one of the semi-annual drills.
- An annual tabletop drill of the Spill Management Team.
- Triennially, a Reasonable Worst-Case Discharge size drill utilizing all appropriate resources.

The drills may be designed to exercise either individual components of the plan or the entire response plan. Such drills, individually or in combination, shall ensure that the entire plan is exercised at least once every 3 years.

Chevron has adopted the National Preparedness for Response Exercise Program (PREP) guidelines and guidance from the Department of Fish and Game Office of Oil Spill Prevention and Response, which have been incorporated into the drill program described above. The PREP drill year corresponds to the calendar year. Exercises conducted in a year may be credited toward meeting the objectives necessary to exercise the entire response plan in a triennial cycle. Each annual exercise must be conducted within a 12-month period. Chevron assumes responsibility for ensuring that the exercise objectives were met according to the PREP guidelines, and self-certifies each exercise for respective credit due.

In addition to the training and drills described above, following the use of these spill response and management programs (in the event of an accidental release) the refinery conducts a "lookback." These lookbacks are a critical review of how the response actually occurred as compared to what was expected in the plan. Areas for improvement are identified and updates are made as needed to the various spill prevention and response plans.

4.13.2.4.2.3 *Coordination*

As part of the emergency response program, the Facility works with local emergency responders in preparing for and responding to emergencies. The Facility conducts emergency drills in which an off-site responding agency (Richmond Fire Department and/or CCHS), the Chevron Fire Department, and non-responding employees work together to resolve the given scenario. This pre-planning activity is intended to ensure that the members of the responding agencies are familiar with the Facility, the hazards of the regulated substances, the resources available at the Facility, and the locations of these resources. It also clearly identifies the capabilities and limitations of each responding agency. These drills are conducted at least once a year (Chevron, 2013b).

The Facility also works closely with the CCHS for any necessary response to hazardous material releases (such as downwind air monitoring) and to alert the public in case of accidental releases, fires, or explosions in accordance with CCHS's Emergency Response Area Plan. Likewise, the Chevron Fire Department supports the Contra Costa County Hazardous Materials Area Plan with equipment and trained personnel. The Facility worked with CCHS, the Contra Costa Sheriff's Department, Contra Costa Community Awareness Emergency Response, and other industries to develop and establish the Community Warning System (CWS) and the Telephone Emergency Notification System (TENS) zones, which provide

incident notification to the community. The Chevron Fire Department also worked with the City to develop the Richmond expanded CWS.

The Chevron Fire Department also provides mutual aid to the City of Richmond Fire Department and responds outside of the Project site within the City of Richmond whenever asked to do so by the Richmond Fire Department. The Chevron Fire Department also belongs to an industrial mutual aid organization, Petrochemical Mutual Aid Organization, and has responded to other oil companies and chemical plants during emergencies. Likewise, the emergency response resources of the other companies in Petrochemical Mutual Aid Organization are available for an emergency at the Facility if needed.

4.13.2.4.2.4 *Facility On-Site Notification*

The Facility's emergency response program has plans and procedures in place for notifying employees and on-site emergency responders. Upon the first detection of a release or other emergency situation, workers are trained to call the central emergency phone number, which initiates the emergency response. Alarms or sirens, discussed in greater detail below, are used to notify workers of an emergency situation, and appropriate actions (e.g., shelter-in-place) would be taken according to the EAP.

Operators routinely carry in-plant two-way radios that are used for both normal and emergency communications. For internal personnel notifications during emergencies, each operating area of the Facility has a local alarm system for incidents within their operating units. For more widespread incidents, Chevron has a Facilitywide alarm system with multiple sirens and loudspeakers used to signify that an incident may have impacted one or more areas of the Facility. Additionally, a dedicated emergency intercom system (1-D Net) provides follow-up information during a large-scale Facility incident. The Facility radio system can broadcast a Facilitywide message to all radio-holders.

Training on the Facility EAP is provided to those employees who are not emergency responders and to contractors. This training instructs that persons who are inside, or near, a building should shelter-in-place inside the building. Persons who are not in, or near, a building are instructed to proceed via a safe route to a designated assembly site. There are designated assembly sites for both local area emergencies and for a Facilitywide emergency. The senior Facility employee at any building or assembly site is responsible for collecting names of the persons present and communicating them to the Chevron Fire Department Dispatcher.

4.13.2.4.2.5 *Injury and Illness Prevention Program*

The IIPP is a basic written workplace safety program. 8 CCR Section 3203 requires every employer to develop and implement an effective IIPP. An effective IIPP improves the safety and health in the workplace and reduces costs by good management and employee involvement. The eight required IIPP elements are:

- Responsibility
- Compliance
- Communication
- Hazard assessment
- Accident/exposure investigation
- Hazard correction
- Training and instruction
- Recordkeeping

To be effective an IIPP must:

- Involve employees, supervisors, and management.
- Identify the specific workplace hazards to which employees are exposed.
- Provide for correction of identified hazards in an appropriate and timely manner.
- Provide effective training.

The Facility implements its IIPP through RI-300 (Chevron, 2011d).

4.13.2.4.2.6 *Other Applicable Controls*

4.13.2.4.2.6.1 *Design Standards*

As an industrial facility handling hazardous chemicals, the Facility must be constructed and operated to certain codes and standards, which are enforced via administrative mechanisms such as internal audits, design reviews, and building inspections. Some of the main design standards include: the API Recommended Practice 750; Codes of Management Practices of the Chemical Manufacturers; American National Standards Institute (ANSI) B31.1: Power Piping; ANSI B13.3: Petroleum Refinery Piping; NFPA 30; and the 2013 CBC.

These design codes and industry standards undergo regular evaluation and upgrading to improve safety and reliability. Whenever new facilities are built, they must meet these improved design codes and industry standards. The new facilities benefit from the improvements in safety and reliability that result from meeting improved codes and standards.

Safety and reliability are incorporated into a project at the beginning phases and throughout the entire project. A process design is completed early in a project's design phases by a project team, comprised of process engineers, and frequently chemical, mechanical, electrical, and civil engineers. This new process design is compared to the existing process conditions. The changes in the process parameters are reviewed by metallurgical and corrosion subject matter experts. This review process determines material upgrades, corrosion control techniques, process changes, and monitoring programs. Tools to aid the subject matter experts in this review are government regulations, codes and industry standards, corporate and refining design standards, best practice guidelines, API standards, and streamlined reliability centered maintenance.

4.13.2.4.2.6.2 *Crude Acceptance Policy and Gas Oil Quality Control*

The Facility has a long standing crude acceptance procedure that evaluates potential crude blends. This evaluation looks at the ability to run particular crudes based on the Facility process configuration and whether the Facility can safely process the crude. The procedure has three main focus areas: selection, a management of change process; and a lookback analysis that evaluates whether the refinery operated consistent with the assumptions made when the crude was selected.

A crude acceptance tool is used at the Facility to screen potential new crudes based on the Facility configuration. The Area Operating Plan planner is responsible for the crude acceptance procedure process documented in the Area Operating Plan planner turnover document. This includes:

- Update and maintain the crude acceptance tool.
- Use the crude acceptance tool to screen potential new crudes.
- Identify potential issues and contact the subject matter expert (typically process engineering department), for further evaluation.
- Complete management of change for new crudes prior to discharge.
- Update crude acceptance status, management of change status and operating experience.
- Complete a lookback analysis after the crude run is complete.

If a crude oil passes an acceptance review and prior to that crude oil being processed a Facilitywide crude management of change is conducted. The management of change includes reviews by process engineers from each plant, operations personnel review, a metallurgy review (as needed) and a health, safety, environmental review. The management of change establishes targets for the new crude rate and percentage of total crude based on the crude acceptance

review and feedback from the management of change evaluation. The management of change process also reviews potential damage mechanisms that may be related to processing the new crude. This review would help set processing limits based on the new crude.

In addition, R1-703, "TKN/TKC/FCC/RLOP/DHT Gas Oil Quality Control" (Chevron, 2013i) gives an overview of gas oil feed hardware and quality control systems associated with the hydrocracker (Taylor Katalytic Denitrifier), fluid catalytic cracker, fluid catalytic cracker feed hydrotreater (FCC FHT), Richmond lube oil plant, and diesel hydrotreater. Included are procedures that will provide gas oil producers, purchasers, and consumers with a mechanism to ensure proper gas oil quality. The instruction assigns responsibility for:

- Quality control for import production, import deliveries, internally produced, transfer tanks, and lines.
- Monitoring of feed tanks and lines for quality control, level, and manifolding.
- Handling of off-test conditions of tanks and lines.

4.13.2.4.2.7 *Chemical-Specific Prevention Measures*

The prevention programs described in this section represent integrated, administrative controls intended to ensure the safety of workers, the public, and the environment. All covered processes have control systems designed to maintain operating parameters (temperature, pressure, flow, level) within allowable limits. The covered processes are also equipped with alarms to alert personnel when the operating parameters exceed allowable limits. The Facility uses procedures and trains personnel to ensure the correct response to any alarms.

The Facility has the following chemical-specific engineering controls to mitigate accidental releases:

4.13.2.4.2.7.1 *Liquefied Petroleum Gas*

LPG is a flammable hydrocarbon. The LPG storage area has been designed to minimize the risk of releasing LPG to the atmosphere by providing high equipment reliability, minimizing the number of connections, avoiding unnecessary equipment, and protecting against inadvertent damage or failure. Some of the specific prevention and mitigation safeguards are described below (Chevron, 2013b):

- The LPG storage spheres are located away from the Facility perimeter to minimize the effect on the public in the event of a release.

- Spheres are separated by a distance equal to at least the diameter of the larger sphere.
- Each sphere is equipped with a firewater deluge system to cool the vessel to prevent failure in the event of a fire.
- The LPG storage area is equipped with alarms, pressure relief devices, and emergency block valves to prevent or limit the severity of a release.
- Each sphere is equipped with a fusible link valve, which is a check valve that will automatically close during a fire and isolate the sphere from all other systems.
- The surrounding area is equipped with fixed fire monitors.
- The drainage near the spheres would cause released liquid to drain away from the spheres and the rest of the Facility and would minimize the surface area to reduce the amount of evaporation.

4.13.2.4.2.7.2 *Anhydrous Ammonia*

The NH_3 storage area has also been designed to minimize the risk of releasing NH_3. Some of the specific prevention and mitigation safeguards are described below:

- The NH_3 storage area is located away from the Facility perimeter so as to minimize the effect on the public in the event of a release.
- The NH_3 storage area is equipped with an NH_3 leak detection system with both audible and control room alarms.
- The NH_3 storage area is equipped with alarms, pressure relief devices, excess flow valves, and emergency block valves to prevent or limit the severity of a release.
- The NH_3 storage area is encircled by a firewater-monitor fog system. One large water fog spray can be remotely operated.
- The drainage in the storage area is such that a release of liquid drains away from the storage vessels and minimizes the surface area to reduce the amount of evaporation.

4.13.2.4.2.7.3 *Hydrogen Sulfide*

The processes containing H_2S are equipped with safety systems designed to prevent or minimize releases of H_2S. The safety systems in place are described below:

- Each sulfur recovery unit train is equipped with either a safety shutdown system or a shutdown interlock system designed to protect personnel and equipment and prevent the potential release of H_2S. Each of these systems shuts down key pieces of equipment automatically when certain operating parameters are outside of established operating limits.
- The sulfur recovery unit is equipped with an emergency quench water system, which can be operated automatically, to protect equipment in the sulfur recovery unit
- Each process that contains H_2S is equipped with alarms, pressure relief devices, and emergency block valves to prevent or limit the severity of a release.
- Each H_2S recovery plant can be routed to an emergency scrubber in the event of a sulfur recovery unit shutdown.
- Each process that contains H_2S is equipped with an H_2S area monitoring system that will detect ambient levels of H_2S and activate alarm systems. The alarm systems will indicate the location and concentration of H_2S leaks.
- The Facility has H_2S monitors located along the Facility perimeter to alert Facility personnel if H_2S is detected.

4.13.2.4.2.8 *Facility Off-Site Notification*

For hazardous material spills or releases with potential off-site impacts (or meeting other reporting criteria), CCHS, the Richmond Fire Department, and other agencies are to be notified immediately. Notifications to area hospitals are handled by the Richmond Fire Department, American Medical Response, or the County emergency medical services. If deemed necessary or appropriate by either Chevron or CCHS, either Chevron or CCHS would activate the Community Warning System (CWS) to alert the surrounding communities (Chevron, 2013b); this system is described in detail below.

4.13.2.4.2.8.1 *Community Warning System*

CCHS and CCHSHMP have established an integrated CWS and the TENS zones, a system that alerts the surrounding community to imminent threats to life and safety. The Facility worked closely with CCHS and the Contra Costa Sheriff's Departments to develop this system and was a major contributor to the CWS project. The CWS has four levels of alerts, which are described below:

- **CWS Level 0.** Easily contained release or incident and controlled by plant personnel and is informational only, on-site only with no off-site consequences and not detectable off-site.

- **CWS Level 1.** A release or incident on-site, possible off-site, but no health impact expected.
- **CWS Level 2.** These events may have adverse effects on sensitive populations downwind of the release. All CWS messages are posted on the CA Electronic Data Information System (EDIS), and may be posted on social media.
- **CWS Level 3** This warning level indicates that an incident is expected to impact the surrounding community, and residents and businesses downwind of the release are instructed to shelter-in-place via the TENS, the National Weather Service broadcasts a warning message over weather radios, the Emergency Alert System is activated, posts are made to social media sites including a public website dedicated to CWS notification postings, sirens are sounded, the media is notified, and emergency response personnel are notified over the CWS computer terminals. These methods of communication are described below.

The theoretical outdoor coverage of the sirens used as a part of the CWS is shown in Figure 4.13-1.

The Facility has several methods of internal and external communication and notification in the event of an emergency, including:

- **Sirens.** For external community notifications, four sirens located adjacent to the Facility can be sounded to provide a loud audible signal to residents and businesses in case of emergency. The sirens signal residents and nearby businesses to proceed indoors to shelter-in-place. Affected individuals can then obtain further instructions and information about the incident via TV or radio, the Community Warning System website, or social media. Sirens are re-sounded every 30 minutes while the emergency situation continues to affect the community.
- **Radios.** Operators communicate both routine and emergency information on in-plant two-way radios that they can carry with them around the Facility. This is not connected to the Community Warning System.
- **TENS.** The TENS system calls households and businesses (landlines), and devices registered with the Community Warning System and transmits short messages about the incident and recommended protective actions. Community members can register to receive voice messages, text messages, and/or email messages. Landlines can only receive voice messages.
- **NOAA Weather Radios.** Working with Community Awareness Emergency Response, the Facility has previously made National Oceanic and Atmospheric Administration (NOAA) weather radios capable of receiving

emergency alerts available to sensitive receptors like schools, hospitals, daycare and senior care facilities (Chevron Data Transmittal #87, 2014). The CWS staff has worked with the NWS to automatically send shelter-in-place messages to these radios when there is a CWS Level 3 event.

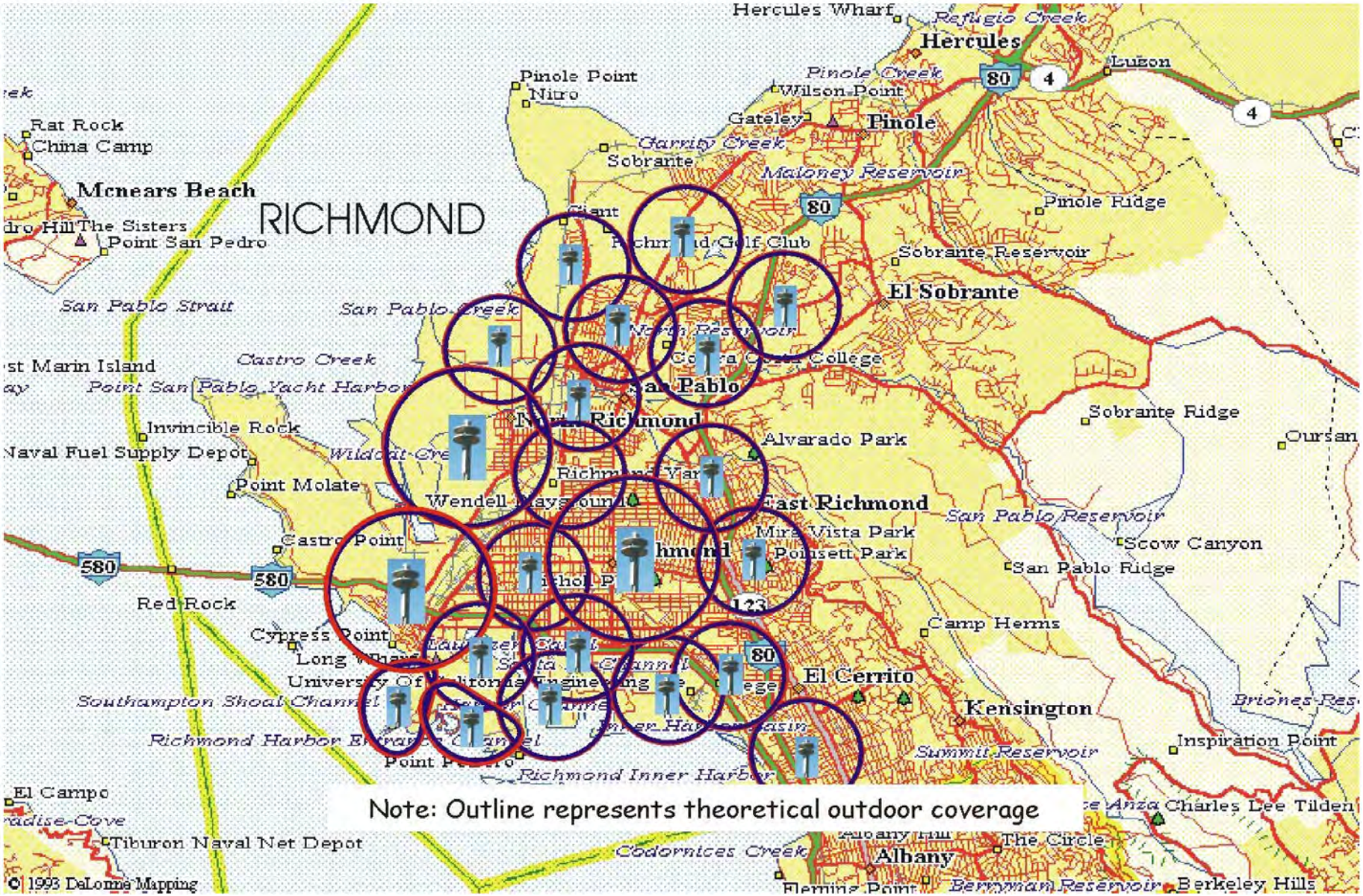
- **Emergency Alert System.** Community Warning System messages can be broadcast to TV and radio via the Emergency Alert system.

  Media. An initial warning, updates, instructions, and an "all-clear" would be distributed to the community through radio, television, and cable by CCHSHMP when there is no longer a potential danger to the community. For Level 3 incidents, messages are sent directly to the media. The CWS sends initial notifications that include directions for the public to the media. Updates may include affected area changes, protective action changes, and/or additional people/areas that need to be notified. The "All Clear" message is also sent to the media. The CWS posts all of its notifications on social media (currently Facebook and Twitter) and on a website where people can go to see more information and a map of the affected area.

4.13.2.4.2.9 *Agency Emergency Response Plans*

The City of Richmond Emergency Operations Plan (Richmond EOP) (City of Richmond, 2005) is an extension of the California Emergency Plan. The Richmond EOP aims to protect the City's population and minimize losses during an emergency. In addition, the Richmond EOP aims to guide the effective and efficient use of resources during large-scale emergency situations.

According to the Richmond EOP, state and local agencies use the California Standardized Emergency Management System (SEMS), which helps standardize emergency response efforts that span multiple jurisdictions; the Richmond EOP includes detailed information regarding the various levels of response and organization of SEMS. The Richmond EOP also discusses alerts and notification systems, such as the CWS, as well as telephone and radio alert systems, among others. A Hazard Analysis/Threat Summary is contained in the Richmond EOP, and includes natural disasters, transportation accidents, terrorism, civil unrest, and hazardous materials accidents. Petroleum refineries are specifically discussed with respect to earthquakes along the Hayward Fault as fires, contamination, and pipeline ruptures may occur. The current Richmond EOP was published in 2005, with revisions added in 2010. The City is currently in the process of updating the Richmond EOP (Gerk, 2014).



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Source: Chevron Site Safety Plan, 2013

Figure 4.13-1

Chevron Refinery Modernization Project EIR

Community Warning System Alert Siren Locations

The Contra Costa County Office of Emergency Services released the Contra Costa Operational Area Emergency Operations Plan (County EOP) in May 2011 (OES, 2011). The County EOP's objective is to "incorporate and coordinate all the facilities and personnel of the County and Operational Area member jurisdictions into an efficient organization capable of responding effectively to any emergency." In addition to instituting an emergency organization, the County EOP also outlines specific policies, procedures, and assignments of responsibility, and aims to coordinate the planning of the various emergency staff and service elements. The County EOP implements SEMS and the National Incident Management System to accomplish these objectives. According to the County EOP, the emergency management organization works with and acts as a liaison between government agencies, private sector entities, and volunteer groups, as applicable. The County EOP details procedures in responding to various threats and scenarios, including hazardous materials incidents. According to a County representative, the County EOP is currently in the process of being updated (Widger, 2014).

While other agencies, such as Cal/OSHA and the BAAQMD, are not primary first responders, they do have plans in place to assist other agencies and first responders with technical and other assistance during emergencies related to industrial accidents. In addition, these agencies assist in investigations of industrial accidents. For example, the BAAQMD currently has Incident Response Procedures, which are directed toward the BAAQMD's Compliance and Enforcement Division. The BAAQMD currently supports emergency response efforts by collecting air samples, by conducting air monitoring, laboratory analyses, engineering evaluations, and inspections, and by communicating with the community and media. According to their Work Plan for Action Items Related to Accidental Release from Industrial Facilities, the BAAQMD is reviewing and updating their current procedures and widening their scope in response to the August 6, 2012 fire at Chevron (BAAQMD, 2012). The BAAQMD aims to document their coordination and improve their communication strategies both internally and with other agencies. Additionally, the BAAQMD plans to develop a coordinated message response program that would provide the community and media with consistent and up-to-date information during incidents.

The City of Richmond has published two guidance documents as emergency preparedness resources. A Community Guide to Emergency Preparedness (Community Guide), which was published by the Richmond Fire Department Office of Emergency Services in May 2011 (RFD OES, 2011). The Community Guide contains information such as locations and contact information for local hospitals, transportation services, utilities, and petrochemical plants. It also provides information on the City of Richmond alert and warning systems, which

are used to signal residents to shelter in place in the event of a chemical release. Finally, the Community Guide provides guidance for how citizens should respond to federal terrorist threat levels.

In addition to the Community Guide, the City has published Business Emergency Planning Guidelines (Business Guidelines) (Richmond Fire Department, 2009). This document provides guidance for businesses and industry to draft their own business plans in order to protect lives and property in the event of an emergency situation. The Business Guidelines also direct businesses to coordinate with the Richmond Fire Department Office of Emergency Services. According to the Business Guidelines, business emergency plans should address: employee safety and basic survival; emergency operating procedures; emergency financial procedures; emergency data processing systems procedures; emergency procedures for storing, securing and retrieval of records, emergency communications systems, emergency transportation systems, alternate office facilities, and procedures for working with local government. Additionally, the Business Guidelines include a countermeasure checklist for hazardous materials that include measures such as ensuring containment systems are watertight, that spill release detectors and alarms are installed, and that explosion proof and/or inherently safe electrical systems and bonding are used in hazardous material storage areas (Richmond Fire Department, 2009).

4.13.2.4.3 *Accident History*

4.13.2.4.3.1 *Prior Accidents*

As required by the CalARP Program, the most recent RMP was prepared for the Facility and submitted to CCHS in October 2011, with an update submitted to CCHS in February 2013 concerning the August 6, 2012 fire. CalARP Section 2750.9 requires facilities to keep records of all accidental releases from covered processes from the previous 5-year period that "resulted in on-site deaths, injuries, or significant property damage, or known off-site deaths, injuries, evacuations, sheltering-in-place, property damage, or environmental damage." Additionally, the RMP also reported accidents that have occurred at the Facility in the previous 5 years (from September 1, 2006 through August 15, 2011). This information serves to inform the community of the impacts of these accidental releases, their causal or contributing factors, and any changes that have been (and continue to be) implemented to reduce the likelihood of the incident from recurring in the future. All incidents that fit the above criteria since 2002 are described in *Appendix 4.13-DET*. The only incident included in the February 2013 RMP is the August 6, 2012 leak and fire that occurred in the Facility's crude unit, which is described in further detail in *Section 4.13.2.4.3.2*, below.

4.13.2.4.3.2 *August 6, 2012 Fire*

On August 6, 2012, a piping failure occurred in the crude unit and subsequently a fire ignited in the area of the failure. The rupture involved an 8-inch carbon-steel atmospheric gas-oil pipe line from the atmospheric distillation tower. The primary location of the fire was near Pump 1149 (P-1149), which is the pump located appurtenant to and at the base of the No. 4 sidecut of the C-1100 atmospheric distillation column. At the time of the fire, operations personnel were in the process of decreasing the feed to the crude unit and evaluating the reported leak with assistance from the Chevron Fire Department. Following ignition of the fire, a shelter-in-place order and CWS Level 3 alert was issued for the cities of Richmond, San Pablo, and North Richmond, which advised residents to remain indoors until the fire was controlled. The Chevron Fire Department, with assistance from the Petroleum Mutual Aid Organization and Municipal Mutual Air, brought the fire under control and the shelter-in-place order was lifted at 11:12 p.m. on the same day. Six responders were treated for first aid injuries including burns. According to CCHS, a large number of people sought medical attention from local emergency rooms, and three individuals were admitted to the hospital. Most cases involved complaints of nose, throat, or eye irritation or respiratory issues.

Following the fire, the CSB,[7] the EPA,[8] Cal/OSHA,[9] and the BAAQMD[10] each undertook investigations into the incident. Chevron also undertook an independent investigation of the fire pursuant to the requirements of the RISO and Chevron's internal incident investigation procedures.

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[7] The CSB is an independent agency created by the Clean Air Act (42 U.S.C. Section 7400, et seq., as amended by Public Law 101-549) to investigate chemical incidents, prepare reports that identify probable causes, and make recommendations to prevent recurrence. The CSB does not have direct regulatory authority over industrial facilities.

[8] The EPA administers the Accidental Release Prevention/RMP Program established under the Clean Air Act (42 U.S.C. Section 7412(r)). Applicable RMP regulations in 40 CFR Part 68 provide that implementing agencies shall conduct inspections for the purposes of regulatory development and enforcement of the Clean Air Act. 40 CFR Section 68.215.

[9] Cal/OSHA's PSM Program is codified at 8 CCR 5189. Its enforcement unit conducts inspections of California workplaces in response to reports of industrial accidents, complaints about an occupational safety and health hazard, or as part of an inspection program. The requirements of the PSM rules are directed primarily at protecting workers within a facility. The PSM Program requires "root cause" investigations in the aftermath of accidents (Cal/OSHA, 1984). Following an industrial accident, Cal/OSHA reviews the Facility's plans to resume operations, including the specific repairs that are contemplated.

[10] The BAAQMD implements regulations governing the construction, operation and modification of stationary sources of air emissions, including petroleum refineries, under the Clean Air Act and the California air pollution control laws (42 U.S.C. Section 7401, et seq.; HSC, Section 39000, et seq.). The BAAQMD has authority to promulgate regulations, issue permits, impose penalties, create compliance programs, and issue orders for abatement pursuant to HSC Sections 42300-42454.

4.13.2.4.3.2.1 *Investigation Findings and Recommendations*

4.13.2.4.3.2.1.1 *Chevron Investigation*

Chevron submitted its investigation report to CCHS on April 12, 2013 (Chevron, 2013c). The investigation was conducted by a team that included external scientific and engineering experts, members of the United Steelworkers Union, and Chevron's technical experts. The team gathered and reviewed historic information and data, interviewed relevant personnel, visually inspected the damaged portions of crude unit number four where the incident occurred, collected samples, and observed testing of the failed pipe section performed by Anamet, Inc. (Anamet), a testing laboratory.

Based on this investigation, the report concluded that a failure occurred in a 5-foot-long piping component of the 8-inch carbon steel atmospheric gas-oil pipe line from the atmospheric distillation tower (known as the "4-sidecut") in the crude unit, resulting in a hydrocarbon leak. Consistent with the metallurgy evaluation report on the failed piping component prepared by Anamet, the investigation found that the 5-foot carbon steel component where the leak occurred failed due to thinning caused by high temperature sulfidation corrosion, which was accelerated by the low-silicon content of the failed component. Individual carbon steel piping components with low-silicon can, and here did, corrode at an accelerated rate not readily detectable by multiple corrosion monitoring locations.

Chevron's investigation team identified four "causal factors"[11] of the August 6, 2012 fire:

- The response and assessment after discovery of the leak did not fully recognize the risk of piping rupture and the possibility of auto-ignition.
- A measurement performed in 2002 showed one-third wall loss in the failed pipe component just downstream of a corrosion monitoring location. This information was only captured as a comment in the inspection management software tool and not elsewhere in the inspection management system. Documenting wall thickness information in a comment without adding it to the inspection management software database limited the ability for future decision-makers to utilize the data.
- Relevant information regarding carbon steel sulfidation corrosion—including the understanding that components with low-silicon are especially suscep-

[11] Based on the methodology used to perform the investigation, a "causal factor" is a mistake or failure that, if corrected, could have prevented the incident from occurring or would have significantly mitigated its consequences.

tible to sulfidation corrosion and the recommendation to perform 100% component-by-component inspection—was not transferred to the Facility inspection management system. The 2009 Reliability Opportunity Identification/Intensive Process Review (ROI/IPR) did not identify the need for 100% component-by-component inspection or the replacement of the 4-sidecut piping.

- Inspection during the 2011 Turnaround did not include every component in the 4-sidecut piping circuit because the recommendation to identify and inspect every component was not built into the inspection plans for the crude unit. A 100% component-by-component inspection would have required the inspection of the pipe component that failed in the August 6, 2012 fire, which could have alerted the Facility to the component's accelerated metal loss.

To address these causal factors, the investigation team made the following recommendations:

- Revise Facility policies and checklists to ensure appropriate information—including process safety and inspection information—is considered when evaluating leaks and addressing the issue of whether to shut down or continue operation of equipment.
- Enhance the Facility's mechanical integrity program to ensure the Facility properly identifies and monitors piping circuits for appropriate damage mechanisms using a standardized methodology and documentation system.
- Implement certain improvements concerning inspector training and competency, oversight of mechanical integrity, inspection plans and escalation procedures; these improvements are discussed in *Section 4.13.2.4.3.2.2* of this EIR. Develop and implement a process to review and act upon mechanical integrity-related recommendations from industry alerts, Chevron Energy Technology Company (ETC), and other subject-matter experts. Inspect crude unit piping that falls under the ETC Sulfidation Inspection Guidelines criteria for sulfidation corrosion prior to restarting the crude unit, and implement the ETC Sulfidation Inspection Guidelines for the remainder of the Facility.
- Ensure relevant technical studies and inspection data are considered for the Facility's equipment reliability plans and incorporated into the ROI/IPR process.

In addition to the four causal factors of the incident, the Chevron investigation report also found six "additional considerations," which, while not considered by

Chevron as being a direct cause of the August 6, 2012 fire, represent opportunities to prevent a similar incident from recurring (with specific additional recommendations noted):

- **Finding:** The Chevron Fire Department did not complete a Hazard Material Data Sheet and positioned Engine Foam 60 too close to the leak source when responding to the August 6, 2012 fire.

  Recommendation: Review the Pre-Fire Plan to ensure sufficient guidance is provided on equipment positioning. This is discussed further in *Section 4.13.2.4.3.2.2.6*.

- **Finding:** The leaking line could not be isolated on the upstream side to mitigate loss of containment.

  Recommendation: Review company/industry loss history on large fractionating towers to determine if internal Engineering Standard FRS-DU-5267 (Emergency Isolation and Depressuring Valves) adequately addresses mitigation of accidental releases from these systems. Revise the standard as warranted by the findings of this review.

- **Finding:** The ETC Sulfidation Inspection Guidelines were not fully implemented and action items were not tracked to completion.

  Recommendation: Ensure Facility business plans provide for the appropriate implementation of process safety recommendations.

- **Finding:** The minimum thicknesses calculated for the 4-sidecut washout spool piping did not include safety factors considered in the Refinery Piping Inspection Guideline and API Recommended Practice 574, which may have triggered a Fitness for Service analysis and led to additional inspections and resulting data (API, 2009b).

  Recommendation: Ensure sufficient organizational capacity and competency for minimum thickness Fitness for Service determinations. This is discussed further in *Section 4.13.2.4.3.2.2.5.*

- **Finding:** The June 2012 inspection of the P-1149/A suction piping was not entered in the inspection management system.

  Recommendation: Consider additional training on expectations under the "Richmond Refinery Piping Inspection Guidelines" and "RFMS Piping Data Entry (Reliability Focused Maintenance System) and ACD (Add/Change/ Delete) Guideline." Training is discussed further in *Section 4.13.2.4.3.2.2.5.*

- **Finding:** The crude unit PHA did not consider the potential for sulfidation corrosion.

Recommendation: Review and modify the PHA procedures to ensure that teams consider known corrosion threats/mechanisms. Revisions to the PHA procedures are discussed in *Section 4.13.2.4.3.2.2.4*.

Recommendation: Consider a project to evaluate the purpose and methods of various PSM reviews to determine if these activities can be combined or better sequenced to improve risk understanding across the various functions and promote better process safety outcomes. This is discussed further in *Section 4.13.2.4.3.2.2.3*.

4.13.2.4.3.2.1.2 *Chemical Safety Board*

The CSB adopted its Interim Report on its findings specific to the August 6, 2012 fire at the crude unit on April 19, 2013 (CSB, 2013). The CSB has also released a "Regulatory Report" focusing on recommendations for regulatory changes rather than specific findings on the August 6, 2012 fire (CSB, 2014). The April 2013 Interim Report found that the piping component that failed did so as a result of sulfidation corrosion, accelerated by the low-silicon content of the failed pipe. The report also found that Chevron missed several opportunities over a 10-year period to inspect and/or replace the pipe, and failed to follow industry and its own internal guidance concerning inspection of piping circuits subject to sulfidation corrosion. In this April 2013 Interim Report, the CSB made two recommendations to Chevron:

- **Recommendation 2012-03-I-CA-R1.** At all Chevron U.S. refineries, engage a diverse team of qualified personnel to perform a documented damage mechanism hazard review. This review shall be an integral part of the PHA cycle and shall be conducted on all PSM-covered process piping circuits and process equipment. The damage mechanism hazard review shall identify potential process damage mechanisms and consequences of failure, and shall ensure safeguards are in place to minimize hazards presented by those damage mechanisms. Analyze and incorporate into this review applicable industry best practices, ETC findings and recommendations, and inherently safer systems to the greatest extent feasible.
- **Recommendation 2012-03-I-CA-R2.** At all California Chevron U.S. refineries, report leading and lagging process safety indicators, such as the action item completion status of recommendations from damage mechanism hazard reviews, to the federal, state, and local regulatory agencies that have chemical release prevention authority.

The CSB also made recommendations to various regulatory agencies, discussed in *Section 4.13.2.3*, above, and available in the CSB April 2013 Interim Report (CSB, 2013).

Several of the CSB's recommendations will be addressed by the pending RISO amendments, an update on which is provided in *Section 4.13.2.3.2.3.2.1* (RMC, Chapter 6.43), of this EIR.

The April 2013 Interim Report identified four additional issues under investigation that were to be addressed in the final report: regulatory oversight, emergency planning and reporting, emergency response, and safety culture. In its January 2014 Regulatory Report, the CSB focuses mainly on the safety case regulatory regime and discusses its potential applications in the U.S. refining industry; this is discussed further below. The Regulatory Report covers the issues of regulatory oversight and somewhat covers the issue of safety culture; however, the issues of emergency planning and reporting and emergency response, were not addressed in this Regulatory Report.

The safety case regulatory regime consists of "both prescriptive and goal setting elements that require duty holders to demonstrate to the regulator through rigorous reviews and audits that they have reduced risks to as low as reasonably practicable, or ALARP." The Regulatory Report discusses seven primary characteristics of the safety case regulatory approach: safety responsibility on the part of the facility; reduction of risk to ALARP; adaptability; workforce involvement; the effective use of process safety indicators; regulatory oversight; and an independent, competent, well-funded regulator. The Regulatory Report asserts that these aspects of the safety case approach differentiate it from existing U.S. and California process safety regulations, and that the United States and California should modify their approach to more closely match the safety case (CSB, 2014).

4.13.2.4.3.2.1.3 *Cal/OSHA*

On January 30, 2013, Cal/OSHA issued citations related to two inspections performed at the Facility, which are described below.

4.13.2.4.3.2.1.3.1 August 6, 2012 Fire Investigation

Cal/OSHA Inspection No. 314331877 concerning the August 6, 2012 fire resulted in 16 citations, nine of which were designated "Serious-Willful." The citations generally fall into two categories: alleged violations concerning the incident response of both Chevron and Chevron's contractors and alleged violations concerning the failure to implement and act on industry and Chevron guidelines concerning sulfidation corrosion, including the alleged failure to perform an effective PHA of the crude unit to include potential hazards from upstream and downstream units. The citations include allegations of Chevron's failure to correct deficiencies in high-temperature 4-sidecut piping identified by its Reliability Department after conducting inspection and testing in accordance

with standard guidelines, and failure to replace 4-sidecut line recommended by the Reliability Department since 2002. These citations are currently subject to an administrative appeal.

4.13.2.4.3.2.1.3.2 Temporary Leak Seal Investigation

Cal/OSHA Inspection No. 314332370 concerning the Facility's leak seal inspection program resulted in eight citations, two of which were designated "willful." These citations did not concern the August 6, 2012 fire or relate to concerns regarding sulfidation corrosion. Chevron is evaluating and clarifying its process for the use, tracking, and removal of temporary leak seals. These citations are currently subject to an administrative appeal.

4.13.2.4.3.2.1.4 *Environmental Protection Agency*

The EPA conducted an investigation into the August 6, 2012 fire concerning the Facility's RMP program. The EPA's investigation included a comprehensive review of Chevron's implementation of its RMP in three processes covered in the Facility; EPA's preliminary finding was that Chevron has not complied with laws and regulations governing prevention of chemical accidents and reporting of chemical releases.

The EPA issued the Facility a Finding of Violations (FOV) on December 17, 2013 (EPA, 2013a), which, according to the EPA, represents its first official action upon completing the investigation (EPA, 2013b). EPA's FOV identifies 49 alleged failures in the implementation of Chevron's RMP and 13 alleged instances of late and deficient release reporting to authorities. Chevron has the opportunity to challenge the EPA violations before they are finalized, and has been working on a response to EPA on the preliminary FOV. If the findings are finalized, Chevron would be required to correct the release reporting deficiencies, submit documentation of the actions taken to correct each violation, and provide information on its plans to improve safety at the facility (both voluntary and required by agreements).

4.13.2.4.3.2.1.5 *BAAQMD*

On August 14, 2012, BAAQMD issued a notice of violation for public nuisance relating to the August 6, 2012 fire. The BAAQMD conducted an investigation into emissions and flaring caused by the fire and, on February 26, 2013, issued three additional notices of violation relating to the August 6, 2012 fire; two of the notices of violation reference two rules that were breached, for a total of six rule violations. A probation agreement entered into with the State of California in August, 2013 resolved two of the BAAQMD notices of violation. The remaining

violations have not yet been finalized, and Chevron still has the opportunity to challenge these violations.

4.13.2.4.3.2.1.6 *State of California*

On August 5, 2013, Chevron U.S.A. Inc. entered a nolo contendere plea to six misdemeanor counts under the Cal/OSHA standards codified in the CLC, Division 5, Part 1, Section 6300 et. seq. and the Non-Vehicular Air Pollution Control requirements codified in the HSC, Division 26, Part 4, Sections 41500 et. seq., and agreed to court probation for a period of 3 years and 6 months. The terms of probation require the following:

- **Sulfidation Corrosion Inspections.** By August 6, 2014, the Facility shall complete a 100% component inspection of all carbon steel piping systems identified as susceptible to sulfidation corrosion in a manner consistent with the methodologies set forth in the Updated Inspection Strategies for Preventing Sulfidation Corrosion Failures in Chevron Refineries (September 30, 2009). Any substantial changes to these methodologies during the period of probation shall be provided to Cal/OSHA for review.

  As part of these inspections, the Facility is required to:

  - Implement inspections to identify components of carbon steel piping circuits that do not have sufficient thickness to remain in service until the next scheduled turnaround.
  - Implement generally accepted engineering practices with respect to components of insufficient thickness.
  - Document solutions with respect to components of insufficient thickness and make such documents available for inspection by Cal/OSHA.
  - Confer with appropriate subject matter experts, such as material engineers, Facility inspectors, consultants and representatives of the Chevron ETC, in connection with solutions referenced above.
  - Manage changes (except for “replacement in kind”) to process chemicals, technology, and equipment, and changes to facilities in accordance with 8 CCR 5189(l).
  - Maintain a list of management of change documents prepared in connection with above-referenced changes made in furtherance of the sulfidation corrosion program and make the list and any underlying documents necessary to understand the list, available for inspection by Cal/OSHA.

  - Maintain a list of all carbon steel piping circuits potentially susceptible to sulfidation corrosion.
  - Establish an inspection frequency for carbon steel piping circuits based upon measured corrosion rates, remaining life calculations, and current process conditions, including sulfur content and temperature.
  - Measure corrosion in all carbon steel piping systems identified as susceptible to sulfidation corrosion, not limited to elbows, but also including straight line pipes.

- **Damage Mechanism Reviews.** By January 1, 2014, the Facility shall modify its work processes for the review of damage mechanisms for processes covered by the PSM standard in accordance with API Recommended Practice 571 (API, 2011a). The damage mechanism review shall identify potential process damage mechanisms and consequences of failure, and shall ensure safeguards are in place to control hazards presented by those damage mechanisms.

  The revised work processes shall require consideration of damage mechanism reviews as part of the PHA process at the Facility. Chevron completed a pilot of this process at the Facility in 2013, and it has now been made a required element of the PSM process at the Facility.

- **Fixed Equipment (Process Piping) Inspection Recommendations.** With regard to turnaround planning, when considering fixed equipment inspection recommendations, turnaround planners shall confer with appropriate subject matter experts, such as material engineers, Facility inspectors, consultants, and representatives of ETC.

  With regard to turnaround planning, by September 30, 2013, the Facility shall maintain a list of fixed equipment inspection recommendations submitted for each turnaround. Fixed equipment inspections recommendations that are not accepted shall be documented. The documentation shall include the reason(s) the recommendation was rejected or deferred, the identity of the individuals who participated in the decision, and the identity of the manager who approved or disapproved of the recommendations. These records shall be made available for inspection by Cal/OSHA.

- **Enhanced Training.** By May 6, 2014, the Facility is required to develop and implement the following enhanced training programs:

  - For Facility incident commanders, first responders, and operations management and employees, provide a revised emergency response training program, including enhanced training on the leak response protocol and shutdown decisions in response to a leak.

- For Facility incident commanders and first responders, provide enhanced training on setting up incident command structures, establishing boundary limits, and evaluating "hot zones."
- For Facility personnel responsible for making Minimum Thickness Fitness for Service determinations, provide enhanced training on the appropriate process and techniques for calculating minimal wall thickness for piping and conducting Fitness for Service assessments.
- The Facility shall maintain a list of the incident commanders, first responders, and operations employees indicating which of them have received the enhanced training referenced above and a list of the personnel responsible for making Minimum Thickness Fitness for Service determinations indicating which of them have received the enhanced training referenced above. The Facility shall make these lists available for inspection by Cal/OSHA.
- The Facility shall provide the proposed training materials to Cal/OSHA for review and approval 30 days prior to beginning these training programs.

- **Reporting and Verification.** The Facility is required to submit a Reporting and Verification Report to the Contra Costa County District Attorney's Office, the California Attorney General's Office, the BAAQMD, and Cal/OSHA every 90 days regarding progress in implementing the above conditions for the first year of probation and every 6 months thereafter until the period of probation ends. The Reporting and Verification Reports began 30 days after the plea agreement was approved by the Court. The Reporting and Verification Reports shall include the following:
  - A list of components identified through the 100% component inspection process that lack sufficient thickness to remain in service until the next scheduled turnaround.
  - A description of the solution implemented with respect to components of insufficient thickness identified above.
  - A list of all carbon steel piping circuits identified as potentially susceptible to sulfidation corrosion.
  - A description of the current fixed equipment inspection frequency for carbon steel piping circuits identified as potentially susceptible to sulfidation corrosion.
  - A list of the revised PHA completed during each reporting period (if any) to account for consideration of damage mechanisms.

- A list of fixed equipment inspection recommendations submitted for each turnaround, indicating which recommendations were accepted, and, for those that were not accepted, the reason the recommendation was rejected.

Upon 48 hours' notice, and upon presentation of appropriate credentials, Chevron shall grant Cal/OSHA access to the Facility during regular working hours to review documents and, as necessary, the specific portions of the facility at issue in the documents and, in addition, on Cal/OSHA's request, shall make available a reasonable number of employees, for the purposes of verification of compliance with the terms and conditions of probation.

4.13.2.4.3.2.1.7 *Global Community Monitor Investigation*

Global Community Monitor, a non-profit environmental justice group located in El Cerrito, conducted testing of surfaces in areas of Richmond beneath the plume. The resulting report concluded that certain constituents (e.g., polycyclic aromatic hydrocarbons) associated with combustion of organic materials such as crude oil, were present on such surfaces. The report did not quantify the extent to which such constituents may have been attributable to the August 6, 2012 fire.

4.13.2.4.3.2.1.8 *Civil Litigation*

Approximately 15,000 people and the City of Richmond, have filed lawsuits against Chevron relating to the August fire. These civil lawsuits are pending.

4.13.2.4.3.2.2 *Chevron's Implementation of Incident Investigation Recommendations*

Following the August 6, 2012 fire in the crude unit, the Facility has taken numerous actions to address the causal factors of the fire and to enhance safety (Chevron Data Transmittal #90, 2014). Many of the actions described below are incorporated into the Modernization Project Reliability Program Project Design Feature, discussed further in *Appendix 4.13-PROG*.

4.13.2.4.3.2.2.1 *Crude Unit Piping Upgrades and Enhanced Monitoring*

As part of the repair of the crude unit, the Facility replaced all fire-damaged piping in the crude unit subject to high-temperature sulfidation conditions with 9 Chrome alloy pipe. The City issued permits for these upgrades and repairs pursuant to fire and building codes in effect at the time the permits were issued. The piping upgrades and other repairs to the crude unit were completed and the crude unit restarted in April 2013, following a PSSR process, reviewed in advance by Cal/OSHA and the EPA. Cal/OSHA conducted a 4-day on-site audit of the PSSR

process in early April. Following completion of its audit, on April 5, 2013 Cal/OSHA lifted the Orders Prohibiting Use that had been in place since immediately following the August 6, 2012 fire.

The Facility also installed a total of 117 Permasense® probes in the crude unit on six piping systems consisting of carbon steel, 5 Chrome, and 9 Chrome materials. Permasense® is the trade name of a type of high-temperature ultrasonic device that is mounted on a pipe or vessel, and penetrates through insulation. It has wireless sensors that provide periodic equipment thickness readings (at variable intervals, but currently set to collect thickness data twice a day) to monitor a system. Due to noise and sensitivity, the technology is limited to longer-term trending (days and months vs. hours), which is appropriate for piping subject to sulfidation conditions with its predictable corrosion rates.

The six piping systems on which the sensors were installed were chosen by Chevron based on past and projected future operating conditions. The wireless probes collect pipe wall thickness data while the Facility is operating, and are used to monitor corrosion rates. This long-term online monitoring program will be part of the Modernization Project Reliability Program (Chevron Data Transmittal #90, 2014).

4.13.2.4.3.2.2.2 *High-Temperature Sulfidation Inspection Program*

Following the August 6, 2012 fire, Chevron undertook a component-by-component inspection of all individual carbon steel piping components exposed to high-temperature sulfidation conditions following newly implemented inspection guidelines consistent with API 939-C – Guidelines for Avoiding Sulfidation (Sulfidic) Corrosion Failures in Oil Refineries and Updated Inspection Strategies for Preventing Sulfidation Corrosion Failures in Chevron Refineries (API, 2009a). The inspection program was divided into two primary phases: phase one called for the inspection of piping components in service with temperatures above 500 degrees Fahrenheit (˚F), and phase two calls for inspection of piping components in service with temperatures between 450˚F and 500˚F. To date, the Facility has inspected nearly 19,000 individual piping components, including all high-priority piping components operating at or above 500˚F. The inspection program is scheduled to be complete by August 2014, consistent with the terms of probation agreed to on August 5, 2013, as monitored by Cal/OSHA. Pursuant to the inspection program, components are replaced as needed, and additional corrosion monitoring locations are being added where the inspections indicate higher corrosion rates (Chevron Data Transmittal #90, 2014).

4.13.2.4.3.2.2.3 *Enhanced Mechanical Integrity Program*

Following the August 6, 2012 fire, the Facility has taken steps to enhance its mechanical integrity program (described in *Section 4.13.2.4.3.2.1.1*, above) to ensure the Facility properly identifies and monitors piping circuits for appropriate damage mechanisms. As a first step, the Facility added a Fixed Equipment Integrity Manager to, among other things, oversee development and implementation of the Facility's Fixed Equipment Integrity program with a goal of achieving zero process safety incidents and improving mechanical availability.

The Facility has also developed a new process to review all damage mechanisms that may affect a given plant at the process level. This Damage Mechanism Review process, which also responds to a CSB urgent recommendation, requires a team of subject matter experts to review, analyze, and make recommendations concerning damage mechanisms and how to mitigate their effect on each process unit. This review of damage mechanisms is facilitated by the Facility's Fixed Equipment Integrity Group subject matter experts and the results are then provided to the process hazard analysis team for their consideration and review as that team formulates its recommendations. Chevron reports that the Damage Mechanism Review process was piloted at the Facility in 2013 and has now been made a required element in the Process Safety Management process at the Facility for identified process units, and is being undertaken on an ongoing basis.

In addition, Chevron reports that the Fixed Equipment Integrity Group is developing asset strategy plans for each process unit at the piping circuit level. These asset strategy plans will include integrity operating windows consistent with draft API 584 – Integrity Operating Windows and will address damage mechanisms and recommendations for mitigation of risks. These circuit-specific asset plans include consideration of among other things, process conditions, inspections, techniques and frequency, mixing and injection points, and corrosion monitoring locations, and will be integrated with the Damage Mechanism Review process. A pilot of the asset strategy plan process has been performed for the crude unit, and asset strategy plans will be implemented for all processing units on an ongoing basis (Chevron Data Transmittal #90, 2014).

4.13.2.4.3.2.2.4 *Additional Oversight of Mechanical-Integrity Recommendations*

Chevron has developed and implemented processes for additional oversight of the review prioritization, and implementation of mechanical integrity-related recommendations from the Facility's Fixed Equipment Integrity Group, Chevron ETC, and other subject matter experts, as well as from general industry alerts. A review of mechanical-integrity standards has been undertaken and these

standards would be compared to existing Chevron standards to identify any discrepancies and establish a plan to reconcile those discrepancies on a go-forward basis.

In addition, the Fixed Equipment Integrity Group at the Facility has developed an Integrity Threat Process, which has been deployed at the Facility to address inspection recommendations for equipment and piping that could significantly impact safety, or environmental or plant operations. The Facility's Operations group is notified of all integrity threat inspection recommendations and takes action to develop a planned resolution by the target completion date. The integrity threat inspection recommendation is tracked through the Facility's MERIDIUM or OERI databases until it is resolved.

As part of this work process update, the Facility has also updated its internal work instructions to address inspection results that indicate that equipment or piping will reach "flag" or "alert" thickness prior to the next scheduled turnaround. The Facility's on-stream inspection work instruction was updated in 2013 to include immediate notification to Chevron of any field measurements that indicate a remaining life of one year or less. An API-certified inspector assesses the results of the inspection and expands the inspection program for the equipment or piping as appropriate. In such an instance, an integrity threat inspection recommendation is issued to the Facility's Operations group and tracked to completion as described above.

Further, with regard to turnaround planning, any decision not to implement a fixed equipment inspection recommendation must be approved by the Refinery Business Manager for the process unit for which the recommendation was made. The approval must include an explanation as to why the recommendation was rejected or deferred. The Facility reports these decisions to Cal/OSHA pursuant to the August 5, 2013 probation terms.

Finally, the Facility has also modified its ROI/IPR process and, as discussed above (Chevron Data Transmittal #90, 2014), its PHA procedure, to ensure that damage mechanisms are appropriately considered.

4.13.2.4.3.2.2.5 *Competency Building*

Since the August 6, 2012 fire, Chevron is working to enhance the requirements for training and competency for leadership, inspections, and technical assessments. The essential inspector competencies have been identified, and individual evaluations and training plans are being developed to ensure inspectors meet the identified competency requirements. Additionally, training

for determining minimum thickness and fitness for service of individual piping components has been enhanced (Chevron Transmittal #90, 2014).

4.13.2.4.3.2.2.6 *Leak Response and Mitigation*

The Facility has developed and deployed a new Leak Response Protocol for evaluating leaks and shutting down equipment (Chevron Data Transmittal #87, 2014). This new protocol has been shared with CCHS, Cal/OSHA, and the CSB, as well as other refineries and industrial facilities in Contra Costa County. New training has been developed for impacted employees, and implementation of this training is being monitored by Cal/OSHA consistent with the August 5, 2013 terms of probation. The Facility has also modified its pre-incident scenarios to provide guidance concerning equipment positioning, and is in the process of reviewing its design and fire-prevention standards for large fractioning towers, with proposed enhancements scheduled to be approved in 2014 (Chevron Data Transmittal #90, 2014).

4.13.2.4.3.2.2.7 *Integration of Enhanced Safety Measures into Manufacturing Standards*

The various work processes described above that have been or are being integrated into Manufacturing Standards include: the Leak Response Protocol; the Asset Strategy Plans (Piping Reliability Plans); the Damage Mechanism Review Process; Pipe Wall Thickness fitness-for-service determinations; and the Integrity Threat Process. These would be maintained and updated by the Manufacturing Technical Authority. Improvements have also been made in the Manufacturing Standards for conducting ROI/IPR and PHA to ensure that Damage Mechanisms are considered when conducting those reviews. Further, a process was put in place for the Manufacturing Technical Authority that would conduct reviews of internal and external recommendations and standards, such as sulfidation corrosion guidelines or fractionator tower design to develop plans for process safety improvements. The Facility's business plans provide the mechanism for implementing these manufacturing standards in Richmond, and are updated periodically (Chevron Data Transmittal #90, 2014).

4.13.2.4.3.2.2.8 *Richmond Industrial Safety Ordinance Amendments*

Chevron is working closely with the City, the County, and affected industries to develop amendments to the RISO responsive to the recommendations made by the CSB in its April 17, 2013 Interim Investigation Report concerning the August 6, 2012 fire. While still pending, the proposed amendments to the RISO currently being considered would require the reporting of process safety indicators to CCHS, incorporation of inherently safer systems analysis into the Facility's Management of Change procedures, completion of layers of protection analysis

or equivalent studies to evaluate the effectiveness of existing safeguards and safeguards recommended in process hazard analyses, implementation of a more robust ISSA program, and funding of additional refinery safety experts to support the County.

4.13.2.4.3.2.3 *City/County Safety Evaluation*

The County has hired a third party to conduct a safety evaluation of the Facility, focused on the management practices and safety culture at the Facility. This evaluation is anticipated to be complete by the end of the second quarter of 2014, and the Facility would work with the County to implement appropriate recommendations from the evaluation.

4.13.2.4.4 *Hazardous Materials and Waste Handled at the Facility*

The 2013 RMP shows that the following substances are generated or used at the Facility, and the potential for accidental release of these substances to the environment were evaluated in the RMP:

- H_2S.
- NH_3.
- Flammable hydrocarbons.
- Sulfuric acid mixed with hydrocarbons.

The 2011 RMP showed similar hazardous materials and quantities as in the 2013 RMP. The Facility is listed under Government Code Section 65962.5 on the Resources Conservation and Recovery Information System of hazardous waste generators. Wastes generated are subject to extensive applicable regulations regarding storage and disposal as described in *Section 4.13.2.3*.

The Facility submits a Hazardous Waste Source Reduction Report (also known as the Waste Minimization Plan or SB 14 report) once every 4 years under the Hazardous Waste Source Reduction and Management Review Act of 1989 (also known as SB 14). The most recent SB 14 report was submitted in 2011 for the reporting year 2010 (Chevron Data Transmittal #78, 2014). The next report is due September 1, 2015.

Any hazardous waste streams that are pre-treated on-site and then subsequently discharged to a publicly owned treatment works or to receiving water under a National Pollution Discharge Elimination System permit are referred to as Category A wastes. The Facility did not report any Category A wastes in the last two SB 14 reporting cycles (reporting years 2006 and 2010) (Chevron Data Transmittal #78, 2014). All other waste streams subject to SB 14 are referred to as Category B wastes. For all Facility Category B wastes, a total of 2.4 million

pounds were reported for 2006 and 5.3 million pounds for 2010. There were four major waste streams:

- **Primary Sludges**. The quantity of primary sludges generated in 2006 was low enough that it was not reported as a waste stream. However, 790,000 pounds were generated in 2010. These sludges were treated at an off-site facility and blended with growing media and used as soil amendment for mine reclamation.
- **Spent Fluid Catalytic Cracker Catalyst**. Approximately 130,000 pounds were generated in 2006, and 2.3 million pounds were generated in 2010. The waste had mainly been used as a substitute feedstock for a cement kiln from 2004 to 2006, during which time it was an exempt waste. However, the cement kiln was shut down in 2006, and since this time the waste has been disposed in a landfill while alternative disposal options are evaluated.
- **Spent Hydroprocessing Catalyst**. 1.4 million pounds were generated in 2006 and about 1.3 million pounds generated in 2010. Approximately 10% of this quantity was reduced by sending it off-site for recycling (metals reclamation).
- **Spent Carbon Downstream of the Desalter**. Approximately 610,000 pounds were generated in 2006 and 126,000 pounds were generated in 2010. The main factor contributing to the decrease in this waste stream was the change in the trigger point for change-out of the carbon.
- **Monoethanolamine**. Approximately 212,000 pounds of monoethanolamine (MEA) were generated in 2006 and about 250,000 pounds were generated in 2010.
- **Facility Industrial Debris**. Approximately 158,000 pounds were generated in 2006 and 354,000 pounds were generated in 2010. The increase from 2006 to 2010 was due mainly to additional Facility shutdowns and consolidation of non-RCRA waste into this waste stream.

The amount of hazardous waste disposed of was reduced by more than 75% from 1986 to 1998 through source reduction, recycling, treatment, and material substitution. From 1998 to 2002, the amount of hazardous waste routinely generated was reduced by 20% due to recycling and classification of carbon as non-hazardous waste. From 2002 to 2012, the amount of hazardous waste generated by the Facility was reduced by approximately 41% due to recycling and tank treatment (Chevron Data Transmittal #78, 2014).

The units at the Facility that would be directly affected by the Modernization Project generated an average of approximately 966 tons of hazardous waste annually for the years 2008 through 2010 (i.e., the baseline period) as shown in

Table 4.13-2. Some of the hazardous wastes consist of spent catalysts that are sent off-site for processing, reclaiming, and regeneration. The remaining hazardous wastes are sent off-site for disposal in an appropriate landfill. Table 4.13-2 summarizes the hazardous wastes generated by the existing facility (Chevron Data Transmittal #78, 2014).

4.13.3 Public Safety Significance Criteria and Methodology

4.13.3.1 Significance Criteria

The significance criteria used for this analysis are from the CEQA Guidelines, Appendix G, Section VII, Hazards and Hazardous Materials. The Modernization Project would result in a significant adverse impact to public safety if it would:

(A) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;

(B) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;

(C) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school;

(D) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment;

(E) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, result in a safety hazard for people residing or working in the project area;

(F) For a project within the vicinity of a private airstrip, result in a safety hazard for people residing or working in the project area;

(G) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; and/or

(H) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

TABLE 4.13-2 FACILITY HAZARDOUS WASTE GENERATION DURING THE BASELINE PERIOD FOR UNITS IMPACTED BY THE MODERNIZATION PROJECT

Hazardous Waste Generated at the Existing Facility	2008	2009	2010
Hydrogen Plant Catalyst (pounds)			
Hydrogen Reforming Catalyst	0	0	0
Hydrodesulfurization Catalyst (First Stage)	0	0	0
Hydrodesulfurization Catalyst (Second Stage)	0	0	0
High-Temperature Shift Converter Catalyst	0	0	0
Low-Temperature Shift Converter Catalyst	0	201,800	0
Methanator Catalyst	0	0	0
Selective Catalytic Reduction Catalyst	0	0	0
FCC FHT Catalyst (pounds)			
R410/411	777,380	796,150	798,840
R420/421	784,620	728,360	814,240
MEA Related (pounds)			
MEA Solution	354,400	300,240	241,960
MEA-contaminated Material	0	0	0
Arsenic-contaminated Material (D004)	0	0	0
Arsenic-contaminated Material, Contaminated Soil, Non-RCRA	0	0	0
Arsenic-contaminated Material, Fluid Catalytic Cracker Catalyst, Non-RCRA	0	0	0
Arsenic-contaminated Material, Primary Sludge, F037	0	0	0
Arsenic-contaminated Material, Sandblast Grit, Non-RCRA	0	0	0

Source: Chevron Data Transmittal #78, 2014.

4.13.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of hazard-related impacts is explained in the context of each impact, as discussed further below.

As an overall methodology, existing federal, state, and local regulatory requirements, as well as relevant provisions of the existing Facility safety

program, are considered in each impact analysis, as are relevant requirements from other applicable industry standard practices. The risks and hazards analyzed in this section are primarily associated with changes in the operation of the Facility, such as process and equipment changes, and changes in the feedstock, such as an increase in crude oil sulfur content, which would occur as a result of the Modernization Project. Although the Modernization Project contemplates an increase in Facility utilization, this change in utilization is not expected to affect public safety risks and hazards, as it would simply increase the rate at which hazardous materials pass through the Facility, but would not significantly affect the quantities of hazardous materials on-site at the Facility at any one time (Chevron Data Transmittal #78, 2014).

Further, the impact assessment takes into account certain inherently safer designs associated with the Modernization Project components, and the increased equipment reliability that would result from these features (Chevron Data Transmittal #80, 2014). These components include:

1. **New H_2S absorber.** The Modernization Project includes the installation of a new H_2S absorber on the recycled hydrogen gas stream of the Facility's FCC FHT process unit. The absorber uses a solvent (diethanolamine [DEA] solution), which, when it comes in contact with the gas stream, removes the H_2S from the gas. The removal of H_2S from this gas stream provides reliability improvements by eliminating a potential source of corrosion in the system.
2. **New amine regenerator (#6 H_2S plant).** To complement the additional H_2S absorber described above, the Modernization Project would also install a new amine regenerator, which separates the H_2S from the amine solution. The H_2S gas is then processed by the sulfur recovery units and regenerated amine solution is reused in the H_2S absorber. The Modernization Project is implementing an inherently safer design for these new components by locating the regenerating process near the sulfur recovery units and not at the FCC FHT unit near the H_2S absorber, thereby limiting the length of the piping circuit that contains H_2S gas. Instead, the longer piping circuit between the FCC FHT and the sulfur recovery units would contain a solvent/H_2S liquid, or "rich amine solution." The potential impact of a loss of containment of rich amine solution, rather than H_2S gas, is significantly lower because the dispersion of the liquid is slower and more easily contained.
3. **New standby H_2S scrubber**. The Modernization Project includes the installation of a new standby scrubber, in addition to an existing scrubber, within the Facility's sulfur removal system. The new scrubber would be used in non-routine operating scenarios to safely absorb and process H_2S gas in the event it cannot be recovered by the sulfur recovery units. The standby

scrubbers offer an added layer of protection to the sulfur removal system by providing additional time for the Facility to shutdown/slowdown process units or divert H_2S gas flows.

4. **Replacement hydrogen recovery plant**. The new hydrogen plant would replace the existing hydrogen recovery unit with a new one. Both the existing and new units utilize pressure swing adsorption technology, which uses an adsorbent along with changes in pressure to separate hydrogen from the remaining portion of the Facility's process gas stream. The new hydrogen recovery unit's design would incorporate structural improvements to the pressure swing adsorption vessel internals that have been developed since the existing pressure swing adsorption unit was built. These improvements would increase the reliability of the units by reducing the risk for pressure swing adsorption vessel fatigue.

5. **Replacement hydrogen manufacturing plant**. The Modernization Project's replacement of the Facility's hydrogen manufacturing facility would result in multiple reliability benefits. First, the new hydrogen plant would utilize pressure swing adsorption technology in place of the existing hydrogen plant's methods to convert and purify the manufactured hydrogen stream. This would eliminate the use of MEA, which is used to separate carbon dioxide (CO_2) from the hydrogen stream, and arsenic, which is used to minimize corrosion in the MEA system. Second, individual units within the hydrogen manufacturing process, such as the reforming furnaces and their associated internals, would be replaced in their entirety. These completely new units would enhance reliability and maintenance efforts compared to the monitoring and eventual replacement of individual components within the existing operating plant.

6. **New hydrogen plant flare and cooling water tower**. The new hydrogen manufacturing facility would be served by independent flare and cooling water tower systems. The subsequent decommissioning of the existing hydrogen manufacturing plant would result in the elimination of a user of the existing cooling water tower and refinery flare gas system located in that processing area. This change would reduce the operational load on both of these systems and ensures that the new hydrogen manufacturing plant would not be impacted by any potential operational changes within the existing cooling water or flare systems.

7. **Hydrogen compressor upgrades**. The Modernization Project upgrades the Facility's main hydrogen booster compressors in order to handle a higher purity hydrogen gas stream. As part of this upgrade, the structures supporting these compressors would be retrofitted to reduce vibration.

Future reliability of this equipment would improve as a result of the decreased vibration, or stress, on the equipment.

8. **Ammonia as a feedstock for** hydrogen **production**. The Facility produces NH_3 as part of the refining process. Currently the NH_3 is collected and used in the Facility's air emission control devices, known as selective catalytic reduction units, or sold as a refinery product. As a result of the Modernization Project, the number of refinery selective catalytic reduction units would increase by one and the new hydrogen manufacturing plant would include added flexibility to use NH_3, along with refinery process gas and import natural gas, as part of its feedstock. The additional selective catalytic reduction and feedstock flexibility provides additional uses for refinery generated NH_3, which could result in a decrease in the amount of NH_3 being stored and loaded onto railcars as product.

In addition, the impact assessment considers a Modernization Project Design Feature that would improve Facility safety and reduce hazard-related risks. The City retained an expert to conduct a reliability analysis for the Project, including identification of damage mechanisms that may be implicated by the Modernization Project and an evaluation of their potential consequences under post-Project operating conditions, including higher sulfur content in the crude oil blends and gas oils processed at the Facility. The reliability analysis technical report is discussed further in *Section 4.13.4.2.2.1* and the full report is included as *Appendix 4.13-REL*. Based on the recommendations made in the reliability analysis report, as well as corrective actions being undertaken as a result of Chevron's investigation into the August 6, 2012 fire and in response to various agencies' recommendations, which are being monitored as part of the probation terms, Chevron developed a Modernization Project Reliability Program to be implemented as a Project Design Feature to reduce potential increases in hazard-related risks. The Facility's Modernization Project Reliability Program is discussed further in *Section 4.13.4.2.2.1,* below and is included as *Appendix 4.13-PROG*.

Finally, following the August 6, 2012 fire, federal, state, and local agencies have been evaluating the existing regulatory programs to determine whether improvements can be made to strengthen oversight and lessen the likelihood of accidents.

In light of this ongoing assessment and in conjunction with the implementation of corrective actions and recommendations following the August 6, 2012 fire (see *Section 4.13.2.4.3.2.2*), additional mitigation is being required to reduce hazard-related impacts to a less-than-significant level. As a general matter, such additional mitigation includes, at minimum, periodic reporting, hazardous materials management requirements, additional training and competency

building, and funding of additional experts to support the City and County with their oversight and inspection role.

4.13.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

Review and comparison of the Modernization Project, including the associated inherently safer components and the Modernization Project Reliability Program Project Design Feature, to the environmental setting clearly shows that the Modernization Project would create no impacts related to the following environmental topics listed in CEQA Guidelines Appendix G.

(E) Would the project be located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, and therefore result in a safety hazard for people residing or working in the project area?

The Modernization Project is not within an airport land use plan and is not within 2 miles of a public airport. There would be no resulting hazard and therefore, no impact. The closest public airport to the Modernization Project is Gnoss Field (Marin County Airport) located in the city of Novato in Marin County approximately 14 miles to the north-northwest of the Facility boundary across the San Pablo Bay (see Figure 4.13-2). The Modernization Project would not result in an airport or aircraft-related safety hazard for workers at the Facility or people in Richmond. Therefore, there would be no impact.

(F) Would the project be located within the vicinity of a private airstrip, and therefore result in a safety hazard for people residing or working in the project area?

The Modernization Project is not located within 2 miles of a private airstrip. There would be no resulting hazard and therefore no impact. The nearest private airstrip is Marin Ranch Airport (also called San Rafael Airport) in the city of San Rafael in Marin County. This airstrip is located approximately 6.4 miles across the San Rafael Bay to the northwest of the Facility boundary (see Figure 4.13-2). The Modernization Project would not result in an airstrip or aircraft-related safety hazard for workers at the Facility or people in Richmond. Therefore, there would be no impact.

4.13.4 Impacts and Mitigation Measures

4.13.4.1 Transport, Use, or Disposal of Hazardous Materials and Waste

(A) Would the project create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

4.13.4.1.1 *Construction Activities*

Impact 4.13-1: There will be no new significant hazard risks from the transportation of hazardous materials and hazardous waste during Modernization Project construction. This would be a less-than-significant impact. (LTS)

Relatively small amounts of hazardous materials (such as gases used for welding[12] would be transported in accordance with applicable U.S. Department of Transportation (DOT) and California Highway Patrol (CHP) regulations, described in the *Appendix 4.13-DET* during the construction phase of the Modernization Project. Any accidents that would occur during the transportation of hazardous materials in the construction phase are expected to be minor accidents, and would not be expected to have significant adverse impacts on the public or environment. From the demolition stage of construction, Chevron expects that at least 80% of the debris and waste from the dismantling would be transported off-site by the dismantling contractor and recycled. The bulk of this debris and waste would be scrap steel and metal from piping, structural supports, vessels, and other equipment. Electrical wiring, copper tubing, and other related instrumentation components would also be shipped off-site and recycled.

Hazardous materials generated during the demolition activities of the Modernization Project include asbestos-containing materials (ACMs), mainly insulation and gaskets, as well as sandblasting grit containing lead paint from paint removal activities and from paint application activities. The transport of ACMs would be performed in accordance with established procedures and the applicable regulatory requirements—i.e., National Emission Standards for Hazardous Air Pollutants (NESHAP) and BAAQMD rules and regulations, as described in *Appendix 4.13-DET*. This would include transportation of the material in covered vehicles and disposal at appropriately licensed facilities. The lead-containing sandblasting grit would also be transported in accordance with applicable regulatory requirements.

[12] Chevron conservatively assumes that all welding for the duration of the Project is tungsten inert gas welding, which requires an Argon covering gas; this is estimated to consume a total of approximately 200,000 cubic feet of Argon gas (assuming 80 cubic feet per welder per week) (Chevron Data Transmittal #87, 2014).

In addition, potentially hazardous soil would be excavated prior to and during the construction of elements of the Modernization Project, and clean engineered fill was transported to the site for grading and geotechnical purposes as described in *Chapter 3, Project Description, Section 3.4.1, Site Preparation*. Any excavated soil would be tested for hydrocarbons and managed in conformance with the Facility's Soil Management Program for handling and disposition, approved by the Regional Water Quality Control Board (RWQCB). Also as required, excavated soil that is contaminated would be managed in accordance with BAAQMD Regulation 8 (Organic Compounds), Rule 40 (Contaminated Soil). Soil determined to be hazardous would be transported off-site in trucks with end dump trailers with roll-off bins. About 20 cubic yards would be transported in each vehicle. During transit, hazardous waste soil would be covered to prevent entrainment into the air while the vehicle travels on public roads. Non-hazardous soil would either be reused on-site or transported off-site as a designated waste, and would comply with transportation regulations for the specific designated waste, if applicable.

Trucks leaving the Facility travel through the Castro Street access to Gate 31. The first part of their journey is typically along Richmond Parkway to one of the following: I-580 east or west, Interstate 80 (I-80) east or west, or I-80 east to State Route 4 east (Chevron Data Transmittal #87, 2014).

Given the absence of Chevron-related hazardous materials construction incidents involving construction phase activities during the 2008 Project (Chevron Data Transmittal #87, 2014), and since the construction activities and transportation of construction wastes and hazardous materials would be conducted under the above regulatory constraints, which are geared to protect both on-site workers and the off-site public, the impacts to the public and the environment from the transport of hazardous materials during construction would be less than significant. Chevron is required to comply with applicable federal, state, and local laws and regulations regarding the transportation of hazardous materials and hazardous waste during Modernization Project construction and operational phases.

Mitigation Measure 4.13-1: None required.



3/14/2014 C:\Users\cviolet\Documents\ArcGIS\Packages\Figure 4.13-21\v101\Figure 4.13-2.mxd

Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Note: Land-based public and private airports and airstips are included in this figure.
Heliports and seaplane bases are not shown.
Source: Chevron (T38r1); FAA, 2014

Figure 4.13-2
Chevron Refinery Modernization Project EIR
Nearby Public and Private Airports in the Vicinity of the Facility

Impact 4.13-2: The use of hazardous materials during the construction phase of the Modernization Project would result in a potentially significant adverse impact requiring mitigation. However, with mitigation requiring construction materials storage only in authorized locations and implementing training and safety requirements for construction workers, the use of these hazardous materials would have a less-than-significant impact after mitigation. (LTS after Mitigation)

The 2008 Project and remaining construction phases of the Modernization Project would include the use and on-site storage of hazardous materials, such as flammable, high-pressure gas and some solvent-based cleaning and coating activities, among others. Hazardous gases are typically used by those employees working in weld bays, which are separate areas where hot work such as cutting and welding is performed. The gases are safely stored nearby in storage racks or lockers as appropriate. There would be a minimum of eight large weld bays for the Modernization Project. Types of materials include acetylene, solvents, and paints. Quantities are variable over the course of construction. Paint is only for touch-up, as the pipe has already been painted off-site.

As described in *Chapter 3, Project Description*, the existing hydrogen plant would be decommissioned and demolished and minor demolition (e.g., pipe supports, piping) would be required in a number of locations. Chevron anticipates that the bulk of this debris and waste would be scrap steel and metal from piping, structural supports, vessels, and other equipment. Electrical wiring, copper tubing, and other related instrumentation components would also be removed from the site and recycled.

These demolition activities could involve ACMs, mainly insulation and gaskets. The removal and handling of ACMs would be performed in accordance with established procedures and the applicable regulatory requirements (NESHAP and BAAQMD rules and regulations, as described in *Appendix 4.13-DET*). The work would be performed and overseen by certified ACM workers. The removal methods may include the use of negative pressure, glove bags, wet methods, or other acceptable methods that are geared to minimize airborne concentrations of asbestos. Modernization Project construction activities also could generate sandblasting grit containing lead paint from paint removal activities and from paint application activities. As with ACMs, these waste materials would be handled and stored in accordance with applicable regulatory requirements.

In addition, it is estimated that approximately 500 tons of potentially hazardous soil would be excavated prior to and during the construction of the Modernization Project. Approximately 157,000 tons of clean engineered fill was imported

for grading and geotechnical purposes at the various 2008 Project component sites including those projects evaluated for cumulative impact considerations. The exact characteristics of soil for the purpose of determining disposal requirements cannot be determined until it is excavated; however, soil determined to be hazardous would be handled and stored as hazardous waste until it is disposed of at hazardous waste disposal facilities. Non-hazardous soil would be reused on-site or would be sent off-site as a designated waste, as required by regulations.

As described in *Section 4.13.2.4,* the Facility has a hot work permit program (RI-341, "Hot Work and General Work Permits") to prevent inadvertent ignition of flammables or combustibles when performing jobs such as welding and to ensure that any fires that may occur can be readily suppressed and extinguished. Management personnel must authorize any hot work (e.g., cutting, grinding, burning, welding, brazing) to be performed in a unit and ensure appropriate safety precautions are taken prior to initiation of the work. Trained personnel from Emergency Services, Operations, and Maintenance are required to perform an inspection of the area prior to authorization of hot work. In addition, the Facility's contractor program (documented in RI-366, "Contractors") requires that safety issues are addressed during contractor selection and that Chevron and the contract company share responsibility for the safety of all employees. RI-366 applies to construction contractors as well. The Facility and all contract companies are jointly responsible for safety and must ensure that contractor's employees are trained in and understand the work practices necessary to perform the job, hazards associated with a process, applicable sections of the emergency response procedure (documented in RI-400, "Emergency Plans and Procedures"),[13] and applicable safe work practices. Agreement to train contractor employees in the work practices necessary to perform the job safety is a requirement of the contracting company for bidding on contract work at Chevron. Applicable RI are provided to all contract companies as part of the bidding process, and they are expected to follow them as a condition of working at Chevron (Chevron Data Transmittal #87, 2014).

[13] RI-400, "Emergency Plans and Procedures," provides the overall framework for the Refinery Emergency Response Plan. In addition to RI-400, the Facility has specific emergency plans for different areas, risks, or types of incidents. These include but are not limited to: RI-406 "Fire Emergency Response;" RI-410 "Marine Oil Spill Emergency Response;" RI-414 "Off-site Material or Waste Spill Response;" RI-417 "Liquid Petroleum Gas Release Emergency Response;" RI-422 "Hazardous Waste Treatment and Storage Facility Contingency Plan;" RI-423 "Hazardous Waste Generator Contingency Plan;" RI-440 "Emergency Plans for Total Power Outage;" RI-480 "Emergency Action Plans;" and RI-481 "Employee Initial Emergency Response" (Chevron Data Transmittal #87, 2014).

In addition, a new leak response protocol has been developed by Chevron since the August 6, 2012 fire, and it includes criteria for shutting down units and emergency response positioning guidance. These additions since the August 6, 2012 fire would be included as mandatory conditions if the Modernization Project is approved.

Since Chevron is required to comply with applicable federal, state, and local laws regarding the use of hazardous materials during the Modernization Project construction and operational phases, and given the enhancements to the Facility's safety programs after the August 6, 2012 fire (as described above), which are geared to protect both on-site workers and the off-site public, the impacts to the public and environment from the use of hazardous materials during construction would be less than significant after the application of the mitigation measures listed below.

Mitigation Measure 4.13-2a: Store hazardous materials for Modernization Project construction activities only in the construction staging locations identified in Figure 3-1 (*Chapter 3, Project Description*) unless an alternate location within a previously developed portion of the Facility is approved as part of the building permit approval process.

Mitigation Measure 4.13-2b: Implement worker training and safety requirements for construction workers, including emergency response and hot work and contractor refinery instructions as more fully described in *Section 4.13.2.3* and *Appendix 4.13-DET*, and report training and implementation of safety requirements monthly to the City during construction and demolition activities. Communicate location and scope of Modernization Project-related construction activities weekly to City and Facility management to avoid any conflicts between construction and refining activities. The required implementation will include the new Leak Response Protocol developed since August 2012 (Chevron, 2012a).

Impact 4.13-3: The management and disposal of hazardous wastes, and demolition and construction wastes, generated during Modernization Project construction could result in a potentially significant adverse impact requiring mitigation. However, with mitigation, this impact would be less than significant. (LTS after Mitigation)

Chevron anticipates that the bulk of the debris and waste from the demolition of the hydrogen plant and other construction would be scrap steel and metal from piping, structural supports, vessels, and other equipment (Chevron Data Transmittal #87, 2014). The waste minimization practices associated with demolition also generally apply to construction. For construction debris (metal,

wood, clean concrete, asphalt etc.), that is not a hazardous waste, the Facility would follow its standard practice of segregating and recycling these waste streams, where applicable. Electrical wiring, copper tubing, and other related instrumentation components would also be removed from the site and recycled. Waste metal from piping (for example, a short section of pipe cut from a longer section of pipe as part of fabrication of a pipe spool) would be recycled in much the same manner as a pipe spool removed during a plant demolition.

Empty welding gas cylinders would be refilled and reused by the welding contractor, and spent solvents would be recovered to the maximum extent possible (Chevron Data Transmittal #87, 2014). All demolished equipment would be hydroblasted clean of hydrocarbon contamination prior to leaving the Facility for recycling (such as for scrap metal value). Hydrocarbon cleaned from equipment would be managed on-site by the hazardous waste team. Recoverable liquid hydrocarbon would be reclaimed from this waste and the solid residues would be sent off-site for disposal at the appropriate disposal facility.

If not cleaned, the contaminated equipment would be contained in waste containers and disposed of appropriately.

As described above, demolition activities could involve ACMs. Disposal of ACMs would be performed in accordance with established procedures and the applicable regulatory requirements (NESHAP and BAAQMD rules and regulations, as described in *Appendix 4.13-DET*). The material would be disposed of at appropriately licensed facilities. Sandblasting grit containing lead paint from paint removal activities and from paint application activities, also discussed above, would be disposed in accordance with applicable regulatory requirements.

Modernization Project construction-related hazardous waste would be predominantly contaminated soil (Chevron Data Transmittal #87, 2014). Soil excavated during the construction phase of the Modernization Project (estimated to be approximately 500 tons) could potentially be hazardous. Disposal requirements would depend on the exact characteristics of the soil, which cannot be determined until it is excavated. Soils are immediately placed in 20-yard roll-off bins and moved to a bin storage area. A representative sample is collected for the site generating the soil and the soil is analyzed to determine if it is a RCRA or Non-RCRA (California Hazardous) waste, or if it is non-hazardous (Chevron Data Transmittal #87, 2014). Soil determined to be hazardous would be sent to off-site hazardous waste disposal facilities. If the soil appears to be clean and a candidate for reuse, an aquatic toxicity bioassay test is performed to test for toxicity. Non-hazardous soil with less than 1,000 parts per million total

petroleum hydrocarbon and less than 100 parts per million for gasoline-range organics is stored in a controlled soil reuse lot (Chevron Data Transmittal #87, 2014). Non-hazardous soil would be reused on-site or would be sent off-site as a designated waste,[14] as required by regulations.

Other hazardous wastes generated during the construction efforts are managed using Chevron's routine waste management process. The generator in the field supplies the hazardous waste team with the source of the waste, the type of waste, and the anticipated volume. The hazardous waste team deploys the appropriate container and labeling. When the container is filled, the hazardous waste team arranges for removal of the container, sampling of the waste, and shipment of the waste off-site for disposal at the appropriate disposal facility (Chevron Data Transmittal #87, 2014).

The Facility has three primary hazardous waste storage areas that are used for storage of bins and drums stored for less than 90 days. Modernization Project wastes anticipated to be stored at those locations are primarily contaminated soil, industrial debris, hydrocarbon contaminated wood, and brick from excavations.

In addition to the Project wastes, these same waste storage sites are used to store routine waste streams and waste streams generated from maintenance activities. The other types of wastes can include spent catalysts, primary sludge (F037), asbestos, used oil, activated carbon and drummed wastes from the maintenance shops. Demolition debris would be stored separately in a designated laydown area prior to being hauled off-site, or be hauled directly off-site from the Modernization Project site (Chevron Data Transmittal #87, 2014).

Construction and demolition activities would be conducted under the listed waste management programs and regulatory constraints above, which are geared to protect both on-site workers and the off-site public. Based on the information above, and Chevron's continued obligation to comply with existing regulatory requirements, the impacts to the public and the environment from the disposal of hazardous wastes and materials would be less than significant after the implementation of the following mitigation measures during construction and demolition activities of the Modernization Project:

[14] According to California Water Code Section 13173, a "designated waste" refers to either: (1) hazardous waste that has been granted a variance from hazardous waste management requirements pursuant to Section 25143 of the HSC; or (2) nonhazardous waste that consists of, or contains, pollutants that, under ambient environmental conditions at a waste management unit, could be released in concentrations exceeding applicable water quality objectives or that could reasonably be expected to affect beneficial uses of the waters of the state as contained in the appropriate state water quality control plan.

Mitigation Measure 4.13-3a: Demolition and other construction wastes, and hazardous wastes, must be stored only in Facility locations approved by the City.

Mitigation Measure 4.13-3b: Hazardous wastes must be transported off-site to an authorized disposal, treatment, or recycling facility by a transportation company with appropriate federal and state transporter licenses within 90 days after the wastes are generated.

Mitigation Measure 4.13-3c: Non-hazardous demolition and construction waste must be transported off-site to an authorized disposal, recycling, or reuse facility by a transportation company with required transporter licenses within 180 days after the wastes are generated.

4.13.4.1.1.1 *Operational Activities*

Impact 4.13-4: Additional quantities of hazardous materials would be used and hazardous wastes generated, during the operation of the Modernization Project relative to the Baseline; however, no new types of hazardous materials would be introduced and no new types of hazardous wastes would be generated. With mitigation, the additional quantities of hazardous materials being managed and hazardous waste generated during Modernization Project operations would have a less-than-significant impact. (LTS after Mitigation)

4.13.4.1.1.2 *Hazardous Materials Stored*

As discussed in *Section 4.13.2.4.1.1,* the 2013 RMP[15] shows that the following EHS are generated or used at the Facility, and the potential for accidental release of these substances to the environment is evaluated in Chevron's 2013 RMP:

- H_2S.
- Anhydrous NH_3.
- Flammable substances (e.g., hydrocarbons and hydrogen).
- Sulfuric acid mixed with hydrocarbons.

As described in *Chapter 3, Project Description*, the Modernization Project would result in new and modified equipment that would result in the presence of additional quantities of some of the EHS currently used at the Facility, but would not introduce any new types of EHS. Similarly, the Modernization Project would

[15] The current versions of RMPs are available at the City of Richmond library, with the exception of the off-site consequence analysis sections, which are extracted due to the potential for security risks. Off-site consequences analysis section may be viewed upon appointment at the Contra Costa Hazardous Materials Programs Office in Martinez.

result in the presence of additional quantities of hazardous substances (those not identified by regulations as "extremely" or "acutely" hazardous) at the Facility. Although the Modernization Project contemplates an increase in Facility utilization, this change does not have a significant bearing on the quantities of hazardous materials at the Facility as the tank farm storage capacity for crude oil, gas oil, and products is not changing with the Modernization Project. Therefore, the Project would not cause an increase in the average amount of crude oil, gas oil, or product stored on the Tank Farm Area. The average fill volume of a tank is a function of multiple factors, including but not limited to changes in market conditions, plant performance, and unplanned shutdowns. Higher utilization would only shorten the time period over which the tank can have imbalanced input and output rates (Chevron Data Transmittal #78, 2014).

However, according to Chevron (Chevron Data Transmittal #78, 2014), several new tanks are being constructed to store DEA, caustic, and liquid oxygen as part of the Project:

- One amine storage tank would be installed to store lean DEA with a capacity of 173,000 gallons.
- One amine storage tank would convert the use of an existing caustic tank (T-2400) to store fresh make-up DEA with a capacity of 73,000 gallons.
- One fresh caustic tank would be constructed at a capacity of 200,000 gallons
- One spent caustic tank would be constructed at a capacity of 400,000 gallons.
- Two liquid oxygen storage vessels would also be added at a total capacity of 30,000 gallons (15,000 gallons each).

Thus, as a result of the Modernization Project, the increase in DEA inventory from Baseline is approximately 3,100,000 pounds. The Baseline DEA inventory is approximately 2,500,000 pounds. The additional caustic is sodium hydroxide, which is already in use at the Facility (Chevron Data Transmittal #78, 2014). The new equipment used to store the materials would be assessed for hazards during revalidations of the Modernization Project component process hazard assessments as discussed at the end of this section.

A summary of the Baseline EHS maximum quantities from the covered processes in the 2013 RMP as compared to the incremental change in total quantities due to the Modernization Project is shown in Table 4.13-3. As shown in the table, the incremental additional quantities are a small percentage of the Baseline total storage capacity at the Facility. The quantities in Table 4.13-3 are maximum

storage quantities and are not dependent on throughput; therefore Facility utilization rates do not change these maximum storage amounts.

After the installation of Modernization Project components at the Facility is complete, a revised RMP and Safety Plan must be prepared and submitted in accordance with CalARP regulatory requirements and the RISO as described elsewhere in this section. These programs require that a PHA of the changed components be conducted. Before construction and operation of the new and modified equipment, Chevron would revalidate the PHAs for the new and modified units as described in its Modernization Project Reliability Program (*Appendix 4.13-PROG*) that would be required to be implemented as a condition of approval of the Modernization Project. The revalidated PHAs would be required to include inherently safer systems analyses, layers of protection analyses, and a damage mechanism review for the new and modified units. The revised RMP also requires a revised off-site consequence analysis of worst-case and alternative accidental release scenarios.[16] The expected changes in the quantities of acutely hazardous materials and the expected changes in risks at the Facility, as a result of the Modernization Project, can be estimated using conservative worst case assumptions as used in the 2013 RMP that was prepared for the entire Facility in 2013 and incorporating the changes that would occur as a result of the Modernization Project. This aspect is addressed in more detail below in *Section 4.13.4.2.3*.

Chevron is also required to comply with applicable federal, state, and local laws regarding safety, risk management, spill prevention, accident response, training, inspection, and notification requirements as applicable in existing regulatory programs including but not limited to CalARP, the RISO, Hazardous Materials Business Plan and inventory requirements, SPCC requirements, and Facility Response Plan requirements.

Given the regulatory compliance obligations in conjunction with the plans and programs listed above, as well as revisions to the Facility's safety programs enhanced after the August 6, 2012 fire (as described above), which are geared to

[16] Off-site consequence analyses provide the federal, state, and local governments, as well as the public, with information about the potential consequences that could result from a chemical release at a facility. Off-site consequence analyses consist of both a worst-case release scenario and alternative release scenarios. A worst-case scenario is defined by the EPA as "the release of the largest quantity of a regulated substance from a single vessel or process line failure that results in the greatest distance to an endpoint" or, alternatively, "the distance a toxic vapor cloud, heat from a fire, or blast waves from an explosion will travel before dissipating to the point that serious injuries from short-term exposure will no longer occur" (EPA, 2009).

TABLE 4.13-3 CHANGES IN EHS STORAGE AT FACILITY

EHS Inventory	Baseline[a] (pounds)	Project Incremental Change (pounds)	% of Baseline Total Based on Net
H_2S	20,350	846 (Project inventory increase) -5,300 (due to decreased concentration in FCC FHT) Net: -4,454	-21.9%
Anhydrous NH_3	2,545,130	3,270 (Project inventory increase) -1,200 (from shutdown of hydrogen trains) Net: 2,070	0.08%
Flammable Substances (e.g., hydrogen and hydrocarbons)	105,840,600	420 (natural gas) 3,500 (other flammables) 40,000 (Praxair flammables) –12,000 (from old hydrogen plant) Net: 31,920	0.03%
Sulfuric Acid[b]	5,800,000	0	0%

[a] The Baseline amounts of the EHS are from Table 1-1 of the 2013 RMP, which shows the maximum quantity in process in the various Facility processes. According to Chevron, these values are representative of the maximum inventories during the 2008-2010 baseline period.

[b] According to Chevron, process units containing sulfuric acid mixed with hydrocarbons would not be physically modified, therefore the largest containments of sulfuric acid at the Facility would not change.

Source: RTKNet, 2013; Chevron Data Transmittals #78, 2014 and #87, 2014.

protect both on-site workers and the public in the vicinity of the Facility, the impacts to the public from the increases in hazardous materials quantities resulting from the Modernization Project's operations would be less than significant after the implementation of the mitigation measures listed below:

Mitigation Measure 4.13-4a: Chevron will implement its Modernization Project Reliability Program (*Appendix 4.13-PROG*) including updating the detailed PHAs prepared for the 2008 Project for all new and modified Modernization Project components, which shall include ISSAs, damage mechanism reviews, and evaluation of the consequences thereof resulting from the Project, and LOPA, as part of these PHAs, prior to recommencement of construction of the Modernization Project, and again post-construction but before startup of Project operations for any changes that arise during construction that may affect the earlier PHAs, ISSAs, and LOPAs. Chevron will notify CCHS and the City of the availability of these PHAs, and make these PHAs available for review by CCHS and the City**.** The PHAs (initial and updates/revalidations), ISSAs, damage mechanisms reviews, and LOPAs shall

be consistent with (proposed) amendments to the RISO. Chevron shall conduct the LOPAs and submit written LOPA reports, prepared in accordance with industry best practices (such as those issued by the Center for Chemical Process Safety) to CCHS and the City for review prior to construction (and post-construction, for those LOPAs warranting changes based on changes that arise during construction). CCHS will work with the City in implementing these and other Public Safety mitigation measures.

Mitigation Measure 4.13-4b: Chevron will submit to CCHS a revised RMP and Safety Plan for the modified and new equipment at the Facility, and shall cause a revised RMP and Safety Plan to be submitted by the operator of the new hydrogen plant, in accordance with the timing and other requirements established in the applicable regulations. The revised RMPs and Safety Plans shall be submitted by the earlier of: 1) prior to operations; and 2) timing requirements under applicable regulations. The revised RMPs and Safety Plans shall reflect integration of ISSA, including consideration of damage mechanisms and evaluation of the consequences thereof resulting from the changes, as well as the LOPAs, conducted as a part of PHAs (initial and PHA updates/revalidations), consistent with (proposed) amendments to the RISO. The RMPs must include all required components, including but not limited to a revised "off-site consequence" analysis of worst case and alternate scenarios (EPA, 2009), a revised accident prevention and training program, pre-startup safety reviews and prescribe training and safety requirements for contractors conducting hot work and other designated types of activities. The RMPs must cover accident risks that have been identified in the Project-related PHAs, including inherently safer systems analyses conducted as a part of Project-related PHAs and management of change procedures. Chevron will report to the City acceptance of these plans by the CCHS prior to start-up of Modernization Project operations.

Mitigation Measure 4.13-4c: Chevron will submit an amended hazardous materials business plan to CCHSHMP via the California Environmental Reporting System (CERS) consistent with the timing requirements of the applicable regulations. Chevron shall cause to be submitted by the operator of the hydrogen plant an amended hazardous materials business plan to CCHSHMP. The amendments will reflect the modified and new equipment at the Facility, including the hydrogen plant. Chevron will provide written confirmation to the City of CCHSHMP's acceptance of the amended plans.

Mitigation Measure 4.13-4d: Chevron will revise the Facility's SPCC Plans and Facility ERPs consistent with the timing requirements of the applicable regulations, and shall cause the SPCC and ERPs for the hydrogen plant to be

updated as well. Plan revisions must address the modified and new equipment at the Facility including the hydrogen plant. Chevron shall make the plans available for review upon request by CCHSHMP and EPA.

4.13.4.1.1.3 *Hazardous Waste Generated*

Petroleum refining operations inherently involve the routine use of hazardous materials, often resulting in routine generation of hazardous waste. Because the Modernization Project would involve mainly replacement units that would perform identical or similar functions while using more modern technologies and design standards, the waste streams generated from the new units would be very similar to those currently generated. Thus, there would be no new types of hazardous wastes generated. However, the quantities of some hazardous wastes would change. Table 4.13-4 summarizes the total quantities of hazardous wastes generated, by processes and equipment, which would be modified with the Modernization Project during the Baseline, as well as post-Project, and the incremental difference resulting from the Modernization Project. The values in Table 4.13-4 represent maximum projections, accounting for increases in Facility utilization where it would have a bearing on the quantity of hazardous waste generated.

Changes in hazardous waste generation rates resulting from the Modernization Project operation generally would fall into two categories, spent catalysts and elimination of MEA and discussed further below.

4.13.4.1.1.3.1 *Spent Catalysts*

Substances that increase the rate at which a chemical reaction takes place are called catalysts; catalysts themselves do not undergo any permanent chemical alterations during the reaction. In the Facility, catalysts are added to enhance the chemical reactions that occur in specific units. Average generation rates for spent catalysts are primarily dependent upon two factors—the amount of catalyst relative to the amount of other chemical reaction components and catalyst life.

The generation rates for spent catalyst waste are anticipated to change as a result of the new hydrogen plant.

- **Hydrogen plant spent catalysts**. Two components of the existing hydrogen plant, the low-temperature shift converter, and the methanator and their catalysts, are eliminated in the new hydrogen plant design. However, the inventory of the two hydrodesulfurization vessel catalysts is larger in the new units, and one of these catalysts must be replaced at a more frequent interval. Catalyst usage for selective catalytic reduction systems is higher due to larger furnaces and because both hydrogen trains would use selective

catalytic reduction (vs. only one of the existing trains). Given these considerations, Chevron expects the replacement of the new hydrogen plant to result in an estimated net increase of 166 tons per year in generation of spent catalyst as shown in Table 4.13-4.

- **Other spent catalysts**. The lives of several other fixed-bed catalysts or catalysts used in fixed-bed reactors (e.g., hydrocracker, lube oil hydrocrackers and finishers) could be increased slightly due to improved hydrogen purity, while catalyst life at the FCC FHT could be reduced slightly due to higher throughput. Based on information provided by Chevron, there is likely very little change in catalyst life and in disposal methods of spent catalyst. Chevron projects an increase in generation of spent FCC FHT catalyst of 417 to 517 tons per year with the Modernization Project as shown in Table 4.13-4.

All precious metal catalysts are sent off-site for metals reclamation. Recovered metals can include platinum, rhodium, palladium, and rhenium. Non-precious metals catalysts are evaluated on a case-by-case basis and the majority of spent catalysts are sent out for metals reclamation. The majority of catalysts are reclaimed for the nickel, molybdenum, vanadium, cobalt, copper, and zinc. Treatment charges, metal credit, and the additional transportation charges to get the material to the reclaiming facilities are the variables considered when evaluating the management method for spent catalyst. Disposal at a secure landfill that is licensed to accept these wastes is an appropriate option if a catalyst does not meet the minimum metal concentrations required by the reclamation facility.

4.13.4.1.1.3.2 *Elimination of Monoethanolamine*

An important environmental benefit of the Modernization Project is the elimination of the use of the amine solvent MEA that has been used at the existing hydrogen plant to separate hydrogen from CO_2. In the new hydrogen plant, the hydrogen–CO_2 separation would occur through the use of pressure swing adsorption, which is a solvent-free process. Based on Chevron-provided data for the baseline period (2008 to 2010), the Facility generated an average of 149 tons per year of spent MEA (Chevron Data Transmittal #78, 2014). As a result of the Modernization Project, it is expected that this MEA waste stream would be eliminated.

TABLE 4.13-4 HAZARDOUS WASTE AND RECYCLED MATERIAL GENERATION

Hazardous Waste/Recycled Material Generation[a]	Baseline[b] (tons/year)	Post-Modernization Project (tons/year)	Change (tons/year)
Spent Hydrogen Plant Catalyst	34	200	166
FCC FHT Catalyst	783	1,200 to 1,300	417 to 517
MEA and MEA-contaminated Material	149	0	-149
Total – Existing / Project / Difference	**966**	**1,400 to 1,500**	**434 to 534**

[a] For spent catalyst hazardous waste originating from plants other than the hydrogen plant, the increases in plant feed rates post-Project are not large enough to significantly change the annual hazardous waste generation of spent catalyst. This is because catalyst life is almost always on the order of multiple years and the Modernization Project enables higher purity hydrogen, which increases catalyst life (Speight, 2006). The exception to this is at the FCC FHT, where historically catalyst life is shorter (about a year) due to higher sulfur, nitrogen and metals in the feedstock, its Title V feed limit would increase as a result of the Modernization Project, its feed would increase in sulfur as a result of the Modernization Project, and its feed rate is stated to more than double in the post-Project case; therefore an increase generation in post Modernization Project conditions is shown in this table for the 93% to 100% Utilization Scenarios. The other hydrotreaters are also stated to have a throughput increase and see sulfur changes, but the throughput increases are much smaller and the decreasing effect on catalyst life is expected to be largely offset by the effect of higher hydrogen purity, which extends catalyst life.

[b] The Baseline annual value is based strictly on the average Baseline years (2008 through 2010) and was not coincident with all catalyst change outs because of the frequency of the change outs. For example, a 5-year catalyst change out may not show up in the 2008-2010 Baseline if the first change out occurred in 2007. Therefore, the change in hazardous waste and recycled material generation is an overstatement. Nevertheless, as indicated by the non-zero value, there was a catalyst changeout for the hydrogen plant in the baseline period.

[c] The Baseline annual value is based strictly on the average Baseline years (2008 through 2010).

Source: Chevron Richmond, Attachment 3 – Hazardous Waste Data for Table 4.13-4 (Chevron Data Transmittal #78, 2014).

Given the above, the impacts to the public and environment from the increases in hazardous waste generated during Modernization Project operation would be less than significant after the application of the mitigation measures listed below:

Mitigation Measure 4.13-4e: For the additional catalyst identified in Table 4.13-4 (at hydrogen plant and FCC FHT), Chevron will either send spent catalyst for metal reclamation or dispose of the spent catalyst that cannot be reclaimed to a secure and licensed facility. Chevron will maintain records on the amount of catalyst sent for reclamation and for disposal and report to the City annually on these amounts.

Mitigation Measure 4.13-4f: Chevron shall ensure, through its contractual arrangements with Praxair, that Praxair will comply with all mitigation measures in this EIR as they pertain to the new hydrogen plant, and shall require Praxair to cooperate with Chevron as needed to ensure the mitigation measures with regard to the hydrogen plant are effectively implemented. Prior to construction of the new hydrogen plant, Chevron shall provide to the City and County documentation reflecting that these requirements are included in contractual agreements between Chevron and Praxair.

4.13.4.1.1.4 *Hazardous Materials and Hazardous Waste Transported*

Impact 4.13-5: Additional quantities of hazardous materials and wastes would be transported during the operation of the Modernization Project relative to the Baseline; however, no new types of hazardous materials or wastes would be transported, nor is the acceptance of crude oil by rail being authorized as part of the Modernization Project. This would be a less-than-significant impact after mitigation. (LTS after Mitigation)

As described above, because the Modernization Project would involve mainly replacement units that would perform identical or similar functions using more modern technologies, the hazardous materials used and the hazardous waste streams generated from the new units would be very similar to those currently used and generated, respectively. Thus, there would be no new types of hazardous materials used or hazardous wastes generated that would be transported after the Modernization Project. There would only be increased quantities of some hazardous materials and wastes, which would result in increases in transport of materials by ship/barge, rail, and truck. In addition, as described above, the type of waste that would be increased (solid spent catalyst) would be much less hazardous than the liquid spent MEA waste stream currently being generated and which would be eliminated with the Project; therefore, the consequences of an accidental spill of the solid catalyst waste during transport would be less than a liquid spill of MEA.

Hazardous waste handling and disposal requirements are discussed in *Sections 4.13.2.3* and *4.13.2.4.1*. There have been two minor incidents involving hazardous waste storage areas since the 2008 EIR: one in February 2010 in a two-yard hazardous waste industrial debris bin, and one in November 2011 in a contractor equipment storage and field office area. There have been no incidents related to hazardous waste transportation or disposal since the 2008 EIR (Chevron Data Transmittal #87, 2014). The regulatory mandates discussed in these sections, in combination with improvements made to Chevron's safety, emergency response, training, and management programs since the August 6, 2012 fire and mitigation measures set forth in this EIR, would collectively serve

to improve overall Facility safety and reduce the potential risks of accidental releases resulting from hazardous materials and hazardous waste storage, collection, transportation, and disposal activities at the Facility.

Section 4.13.2.3 and *Appendix 4.13-DET,* describe the transportation-related safety regulations that Chevron currently adheres to, including DOT and CHP requirements. The following sections address the transport of hazardous materials by shipping, rail, and trucking.

4.13.4.1.1.4.1 *Shipping*

As discussed in *Section 4.3, Air Quality*, the Facility imports crude oil, gas oil and some blendstocks and exports a portion of its transportation fuels and some gas oil, blendstocks, and baseoils via ships and barges (the rest is exported via rail, truck, or pipeline) as described in *Section 4.0.3.3.4*. This waterborne transport includes self-propelled ocean-going vessels (i.e., tanker ships) and vessels that are not self-propelled (i.e., barges) that dock at Chevron's Long Wharf and unload and/or load liquid materials over the dock. Shipping would change with the Facility utilization rate as the amount of feedstock entering the Facility and the amount of product leaving the Facility would be different. As the utilization of the Facility increases, the amount of feedstocks, blendstocks, and products being pumped at the Long Wharf and associated number of vessels needed to transport these materials also increases.

Total crude and gas oil volumes for the Modernization Project were estimated using the Unit Rate Model, as described in *Appendix 4.3-URM*. The Modernization Project assumes an increase over Baseline in cutter and light product discharges. For the Modernization Project, two Facility utilization rates using Basrah + Arab Light crude blend with and without hydrogen export were considered: 93% Utilization Scenario and 100% Utilization Scenario. In addition, the Lightest/Max Shipping crude blend at 93% Utilization and 100% Utilization with and without hydrogen export were considered in *Section 4.3, Air Quality*. The result of these evaluations show shipping increases for the Modernization Project are primarily related to Facility utilization; therefore ship and barge calls at the Long Wharf would increase as utilization increases. Details on the increase in number of calls are shown in *Appendix 4.3-SHP*.

Thus, there could be an increase in the number of ships and barges carrying flammable materials that call on the Long Wharf as a result of the Modernization Project. The Long Wharf EIR assessed the potential impacts from anticipated shipping activity at the Long Wharf and included assessments related to Public Safety (Chambers Group, Inc., 2006, 2007). These assessments evaluated

activities at the Long Wharf, in the Bay, and outer coast and included the following:

- Potential for fires, explosions, releases of flammable or toxic materials, or other accidents or upsets from the terminal or from vessels calling at the terminal that could cause injury or death to members of the public.
- Response capability for fires or explosions.
- Spill response capability and potential for public risk at the Long Wharf.
- Whether existing and proposed emergency response capabilities are not adequate to effectively mitigate spills and other accident conditions.

The approved Long Wharf Final EIR contained several mitigation measures to protect public safety based on the analysis described above (Chambers Group, Inc., 2006, 2007). These mitigation measures include the following, all of which remain applicable and would also be included in the Modernization Project Mitigation Monitoring and Reporting Program:

OS-3b. Install tension-monitoring devices at Berth 1 to monitor mooring lines and avoid excessive tension or slack conditions that could result in spills. An alarm system (visual and sound) that incorporates communication to the control-building operator shall also be a part of the system. In addition, if any vessel drifts (surge or sway) more than 7 feet from its normal manifold or loading arm position at any other terminal berth, Chevron shall install, within 6 months after the incident, tension-monitoring devices at such berth.

OS-3c. Install Allision Avoidance System at the terminal to prevent damage to the pier and/or vessel during docking operations. Prior to implementing this measure, Chevron shall consult with the San Francisco Bar Pilots, the U.S. Coast Guard, and the staff of the California State Lands Commission (CSLC) and provide information that would allow the CSLC to determine, on the basis of such consultations and information regarding the nature, extent and adequacy of the existing berthing system, the most appropriate application and timing of an Allision Avoidance System at the Chevron Long Wharf.

OS 4. Chevron shall confer with the CSLC regarding Group V oil spill response technology, including potential new response equipment and techniques that may be applicable for use at the Long Wharf. Chevron shall work with the CSLC in applying these new technologies, as agreed upon, if recommended for this facility.

OS-6b. Chevron shall develop a set of procedures and conduct training and drills for dealing with tank vessel fires and explosions for tankers berthed at the Long Wharf. The procedures should include the steps to follow in the event of a tank vessel fire and describe how Chevron and the vessel will coordinate activities. The procedures shall also identify other capabilities that can be procured if necessary in the event of a major incident. The procedures shall be submitted to the U.S. Coast Guard and California State Lands Commission within 90 days of lease renewal.

OS-7a. Chevron shall participate in an analysis to determine the adequacy of the existing vessel traffic service in the Bay Area, if such a study is conducted by a federal, state, or local agency during the life of the lease. Agencies such as the San Francisco Bay Harbor Safety Committee often conduct studies of safety issues within the Bay Area. As vessel traffic increases in and around the Bay Area and as technology improves, it may be necessary and feasible to upgrade and expand the vessel traffic service in and around the Bay Area. Chevron shall participate in this analysis and contribute a pro-rata share toward the upgrade and expansion of the system, if required to do so by the CSLC.

OS-7b. Chevron shall respond to any spill from a vessel traveling to or from the wharf, moored at its wharf, related in any way to the wharf, or carrying cargo owned by Chevron, as if it were its own, without assuming liability, until such time as the vessel's response organization can take over management of the response actions in a coordinated manner.

OS-9b. Mitigation for pipelines includes that presented in MM GEO-8, adhering to proper engineering design, inspection, maintenance, and retrofitting.

Given the assessments and conclusions of the Long Wharf EIR, the impacts from the transportation of hazardous materials via ships and barges for the Modernization Project would be less than significant if the mitigations specified in the Long Wharf Final EIR continue to be implemented.

4.13.4.1.1.4.2 *Rail*

As discussed in *Appendix 4.3-TRANS*, certain materials are transported by rail to and from the Facility. Materials transported by rail include LPGs, lubricant baseoils, lubricants, lubricant additives, and NH_3. During the baseline period and years since, the Facility did not receive gas oils or crude oil by rail. Chevron has attested that in order to receive crude or gas oils by rail, the Facility would at a minimum require equipment additions and/or modifications that are not part of

the Modernization Project, and that it has no plans to pursue a project that would enable it to import crude or gas oil by rail. Thus, the Facility would not receive gas oils or crude oil by rail as a result of the Modernization Project (Chevron Data Transmittal #36G, 2013).

Though crude oil and gas oil are not transported by rail, the Facility throughput directly affects the quantity of material needed (i.e., LPG and additives) and produced (i.e., LPG, lubes, and NH_3), which are transported to and from the Facility by rail. The increased hydrogen plant utilization that is considered as part of the Modernization Project would not impact rail or trucking activities, as discussed in *Appendix 4.3-TRANS*. As shown in Table AQ-TRANS-1, the Modernization Project would result in about a 7% increase in locomotive trips with the 93% Utilization Scenario up to a 15% increase with the 100% Utilization Scenario. Transport of the materials by rail is regulated under DOT regulations as discussed in *Appendix 4.13-DET*.

4.13.4.1.1.4.3 *Trucking*

Current operations at the Facility include on-road mobile sources such as propane and other chemicals delivery trucks, and sulfur, sodium bisulfite, products, and solid and hazardous wastes shipment trucks. Trucking for the Modernization Project are impacted both by the increase that would result from the change from Baseline utilization to a reasonably foreseeable utilization, and by the processing of a wider variety of fuels, such as sulfur produced by the Facility and removed by trucking. In addition to increasing the trucking to account for the increase in Facility utilization, additional trucks are considered for the additional sulfur produced by the Facility. Similar to the rail analysis, the increased hydrogen plant utilization that is considered as the Modernization Project would not impact trucking activities, as discussed in AQ-TRANS. As shown in Tables AQ-TRANS-13 and AQ-TRANS-14 (tables for Baseline and Project activities), respectively, the Modernization Project would result in 20% increase with the 93% Utilization Scenario in truck trips up to a 30% increase with the 100% Utilization Scenario.

Note that some of the truck trips that increase with the Modernization Project would be for the transport of the additional sulfur removed by the Project (up to 900 tons per day). Sulfur is a non-metallic chemical element that is bright yellow in color and is a solid at room temperature and pressure. In order to facilitate loading and unloading, sulfur is heated into a molten state at the Facility and shipped in its molten state. While molten or solid sulfur is not regulated as an EHS, its Material Safety Data Sheet (Chevron, 2013a) does indicate that it can ignite and burn at temperatures exceeding the flash point and that it can give off

vapors due to reaction including H_2S. Transport of the sulfur by truck is regulated under DOT regulations as discussed in *Appendix 4.13-DET.*

Chevron and transporters serving the Facility are also required to comply with applicable federal, state, and local laws regarding transportation safety (shipping, rail, trucking, and pipeline), including but not limited to mandates regarding training, inspection, notification, spill and leak reporting, safety, risk management, spill prevention and cleanup, and accident reporting and response.

The Facility has maintained a good compliance record on transportation-related safety regulations and a good safety record on transportation incidents. Based on the information above, and Chevron's continued obligation to comply with existing transportation mandates, the impacts from transportation of hazardous materials and wastes would be less than significant with the mitigation specified below:

Mitigation Measure 4.13-5a: Chevron is required to continue to implement the following mitigations from the Long Wharf EIR (Chambers Group, Inc., 2006, 2007): OS-3b,c; OS-4; OS-6b; and OS-7a,b.

Mitigation Measure 4.13-5b: Implement Mitigation Measure 4.13-4d.

Mitigation Measure 4.13-5c: All spills and releases of hazardous materials or hazardous waste to the environment, including those from the transportation of these materials, must be reported within 48 hours to the City, and to the other appropriate regulatory agencies in accordance with the timing and other notification and reporting requirements prescribed by the applicable laws and regulations. Prompt cleanup of all such spills is also required.

4.13.4.2 Assessment of Reasonably Foreseeable Upset and Accident Conditions

(B) Would the Modernization Project create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

One of the causal factors in the August 6, 2012 fire was a piping component that failed as a result of high-temperature sulfidation corrosion, which was accelerated by the low-silicon content of the pipe. High-temperature sulfidation corrosion is a damage mechanism at refineries in pipes and vessels where sulfur is present at high temperatures. Given the conditions that led to the August 6, 2012 fire and the fact that the Modernization Project proposes to increase the

sulfur content of crude oil inputs at the Facility, the potential impacts to public safety resulting from the Modernization Project could be significant if not mitigated. This section further analyzes these potential impacts to public safety that could result from the Modernization Project.

Noncompliance with applicable regulations or generally accepted petroleum industry practices or design codes would indicate a potential for significant hazards to members of the public off-site as well as workers on-site. Hence, the Modernization Project would have a potentially significant adverse impact to public safety under this criterion if it would:

- Be in noncompliance with any design code or regulation including but not limited to applicable building and fire code standards;
- Be in nonconformance with applicable federal, state, BAAQMD, or local laws, regulations, ordinances, or standards relating to public health or safety, including but not limited to those relating to the accidental or planned release of any hazardous material to the environment; or
- Be in nonconformance with any adopted industry standard.

The Modernization Project includes changes in physical facilities, operations, and feedstocks compared to existing conditions. Existing conditions are reflected in the CalARP RMP that was prepared for the Facility in February 2013 (Chevron, 2013d) based on the characteristics of the feedstocks, blendstocks, and products represented in the baseline period operations (Chevron Data Transmittal #87, 2014).

An impact from an explosion or fire would be considered significant if the significance thresholds for blast and thermal impacts, as defined by the RMP Guidelines as a level of concern, would be exceeded (EPA, 2009). For toxic chemicals, an impact would be significant if the off-site concentration, or "toxic endpoint," from an accidental release would exceed the concentrations outlined in the CalARP regulations (OES, 2004).

The analysis of potential impacts to public safety resulting from the Modernization Project involves evaluation of three fundamental considerations: (1) conformance of Modernization Project's physical changes with applicable regulations, codes, and generally accepted petroleum industry practices; (2) changes in potential risk of damage to process equipment, and therefore likelihood of upsets, due to Modernization Project operational and feedstock changes; and (3) the potential severity of impacts assuming an accidental release of Modernization Project-related storage of acutely hazardous substances.

4.13.4.2.1 *Project Physical Changes*

Impact 4.13-6: The Modernization Project's physical changes could increase the risks of accidental releases of acutely hazardous substances. As mitigated, this impact would be reduced to less than significant. (LTS after Mitigation)

The Facility is subject to, or voluntarily follows, a vast array of codes and industry standards for purposes of construction and ongoing operations and maintenance.

4.13.4.2.1.1 *Application of the California Building Code*

All construction at the Facility has to comply with the CBC, Title 24 of the CCR, which has been adopted and incorporated by the City in Chapter 6.02 of the RMC.

- State law (HSC Section 18901) provides that the CBC are the minimum standards applicable to all "occupancies," i.e., all buildings and structures, in the state.
- The California Building Standards Commission adopts these technical codes based on input from expert agencies, and reviews and amends the codes on a regular cycle (CBSC, 2013).
- Local agencies such as Richmond may amend the CBC to provide more restrictive standards provided the agency makes express findings that amendments are necessary because of local climatic, geological or topographical conditions. Amendments are not effective until copies of both the express findings and the amendments have been filed with the California Building Standards Commission.

The CBC includes multiple technical codes, divided into "Parts," which are periodically updated. The CBC parts applicable to the Modernization Project include:

- The CBC, codified at 24 CCR Part 2, which regulates demolition and repair of buildings and structures.
- The CFC, codified at 24 CCR Part 9, which regulates structures, processes, premises and safeguards concerning, among other things, the "hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices" (CFC Section 101.2.1).
- The California Electrical Code (24 CCR Part 3) and the California Mechanical Code (24 CCR Part 4) are also applicable.

The installation of "process piping," i.e., the piping in the Facility through which crude oil blends and gas oil flows, is regulated in two ways:

- Support structures for the piping systems require a building permit pursuant to the CBC. A building permit must be obtained from the City's Building Official for all such work under the CBC (CBC Section 3405.1).
- The selection of the materials for process piping and the design of the piping system requires fire construction permits pursuant to CFC Sections 105.1 (General), 105.1.2.2 (Construction Permit), 105.7 (Required construction permits), and 105.7.7 (Flammable and Combustible Liquids). The "fire code official," which in Richmond is the Fire Marshal, is responsible for reviewing and issuing fire construction permits.

4.13.4.2.1.2 *Technical Standards of the California Fire Code*

In reviewing and issuing fire construction permits, the Fire Marshal must determine whether the proposed process piping systems comply with the general provisions of the CFC, as well as technical standards that are incorporated into the code as set forth in CFC Chapter 47 – Referenced Standards. The general provisions applicable to storage, dispensing, use and handling of hazardous materials, including combustible liquids and flammable solids, liquids, and gases, are codified in CFC Chapter 27. Section 2703.2.2.2 of this chapter provides that supply piping for these materials "shall be in accordance with ASME [American Society of Mechanical Engineers] B31.3."[17]

"ASME B31.3 – Process Piping" sets forth the engineering requirements deemed necessary for the safe design and construction of process piping typically found in petroleum refineries; chemical, pharmaceutical, textile, paper, semiconductor, and cryogenic plants; and related processing plants and terminals. ASME B31.3 sets forth, among other things:

- References to acceptable material specifications and component standards, including dimensional requirements and pressure–temperature ratings.

[17] ASME standards are promulgated in accordance with ANSI protocols. This is a rigorous, public process which brings together technical expertise from all sectors (e.g., industry, government, nongovernmental organization, education) to formulate technical standards for specific subject areas (ASME, 2014). The Committee for ASME B31.3 is a continuing one, and keeps all sections current with new developments in materials, construction, and industrial practice. New editions are published at intervals of 2 years. (The history of ASME B31, as well as process used by the B.31.3 Committee to develop and publish the standards, is discussed in further detail in the Forward and Introduction to ASME B.31.3.)

- Requirements for design of components and assemblies, including piping supports.
- Requirements and data for evaluation and limitation of stresses, reactions, and movements associated with pressure, temperature changes, and other forces.
- Guidance and limitations on the selection and application of materials, components, and joining methods.
- Requirements for the fabrication, assembly, and erection of piping.
- Requirements for examination, inspection, and testing of piping.

In conjunction with CFC Chapter 27, CFC Chapter 34 – Flammable and Combustible Liquids, sets forth the requirements for prevention, control and mitigation of dangerous conditions related to storage, use, dispensing, mixing and handling of flammable and combustible liquids. Section 3403.6.2 – Design, fabrication and installation of piping systems and components, provides that "piping system components shall be designed and fabricated in accordance with the applicable standard listed in Chapter 27 of NFPA 30."[18]

"NFPA 30 – Flammable and Combustible Liquids Code" sets forth the fundamental safeguards for the storage, handling, and use of flammable and combustible liquids. Chapter 27 – Piping Systems, applies to the design, installation, testing, operation, and maintenance of piping systems for flammable and combustible liquids or vapors, and Section 27.4.1 – Materials Specifications, provides that pipe and other materials used in piping systems "shall meet the material specifications and pressure and temperature limitations of ASME B31." NFPA 30 also provides standards for the installation of piping systems (Section 27.6) and the testing of piping systems (Section 27.7).

There are numerous other standards and codes incorporated into the CFC as set forth in CFC Chapter 47, including certain API standards.[19]

[18] The NFPA is an international organization that develops scientifically based consensus codes and standards, research, and education for fire and related safety issues. All NFPA standards are developed in accordance with standards-making protocols requiring a full, open, consensus-based process that brings together technical expertise from various fields to develop, revise and update standards on during a 3- to 5-year revision cycle (NFPA, 2014).

[19] API Recommended Practice 939-C – Guidelines for Avoiding Sulfidation (Sulfidic) Corrosion Failures in Oil Refineries, is not one of the standards incorporated into the CFC; nor is API Recommended Practice 580 – Risk-Based Inspections or API 581 Recommended Practice – Risk-Based Inspection and Damage Mechanisms. These recommended practices are applied voluntarily by the industry or, in some instances, incorporated into Cal/OSHA's PSM regulations, as discussed in *Section 4.13.2*.

4.13.4.2.1.3 *Scope of Fire Marshal Review and Approval of Permits*

When the Fire Marshal reviews and issues fire construction permits pursuant to the CFC, the Fire Marshal is determining that the proposed process piping, including materials, complies with engineering (ASME B31.3) and fire-safety (NFPA 30) standards that have been promulgated and peer-reviewed by international standards organizations. In other words, the Fire Marshal is not determining in the first instance whether a proposed material is adequate for the proposed service from an engineering or fire-safety perspective. Rather, the Fire Marshal is confirming that a proposed material has been recognized as suitable for the proposed service in the applicable technical standards. The City of Richmond contracts with the County to provide assistance and support to the Fire Marshal.

4.13.4.2.1.4 *Ongoing and Future Code Compliance*

Following the City's 2008 approval of the Chevron Hydrogen and Energy Renewal Project and prior to the July 2009 court decision setting aside the 2008 EIR, construction commenced on various Modernization Project components. Since construction ceased in 2009, the CBC has undergone two revisions, the 2010 revisions, which took effect January 1, 2011, and the 2013 revisions, which took effect January 1, 2014. The 2010 revisions in particular included substantive amendments to the seismic standards, among other things. The CFC has also been updated, with the current 2013 CFC having taken effect on January 1, 2014. The 2013 CFC continues to follow the same process, and incorporates and relies upon the same technical standards, as discussed above.

Chevron is required by law to obtain building and fire construction permits for the Project, and the permits would only be issued by the City if the City determines that the Project meets code requirements in effect at the time the permits are issued. Given the above considerations, the impact from the physical changes included in the Modernization Project to public safety through increased risks of accidental releases of acutely hazardous substances would be less than significant if the following mitigation measures are implemented:

> Mitigation Measure 4.13-6: Prior to commencing construction, Chevron shall:
>
> 6a: For all Modernization Project new and modified equipment, including but not limited to the hydrogen plant, Chevron shall obtain new or amended building permits from the City's Building Department pursuant to City Building Code and CBC requirements in effect at the time the permits are issued.

6b: For all Modernization Project new and modified equipment, including but not limited to the hydrogen plant, that are subject to City of Richmond Fire Department permit requirements, Chevron shall obtain new or amended fire permits from the City of Richmond Fire Department pursuant to City Fire Code and the CFC requirements in effect at the time the permits are issued.

4.13.4.2.2 *Modernization Project Operational Changes*

Impact 4.13-7: The Modernization Project has the potential to increase the risk of accidental releases of acutely hazardous materials due to Modernization Project-related operational changes resulting in increases in sulfur content of feedstocks, increased hydrogen purity produced by the new hydrogen plant, and increased H_2S partial pressures in hydroprocessing plant's recycle stream. This would be a less-than-significant impact after mitigation. (LTS after Mitigation)

While potential exposures to hazardous substances can occur during deviations from routine operations such as shutdowns or maintenance work; these types of accidental exposures, if they occur, are often localized to on-site employees. However, accidental releases can also occur during routine operations if damage or degradation of equipment occurs that results in a loss of equipment function or a pressure boundary release to the atmosphere (e.g., breach of a pipe or equipment wall).

A refinery is made up of a complex array of processing units and equipment, including storage tanks, furnaces, distillation towers (fractionating columns), reactors, heat exchangers, pumps, pipes, fittings, and valves that are connected together by a network of pipes, including valves and fittings, through which crude oils and gas oils, intermediates, products and other hazardous materials are transported. These processing units and equipment are typically modern, and process operations are largely automated and completely enclosed. The risk of process accidents and releases of hazardous chemicals that result in exposures is generally low as a result of routine inspections and maintenance, compliance with regulatory requirements, and adherence to industry standards for design, construction, and operation. However, the potential for hazardous exposures always exists due to:

- The inherently hazardous nature of the crude oils, gas oils, intermediate component streams (i.e., crude and gas oil fractions at different stages of processing), products and other chemicals used in the refining process.
- Potentially hazardous process conditions.

- Degradation of process unit and equipment materials resulting from corrosion processes and other damage mechanisms associated with routine operations.

As discussed in *Section 4.13.2.2,* the Facility processes crude and gas oils that are inherently hazardous in nature. These crude and gas oils are composed of many different flammable and/or toxic hydrocarbons and varying amounts of other hazardous components such as sulfur, vanadium and arsenic compounds. During the refining process, crude and gas oils are separated into intermediate component streams that are further refined to produce final products (e.g., gasoline, diesel fuel, jet fuel, and lubricant oils, sulfur). Most, if not all of these component streams are hazardous, as are other chemicals (e.g., hydrogen, NH_3, sulfuric acid) added during the refining process.

The refining process also requires many units and components to operate under potentially hazardous process conditions, such as high temperatures and pressures. Chemical reactions associated with refining processes occur in many of these units, resulting in hazardous process conditions and generating chemical streams containing acids, salts and other hydrocarbons that can result in damage to equipment or process unit materials and piping, as described further below.

Damage or degradation of process unit equipment and piping at a refinery can occur during the processing of crude and gas oils, intermediates, products and other hazardous materials as a result of corrosion processes, cracking mechanisms and mechanical and metallurgical changes. The specific process by which damage or degradation of a material occurs is referred to as a "damage mechanism." Damage mechanisms occur as a result of degradation of a material through environmental interactions (e.g., loss of metal on the inside surface of a pipe due to a chemical reaction with sulfur constituents present in crude oils). The activity of damage mechanisms in a particular process unit depends on the process conditions, presence of specific types of chemicals or constituents in the process stream, and type(s) of materials of construction of equipment and piping. For instance, the types and concentrations of certain constituents in crude and gas oils (e.g., sulfur, nitrogen, heavy metals) and the environmental conditions (i.e., high temperatures or pressures, high flow rates) can influence whether damage or degradation occurs for a given material and the rate at which it occurs.

The API RP 571, "Damage Mechanisms Affecting Equipment in the Refining Industry" lists 66 of the most common damage mechanisms occurring in the

refining, petrochemical, pulp and paper and fossil utility industries (API, 2011a). For refineries, API RP 571 categorizes these damage mechanisms as follows:

- Mechanical and metallurgical failure.
- Uniform or localized loss of thickness.
- High-temperature corrosion.
- Environment assisted cracking.

4.13.4.2.2.1 *Modernization Project Reliability Analysis*

The Modernization Project results in operational and feedstock changes from existing operations that may result in additional damage mechanisms or increases in the activity of existing damage mechanisms associated with affected process units and associated equipment and piping. In order to understand potential impacts to public safety from the operational and feedstock changes that are part of the Modernization Project, a reliability review, including a damage mechanism review, was undertaken by Chevron to analyze the potential impacts that changes to Facility feedstocks and other operational changes associated with the Modernization Project would have on the mechanical integrity of process units potentially impacted by Modernization Project. In addition, the City retained technical experts to conduct an independent reliability analysis and damage mechanism evaluation of the Modernization Project changes.

The primary driving force for additional damage mechanisms or the increased severity of existing damage mechanisms is the planned increase in total sulfur content of purchased crude and supplemental gas oil feed to the Facility associated with the Project. Other changes that could result in additional damage mechanisms or increased activity of existing damage mechanisms include the construction of the new hydrogen plant, which could potentially add additional damage mechanisms or increase the activity of existing damage mechanisms by increasing the purity of hydrogen feed to several Facility units that use the hydrogen to process and reduce sulfur in sulfur containing hydrocarbons (e.g., hydroprocessing units). In addition, various physical changes or additions to accommodate the increased H_2S and ammonium bisulfide content in sour water and sour gas streams occurring in sulfur conversion (i.e., hydroprocessing) units could potentially result in additional damage mechanisms or increase the severity of existing damage mechanisms. The reliability analysis and methodology is described further below and in more detail in *Appendix 4.13-REL.*

4.13.4.2.2.1.1 *Modernization Project Reliability Analysis Methodology and Results*

The City's reliability analysis was conducted in order to determine the potential impacts associated with Modernization Project changes to feedstocks and other operations on the mechanical integrity of Facility process units. The reliability

analysis methodology was based on City's technical consultant's interviews with and review of information provided by Facility and Chevron Technical Department subject matter experts from several technical disciplines including Process Engineering, Technical Department Materials and Equipment Engineering, and refinery Materials Engineering personnel, with support from other departments, as needed. Based on discussions and interviews with Chevron personnel and review of relevant documents, the methodology for conducting the reliability analysis for the Modernization Project included the following steps:

1. Determine the post-Modernization Project operating conditions.
2. Identify the potential damage mechanisms that could result from the Modernization Project operating conditions, and identify the units and equipment that potentially would be impacted by these damage mechanisms.
3. Evaluate the potential impact of the identified damage mechanisms on fixed equipment, piping, and piping components under post-Modernization Project operating conditions.
4. Recommend measures to reduce the potential impacts of new or increased damage mechanism activity that could result from the Modernization Project.

The first step in the reliability analysis—identifying the post-Modernization Project operating conditions—was accomplished by conducting interviews with Chevron subject matter experts and collecting and reviewing relevant documentation containing information on feedstock qualities, process temperature and pressure changes, Modernization Project physical changes, changes in crude and gas oil sulfur content, increases in H_2S and ammonium bisulfide in sour water and sour gas streams and process monitoring tools. A description of the changes resulting from the Modernization Project is provided in *Chapter 3, Project Description* and summarized in *Appendix 4.13-REL*. The reliability analysis identified the following changes in operating parameters and feedstock characteristics relevant to the damage mechanism evaluation:

- Increased sulfur content (weight percent [wt%]) in feedstocks (crude and gas oils).
- Increased hydrogen purity (partial pressure) produced from a new hydrogen plant.
- Increased H_2S partial pressures in refinery processing units where the sulfur in the crude is either intentionally, or as a by-product of other reactions, converted to other sulfur containing compounds.
- Increase in nitrogen content based on a moderate to strong statistical relationship found between API gravity in the intermediate-light gravity range

(between 28 and 40 API) and nitrogen content and a weak correlation between sulfur and nitrogen content as described in *Appendix 4.3-MET.*

- Increased ammonium bisulfide content of many process streams due to increased nitrogen in the feedstocks.

Increased Facility operational utilization from 89% up to 93% and possibly to 100% of Title V permitted levels was also evaluated in the context of damage mechanism activity. Potential impacts from damage mechanisms caused or increased by the Modernization Project have been analyzed and mitigated based on a 100% Utilization Scenario (i.e., constant exposure to the environmental factor causing the degradation).

The City's expert conducting the reliability review determined which process units and associated equipment and piping may be impacted by Modernization Project changes by reviewing information provided by Chevron subject matter experts and interviewing Chevron subject matter experts. In order to determine which processing units would be affected by the increase in sulfur content, the sulfur-containing streams were traced from where the crude first entered the Facility at the crude unit through downstream processing units in the Facility to a point where: (1) the sulfur became extinct (i.e., removed); (2) the sulfur levels returned to baseline levels; or (3) sulfur in the crude, where converted to other, lighter sulfur compounds through contact with heat, pressure or catalysts, was at the original baseline level. A similar approach was used to evaluate changes in hydrogen purity and increases in H_2S and ammonium bisulfide in sour water and sour gas streams. This analysis relied on information from Chevron subject matter experts and review of technical documents such as piping isometric diagrams, piping and instrumentation diagrams, process flow diagrams, information on metallurgy of piping and equipment, Chevron Best Practice documents and process descriptions. Figure 4.13-3 presents a schematic showing the streams and process units that may be impacted by changes to operational and feedstocks associated with the Modernization Project.

Based on this diagram, review of technical documents, and discussions with Chevron subject matter experts, many of the process units at the Facility were determined to not be affected by operational or feedstock changes resulting from the Modernization Project, as discussed with rationale for their exclusion from further analysis in *Appendix 4.13-REL*. These process units include:

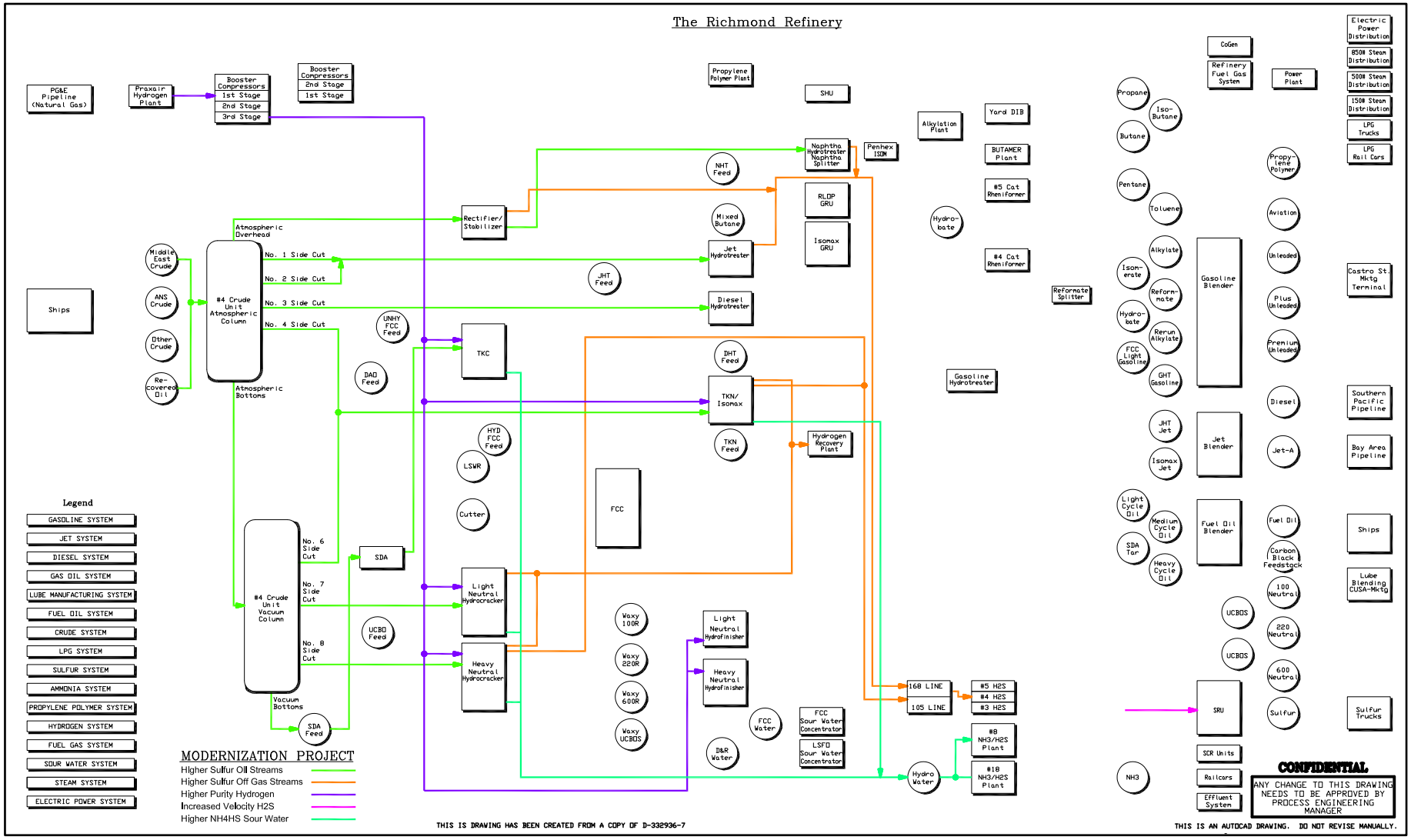
- Fluid catalytic cracker unit,
- Isomerization/penhex unit,
- Alkylation unit,
- Rheniformers,

- Yard deisobutanizer,
- Naphtha/reformate splitter,
- Butamer unit,
- Light and heavy neutral finishers,
- Isomax reactors,
- Propoly plant/selective hydrogenation unit,
- Gasoline hydrotreater.

For the units that were identified as potentially impacted by changes resulting from the Modernization Project (shown in Figure 4.13-3), the review then evaluated the potential for additional damage mechanisms or increased activity of existing damage mechanisms. This assessment evaluated all potential damage mechanisms for each process unit that was identified as being affected by Modernization Project changes, and was based on information gathered regarding Modernization Project changes, information regarding refinery damage mechanisms in API RP 571 (Damage Mechanisms Affecting Fixed Equipment in the Refining Industry) and interviews with Chevron subject matter experts, as well as the reviewer's extensive experience in the industry. For each process unit that was identified as potentially impacted by Modernization Project changes, *Appendix 4.13-REL* provides a detailed discussion regarding the damage mechanisms that were not active or did not increase in activity based on Modernization Project changes.

Nine damage mechanisms were identified as either additional damage mechanisms or damage mechanisms with increasing activity as a result of the Modernization Project. These damage mechanisms, as well as the units potentially affected by each damage mechanism, are presented below in Table 4.13-5 and described in detail in *Appendix 4.13-REL*. These damage mechanisms were further evaluated to determine potential reliability impacts in the next step of the analysis.

As indicated above, the potential reliability impacts on process units and associated equipment and piping from additional damage mechanisms or damage mechanisms with increased activity as a result of the Modernization Project were evaluated. This evaluation included a detailed review of all damage mechanisms identified in Table 4.13-5 and available information on process conditions within each unit or stream, changes in crude and gas oil sulfur content, increases in H_2S and ammonium bisulfide content in sour water and sour gas streams, metallurgy of process equipment and piping, as well as interviews with Chevron subject matter experts to determine specific locations within process units and associated piping where damage mechanisms could



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Source: Chevron (T85)

Figure 4.13-3

Chevron Refinery Modernization Project EIR

Facility Streams and Process Units Impacted by Modernization Project

become more active (i.e., the rate of degradation or damage could increase). Potential reliability impacts for each process unit were then determined based on the expected increases in the activity of damage mechanisms, information on process monitoring and inspections, integrity operating windows, turnaround schedules, and equipment lifetimes. The results of this evaluation are presented as detailed recommendations to reduce the likelihood of damage and, therefore, of potential accidental releases, in *Appendix 4.13-REL*.

4.13.4.2.2.1.2 *Modernization Project Reliability Analysis Conclusions and Recommendations*

Based on the reliability analysis methodology described above, specific recommendations were developed for each process unit, as well as associated equipment and piping, to reduce the likelihood of damage, and therefore, accidental releases, due to operational or feedstock changes associated with the Modernization Project. These recommendations are described in detail in *Appendix 4.13-REL*, and generally fall into one of the following four categories:

- Recommendations to follow-up on and confirm assumptions made during the damage mechanism review regarding changes in post-Modernization Project process and/or operating conditions that influenced the damage assessments.
- Recommendations to reduce risks associated with an uncertainty as to the existing condition of equipment that could pose a risk of failure under Modernization Project conditions.
- Recommendations regarding the need to communicate the progress and status of identified risk reduction improvements.
- Recommendations to correct specific deficiencies identified during the review.

The specific recommendations include but are not limited to replacing numerous piping circuits, installing additional monitoring devices on certain carbon steel piping circuits, reviewing all corrosion monitoring locations to ensure that the locations are consistent with the findings of the damage mechanism analysis conducted by the Chevron reliability team and the City's reliability review expert, developing integrity operating windows, analytical testing of certain components, implementing new inspection, sampling, and monitoring regimes, and a system of verifying post-Project operating conditions when the sulfur content of crude oil being processed at the Facility reaches specified levels. In addition, the reliability analysis recommended annual Chevron reporting to the

TABLE 4.13-5 FACILITY UNITS AND MODERNIZATION PROJECT-RELATED DAMAGE MECHANISMS FOR FURTHER EVALUATION

API RP 571 Damage Mechanisms		Crude Unit	Hydro-treating	Solvent De-Asphalting Unit	Sulfur Recovery Unit	Sour Gas (Off Plot)	Sour Water Plants and Sour Water (Off Plot)	Recovered Oil
1	Sulfidation	X	X	X				X
2	Wet H_2S Damage (Blistering/HIC/ SOHIC/SSC)	X	X	X		X	X	
3	Creep /Stress Rupture	X						
4	High-temperature Hydrogen/H_2S Corrosion		X					
7	Ammonium Bisulfide Corrosion	X	X			X	X	
8	Ammonium Chloride Corrosion	X						
10	High-Temperature Hydrogen Attack		X					
13	Sour Water Corrosion (Acidic)	X						
65	Oxygen-Enhanced Ignition and Combustion				X			

Source: API, 2011a; *Appendix 4.13-REL.*

City on the implementation of recommended measures, as well as on the status and results of inspections and monitoring activities. In addition to the specific recommendations made by the reliability analysis, several general recommendations were made as well. These general recommendations include ensuring that procedures are revised to incorporate mechanisms for addressing and tracking recommendations resulting from inspections, turnarounds, and audits, clarifying and incorporating periodic reviews of work processes, extending integrity operating windows to all operating units, and additional specified changes to key Facility procedures. All of the recommendations that were developed as part of this reliability analysis identified in *Appendix 4.13-REL* have been incorporated into Chevron's Modernization Project Reliability Program included as *Appendix 4.13-PROG*.

Chevron's Modernization Project Reliability Program also incorporates additional measures that were not identified as recommendations from the reliability review. The Modernization Project Reliability Program includes requirements that process hazard assessments be conducted or revalidated prior to construction and again after construction prior to commencement of Project operations, and that these process hazard assessments will include inherently safety systems analysis, layers of protection analysis, and damage mechanism evaluations. The Modernization Project Reliability Program also includes a commitment that Chevron will convene annual town hall meetings to update the community regarding the status and results of corrective actions following the August 6, 2012 fire, the status and/or results of material upgrades, inspections and monitoring, and ongoing compliance with the RISO including Project-related process hazard assessment revalidation and damage mechanism reviews, and when triggered, the status of implementation of the recommendations from the City's reliability review conducted for the Modernization Project. The Modernization Project Reliability Program also commits Chevron to submitting periodic reports to the City regarding Chevron's probation terms, and annual reports to the City regarding audits conducted by any regulatory agency and the status of findings and recommendations from prior audits.

With implementation of the Modernization Project Reliability Program Project Design Feature described above, and implementation of the following mitigation measures, accidental releases of acutely hazardous materials during operation would be reduced to a less-than-significant impact:

> Mitigation Measure 4.13-7a: Chevron shall implement the Modernization Project Reliability Program for all units and processes affected by the Modernization Project, including written reports specified in the Modernization Project Reliability Program. An initial Reliability Program report shall be submitted to the City and County prior to Project construction. Annual reports shall be submitted thereafter, including a report prior to commencement of Project operations. For the PHAs (initial and revalidations) specified in the Modernization Project Reliability Program, Chevron would complete the PHAs prior to commencement of Project construction, and again after construction but before startup of Project operations for any changes that may have arisen during construction that could affect the earlier PHAs. Chevron will thereafter update and revalidate PHAs in accordance with the RISO but not less than once every 5 years. As indicated in Mitigation Measure 4.13-4a, the PHAs shall include LOPAs, and written LOPA reports must be submitted to the County prior to construction for review, and Chevron shall submit a copy to the City simultaneously. To the extent that any post-construction PHA revalidations are warranted,

Chevron shall submit LOPA reports for the post-construction PHA revalidations to the County for review prior to the startup of Project operations, and Chevron shall submit a copy to the City simultaneously.

Mitigation Measure 4.13-7b: Chevron shall complete an ISSA (as defined in the RISO), including review damage mechanisms and evaluation of their consequences, and LOPAs with written LOPA reports submitted by Chevron to the County for review, for new and modified Modernization Project components as part of the PHA revalidation process specified in the Modernization Project Reliability Program and Mitigation Measure 4.13-7a. Chevron will make the ISSA and PHAs available for review by the CCHS and the City, and will submit the LOPA reports to the County prior to construction for review.

Mitigation Measure 4.13-7c: Chevron will continue to review its procedures and programs for evaluating the hazards of planned changes at the Facility, and update them to incorporate damage mechanism review, including the identification of applicable damage mechanisms as well as the evaluation of the potential impacts of the damage mechanisms in light of the proposed changes, and layers of protection analysis consistent with the Reliability Program. Chevron's review and update of programs and procedures shall include, at a minimum, the Facility's management of change program/ procedure and its PHA program/procedure. Chevron shall include, in its annual Modernization Project Reliability Program reports to the City, a description of the status of this documentation review and update process, as well as how the changes to these programs/procedures are being implemented at the Facility.

Mitigation Measure 4.13-7d: Chevron will fund the costs of qualified third-party experts to assist CCHS and the City in the review of PHAs, ISSAs, and LOPAs completed for the Modernization Project pre- and post-construction, and will cooperate in providing access to Chevron documentation and facilities, as needed, for the third-party expert, CCHS, and the City to complete these reviews. At such time as the RISO is amended, and to the extent this amendment requires Chevron to fund a new, full-time chemical process safety inspector to do inspections at the Facility, Chevron shall provide to CCHS and/or the City the level of funding required to hire a new, full-time chemical process safety inspector for the Facility, and thereafter shall no longer be required to fund a separate third-party expert for post-construction reviews of PHAs, ISSAs, and LOPAs or other inspections.

Mitigation Measure 4.13-7e: Chevron shall provide funding in a reasonable amount sufficient for the City to complete an air deposition background study of air quality at up to 20 locations in Richmond. The study may be done in conjunction with local high school science departments or otherwise, and may include quarterly sampling, using surface sampling collection pads, and certified laboratory analysis of such pads at locations to be determined. Study results shall be compiled annually, and made publicly available. Chevron will fund this program for a 5-year period following commencement of Modernization Project operations. In the event of a future accidental fire or other significant accidental release of air pollutants from the Facility, Chevron shall reimburse the City for the cost of engaging a qualified consultant to perform additional air deposition sampling and analysis to evaluate the magnitude and significance of the release. The results of the post-accident deposition sampling will be publicly available.

Mitigation Measure 4.13-7f: Given the Modernization Project would include new equipment and operational practices at the Facility, Chevron will provide further training for and coordinate with the Richmond Fire Department prior to Modernization Project operations. Training would continue annually during Project operations.

Mitigation Measure 4.13-7g: Chevron shall work with the Contra Costa Sheriff's Department, the City, and other interested stakeholders, prior to the commencement of Project operations, to evaluate the existing CWS and to determine whether additional services would be beneficial, including but not limited to mechanisms for the provision of emergency messages and communications, translated into multiple different languages (considering possible integration with existing cell phone registration, email, and social media notification databases and systems), and the provision of emergency notifications to locations in the community where large numbers of people may congregate at any given time (such as shopping centers, transit centers such as Bay Area Regional Transit stations, Amtrak stations, and bus stations). Chevron shall contribute toward, and help identify additional funding for, such additional services.

Mitigation Measure 4.13-7h: Chevron will fund the costs of a third-party expert to assist the County and the City with the review of the Reliability Program reports and other submittals required by the Reliability Program and related mitigation measures, as needed. The third-party expert will be selected and retained by the County or the City within the County's or City's discretion. This funding obligation survives any amendment of the RISO that may require funding of an inspector for the Facility.

Mitigation Measure 4.13-7i: Chevron shall adhere to the total acid number (TAN) limits of 0.3 mg milligrams potassium hydroxide per gram (KOH/g) for crude, 1.5 mg KOH/g for sidecuts produced from the crude unit, and 1.0 for gas oils and blends processed through the fluid catalytic cracker, fluid catalytic cracker feed hydrotreater, hydrocracker, heavy neutral hydrocracker, and light neutral hydrocracker. If Chevron intends to process a feedstock for a short-term basis (i.e., up to 6 months) that exceeds these TAN limits, it must complete its Management of Change (MOC) process, which shall include a corrosion review, for the proposed deviation, and shall take into account any existing damage mechanism reviews as specified in Mitigation Measure 4.13-7c that have been prepared for the identified units and piping circuits. If Chevron intends to process a feedstock for a longer-term basis (i.e., more than 6 months) that exceeds these TAN limits, it must complete its MOC process for the proposed deviation, and the MOC shall include a reliability analysis to evaluate, among other things, existing process conditions, monitoring and inspection data, expected corrosion rates, metallurgy, existing damage mechanism reviews, and monitoring and inspection frequency. The MOC evaluation, for short or longer duration TAN deviations, shall include an evaluation of the potential hazards that could result from the TAN deviation in all affected units and piping circuits, including naphthenic acid corrosion impacts. Chevron shall designate a Facility Area Business Unit Manager with final decision-making authority to approve any TAN deviation from the TAN limits. Chevron shall provide the results of any TAN deviation MOC evaluation to the City and County before processing the feedstock that deviates from the established TAN limits.

Chevron shall include in its annual Reliability Program reports: (a) details regarding the results of its MOC for any TAN deviations; (b) average annual TAN for crudes and gas oils/blends processed at the Facility for each calendar year starting with 2008; and (c) for any feedstock runs with TAN levels higher than established TAN limits, include the actual TAN levels of the deviating feeds and the duration of the deviating feedstock runs.

Mitigation Measure 4.13-7j: Chevron shall include in its annual Reliability Program reports the annual average sulfur content of feedstocks, including separate annual averages for crude oils/blends and gas oils/blends, processed at the Facility for each year since and including 2008.

4.13.4.2.3 *Impacts from Release of Modernization Project Storage of Acutely Hazardous Substances*

Impact 4.13-8: The hazard risks of accidental releases of acutely hazardous substances from Modernization Project-related storage quantities were

evaluated and none were found to cause an increased risk beyond the existing potential Facility impacts from currently stored acutely hazardous substances, but H_2S and anhydrous NH_3 were found to have a potential for off-site impacts in non-residential areas. With mitigation, this impact would be reduced to less than significant. (LTS after Mitigation)

The significance of any potential upset or accident due to the Modernization Project is judged by the increased likelihood of its occurrence and the severity of resulting consequences if an accidental release of acutely hazardous materials were to occur. Potential changes in likelihood of occurrence and severity of consequences resulting from the Project are measured relative to existing conditions. Existing conditions are reflected in the CalARP RMP for EHS that was prepared for the existing Facility in February 2013 (Chevron, 2013d), which reflects the same maximum stored quantities of EHS as in the Chevron 2011 RMP and based on the characteristics of feedstocks, blendstocks, and products represented in the Baseline (Chevron Data Transmittal #87, 2014). The likelihood of increased upsets leading to potential human health impacts based on Modernization Project-related changes was addressed in the above analysis of Impact 4.13-7. The resulting severity of a potential release from storage of Modernization Project-related acutely or EHS is assessed in this impact analysis.

An impact from an explosion or fire in a location where acutely hazardous substances are stored would be considered significant if the significance thresholds for blast and thermal impacts from a CalARP regulated hazardous substance, as defined by the RMP Guidance as a level of concern, would be exceeded (EPA, 2009). For toxic chemicals, an impact would be significant if the off-site concentration from an accidental release of an EHS would exceed the concentrations considered the threshold level of concern in the CalARP regulations (OES, 2004).

A summary of the Baseline EHS maximum stored quantities from the covered processes in the 2013 RMP as compared to the change in total quantities due to the Modernization Project are discussed in *Section 4.13.4.1.2.1,* and are shown in Table 4.13-3. As shown in the table, the Modernization Project's new additional quantities are a small percentage of the maximum total quantities currently stored at the Facility. After the installation of Modernization Project components is complete, a revised RMP must be completed to satisfy the CalARP requlations as described in the setting. The RMP requires that a detailed PHA of the changed components be conducted. Before commencing operations of the new and modified equipment, Chevron would revalidate the PHAs for the new and modified Modernization Project units, which would include a damage mechanism review, as described in Mitigation Measure 4.13-4b in *Section*

4.13.4.1.2.1. PHAs are required to address the safety hazards of specific chemicals or hazardous materials used in processes at a facility. In addition, Mitigation Measures 4.13-9a to 9g in *Section 4.13.4.2.2,* are required before operation of the new and modified equipment to address Modernization Project-related impacts discussed in Impact 4.13-7.

The RMP also requires a revised off-site consequence analysis of worst-case and alternative accidental release scenarios.[20] The expected changes in the quantities of hazardous materials and the expected changes in risks at the Facility, as a result of the Modernization Project, can be estimated using conservative worst case assumptions as used in the RMP that was prepared for the entire Facility in 2013 and incorporating the changes that would occur as a result of the Modernization Project. The off-site consequence analysis is based on two regulatory programs designed to assess and help mitigate potential accidental releases from industrial sources: the RMP and the CalARP Program. These two programs establish both applicability threshold quantities (quantities below threshold values do not trigger the RMP/CalARP requirements, and methodologies to assess potential impacts from accidental releases from these stored chemicals to either flammable or toxic endpoints (or both). The off-site consequence analysis conservatively was conducted for the worst-case release scenario as defined by the RMP and CalARP. These programs have defined the worst-case release scenario as the release of the largest quantity of a regulated substance from a single vessel or process line failure that results in the greatest distance to an endpoint under conservative meteorological conditions. For worst-case release scenario analysis under RMP, the possible causes of the worst-case release or the probability that such a release might take place are not considered; the release is simply assumed to occur. Worst-case release scenarios represent the failure modes that would result in the worst possible off-site consequences, however unlikely, and not the more likely smaller releases that would potentially result in smaller impacts.

Following these guidelines, Modernization Project impacts were assessed using the maximum storage amount of EHSs under the Modernization Project operating conditions. If relevant equipment storing EHSs is not changing with the

[20] Off-site consequence analyses provide the federal, state, and local governments, as well as the public, with information about the potential consequences that could result from a chemical release at a facility. Off-site consequence analyses consist of both a worst-case release scenario and alternative release scenarios. A worst-case scenario is defined by the EPA as "the release of the largest quantity of a regulated substance from a single vessel or process line failure that results in the greatest distance to an endpoint" or, alternatively, "the distance a toxic vapor cloud, heat from a fire, or blast waves from an explosion will travel before dissipating to the point that serious injuries from short-term exposure will no longer occur" (EPA, 2009).

Modernization Project then an assessment was not performed since Chevron's existing RMP off-site consequence analysis evaluated existing maximum vessel storage amounts to determine the worst-case quantities for existing Facility storage configuration. As this analysis is based on maximum stored amounts in new or modified equipment, the quantities used do not vary with utilization rate fluctuations of the Facility; thus a single assessment was done for this impact analysis. RMP*Comp software was developed by the EPA to analyze compliance with its RMP rule, and it was used for the off-site consequence analysis. RMP*Comp (EPA, 2014) is based on the EPA RMP Guidance document (EPA, 2009) and represents a simplified but conservative approach.

As discussed in *Section 4.13.4.2.3,* the Modernization Project would not add any new RMP or CalARP regulated EHS that are not currently present in the Facility. Although the Modernization Project could result in a larger total processed amount of sulfuric acid mixed with hydrocarbons (i.e., in the post-Modernization Project higher utilization cases) for the entire Facility, process units containing sulfuric acid mixed with hydrocarbons would not be physically modified as part of the Modernization Project. Thus, neither the Modernization Project nor changes in Facility utilization would result in changes to the largest containment of sulfuric acid mixed with hydrocarbons already existing at the Facility; therefore, there would be no additional Modernization Project-related impacts from maximum stored amounts of sulfuric acid mixed with hydrocarbons above the existing potential impacts for the existing Facility as reported in its RMP.

The Modernization Project would, however, result in an increase in the use and stored inventory of H_2S, flammables/hydrogen, and NH_3 due to new and modified equipment in the Modernization Project. The Modernization Project would also result in new locations storing these substances. An overall increase in the total inventories of H_2S, flammables/ hydrogen, and anhydrous NH_3 are shown in Table 4.13-3.

The following sections discuss each of these three EHSs stored at the Facility where storage amounts associated with Modernization Project would change and: (1) describes how and where they would be used for processes related to the Modernization Project; (2) estimate the increase or decrease in quantities of such materials due to the Modernization Project; and (3) evaluates the potential off-site impacts of these EHS from the Modernization Project. The largest containment of each EHS (the worst case release as defined under RMP and CalARP) at new or modified equipment was used to determine the estimated distance to the level of concern.

4.13.4.2.3.1 *Hydrogen Sulfide*

Crude oils contain sulfur that is typically removed to make petroleum products. The removal process occurs as the crude oil is separated into various fractions (or "cuts") based on boiling point. The sulfur removal process is necessary to prevent contamination of catalyst used in Facility processes and to meet product sulfur specifications. One of the sulfur products that can be generated as part of the removal process is H_2S. For example, the FCC FHT, as well as other hydrotreaters, removes sulfur from the various hydrocarbon streams and bonds it with hydrogen to form H_2S gas. The H_2S gas created during the treatment process is routed to an "amine absorber," which contains a solvent (DEA) designed to absorb the H_2S molecules, effectively separating them from the hydrogen and hydrocarbon in the gas stream. From the amine absorber, a liquid consisting of a mixture of H_2S and DEA is sent to an "amine regenerator," where the H_2S and the DEA are separated. The DEA is reused in the process. This regeneration releases a gas stream containing a high-concentration of H_2S gas. The gas is then processed in the sulfur recovery units to recover elemental sulfur, which is stored in heated tanks as a liquid to prevent solidification of the sulfur before it is sold to fertilizer manufacturers and other customers.

Currently, the H_2S absorbers and DEA regenerators are located near one another at the Facility, within the process unit. In order to process additional sulfur in the feedstock, the Modernization Project proposes to install one additional amine absorber unit at the FCC FHT and one additional amine regenerator (No. 6 H_2S plant). The new amine absorber and related equipment would be constructed on the FCC FHT's recycle hydrogen stream, which contains the Facility's greatest concentration of removable sulfur. The new amine regenerator would be located adjacent to the sulfur recovery units (see Figure 3-1 in *Chapter 3, Project Description*). Neither the amine absorber nor the amine regenerator create or refine hydrocarbons, but instead are the next steps in the sulfur handling process once the sulfur is converted to H_2S by the FCC FHT. In this new configuration, the long pipe run to the sulfur recovery unit area would contain liquid DEA with H_2S absorbed in it, rather than H_2S gas as is the case with the existing H_2S plants in the refinery. This Project modification involved implementation of an inherently safer configuration because a potential accident on this line would involve a liquid leak rather than a gas release. A liquid leak of DEA with H_2S absorbed in it is likely to have only a localized impact and minimal liberation of H_2S gas, whereas a H_2S gas release, potentially associated with the existing system, is mobile and may increase the potential to impact distant areas.

4.13.4.2.3.1.1 *Change in Quantity of Hydrogen Sulfide*

The Baseline inventory of maximum stored H_2S in the Facility is reported in the 2013 RMP to be 20,350 pounds. Compared to the Baseline, the Modernization Project results in an overall decrease of 4,454 pounds of H_2S, or approximately 22%, of the Baseline total, as shown in Table 4.13-3. For the Modernization Project, the largest single amount of H_2S in the gas phase would be 370 pounds in the proposed No. 6 H_2S regenerator.

4.13.4.2.3.1.2 *Impacts from Increased Hydrogen Sulfide*

The largest new single containment of H_2S gas (370 pounds) would occur in the No. 6 H_2S regenerator. A level of concern could be reached for a worst case release of this largest storage amount at a distance of about 0.9 mile (4,752 feet or 1.4 kilometers [km]), as indicated in *Appendix 4.13-OCA*. This distance is greater than the closest Facility boundary; however, there are no residential neighborhoods within this 0.9-mile radius of the proposed No. 6 H2S regenerator. Therefore, it would not present an increased risk to the general public (off-site residential receptors). There is a potential that non-Chevron worker populations or recreational users could be present in these areas; therefore, they are potentially impacted by this worst case release. However, the Modernization Project impacts would be within the existing worst-case toxics distance reported in the 2013 RMP of 5 miles for a release of NH_3. Since the Modernization Project distance is within the existing Facility impact distance from the 2013 RMP and the significance determination is based on risks to the general public, this impact would be less than significant.

The largest current single containment of H_2S gas is approximately 1,500 pounds in a line at the No. 5 H_2S plant (Chevron Data Transmittal #78, 2014). A failure and worst-case release from this line would result in level of concern concentration reaching a distance of 1.9 miles (10,000 feet or 3.1 km) from the release; the nearest off-site receptor was reported to be approximately 1,200 feet southwest from the release point.

4.13.4.2.3.2 *Anhydrous Ammonia*

Crude oil also contains various nitrogen compounds. These compounds are converted to NH_3 in the hydrotreaters. The treatment process also removes nitrogen, which bonds with hydrogen to form NH_3. The NH_3 is dissolved in the hydrotreater sour water and is recovered as anhydrous NH_3 in one of two sour water plants. The Facility collects the NH_3 in pressurized vessels. Most of the NH_3 is sold as product, but a portion of the NH_3 is injected into Facility process or utility heaters as required by the BAAQMD to reduce emissions of nitrogen oxides from these sources to gaseous nitrogen.

It is anticipated the Modernization Project would result in a net increase in NH_3 as a result of new process lines from the NH_3 storage areas to the new hydrogen plant. The Modernization Project would include a total anhydrous NH_3 inventory of approximately 3,000 pounds at the new hydrogen plant (Praxair, 2013), including from a 2-inch anhydrous NH_3 pipeline extending 300 feet. This line would run from the existing NH_3 system to the new hydrogen plant. The purpose of this new line is to feed NH_3 to the hydrogen plant and to provide NH_3 for Praxair's selective catalytic reduction units. The new line itself would contain approximately 270 pounds of NH_3.

Also in the Modernization Project, the existing hydrogen plant would be deactivated. The "A" Train of this unit has a selective catalytic reduction system that uses anhydrous NH_3 to reduce stack emissions of nitrogen oxides from furnace burners by using NH_3 to react with nitrogen oxides to form nitrogen gas and water. The NH_3 that is used in the existing selective catalytic reduction system is delivered through a 2-inch pipe header from the pressurized NH_3 storage vessels. The delivery system would be deactivated, and it includes small sections of 0.75-inch piping connecting the header to the hydrogen plant.

4.13.4.2.3.2.1 *Change in Quantity of Ammonia*

The deactivation of the hydrogen trains of the existing hydrogen plant would result in a reduction of NH_3 at the Facility by approximately 1,200 pounds.

The inventory of NH_3 for the new units and the new hydrogen plant is approximately 3,270 pounds. The net NH_3 inventory increase after shut down of the existing hydrogen train selective catalytic reduction system is approximately 2,070 pounds. This represents an increase compared to the Baseline (prior to the Modernization Project) of 0.08%, as shown in Table 4.13-3.

The largest single containment of NH_3 added by the Modernization Project is approximately 900 pounds and would be in the Praxair hydrogen plant.

4.13.4.2.3.2.2 *Impacts from Increased Ammonia*

The largest single amount of new NH_3 storage from the Modernization Project would occur in the Praxair hydrogen plant and would contain 900 pounds. The distance where a level of concern could be reached through a release would be approximately 0.9 mile (4,750 feet or 1.4 km), as shown in *Appendix 4.13-OCA*. This distance is greater than the closest Facility boundary; however, there are no residential neighborhoods within this 0.9-mile radius of the new hydrogen plant. It would therefore not present an increased risk to the general public (off-site residential receptors), over existing conditions. There is a potential that non-Chevron worker populations or recreational users could be present in these

areas; therefore, they are potentially impacted by this worst case release. The quantity of NH_3 that could be released from this additional pipeline would be much smaller than the NH_3 release scenarios that were evaluated in the 2013 RMP for the existing facility (5 miles to the level of concern), and the potential impacts from a release from the new pipeline would be much lower than those that were reported in the RMP. Since the Modernization Project distance is within the existing Facility impact distance from the 2013 RMP and the significance determination is based on risks to general public, the impact would be less than significant.

4.13.4.2.3.3 *Flammables – Hydrocarbons and Hydrogen*

Flammables include hydrocarbons and hydrogen that exist throughout the Facility. New inventories of listed flammable hydrocarbons and hydrogen include the reactors, vessels, and lines (natural gas, process gas) at the new hydrogen plant, natural gas and process gas lines to the new hydrogen plant, and three new vessels and associated piping in the FCC FHT recycle hydrogen train. Hydrogen is also flammable and plays an important role in many of the main processing steps for producing end products, including removing sulfur during the treatment process, and the "cracking" process of breaking up the heavy, long chains of carbon molecules in crude oil and gas oil into the lighter, shorter chains of molecules in refined products like gasoline and jet fuel. Hydrogen gas is produced on-site in an existing hydrogen plant as well as from the catalytic reformers (#4 and #5 Rheniformers). The Modernization Project would replace the existing hydrogen production facility with a new, more energy-efficient one capable of producing purer hydrogen. In addition to being produced at the hydrogen plant, hydrogen is also produced in the "reforming" process in which higher octane gasoline is made.

Chevron has selected the firm, Praxair, to design and build the new hydrogen plant. Praxair has considerable experience in designing, building, and operating hydrogen plants. Praxair owns and operates 15 SMR-type hydrogen plants that produce gaseous hydrogen throughout the world; 10 of these plants are in the United States and one of these plants is in California.

Praxair would also serve as Chevron's contracted operator of the new hydrogen plant; Praxair would be required to prepare an RMP and Safety Plan for the new hydrogen plant while Chevron would be required to update its RMP and Safety Plan for the remainder of the Modernization Project changes if required by CalARP and RISO requirements discussed in *Section 4.13.2.3*, above. The RMP requires that potential hazards from the Modernization Project be analyzed in detail and that potential impacts of accidents must be minimized through design changes and other measures defined in the RMP process. The RMP also requires

that an inspection and maintenance program be implemented to assure that the related pipelines, including those related to hydrogen transport, are safe for their duty.

The Modernization Project would replace the existing hydrogen production plant with a larger, more energy-efficient hydrogen plant. The existing hydrogen plant would be shutdown, decommissioned, and dismantled following the new plant's start-up. The new hydrogen plant would consist of a new hydrogen recovery unit and two identical production units, known as "trains." Each train generally consists of a steam methane reformer to produce, and a pressure swing adsorption unit to purify, the hydrogen stream. Each hydrogen train would be permitted to produce 122 million standard cubic feet per day (scfd) of hydrogen gas on an annual basis for a total of 244 million versus the previous capacity of 181 million scfd. The purity of the hydrogen stream would also increase to 99% instead of the existing 94%. In addition to the hydrogen produced at the hydrogen plant, the new hydrogen recovery unit would be permitted to recover 50 million scfd of hydrogen. The new hydrogen plant would thus be permitted to generate up to 294 million scfd of hydrogen gas, an increase in production and recovery capacity of 63 million scfd from the existing plant. This increase in hydrogen gas is needed to provide the Facility with the flexibility to remove larger quantities and higher concentrations of sulfur in feedstocks that may be refined following construction and operation of the Modernization Project. In some operational circumstances the Facility itself may use all or most of the hydrogen production capacity of the new hydrogen plant. However, there may be other circumstances in which excess hydrogen from the plant is available for sale and export to third parties such as other refineries.

4.13.4.2.3.3.1 *Changes in Quantity of Flammable Hydrocarbons and Hydrogen*

The Modernization Project does not add any new inventory of LPG; therefore, there is a net change of zero. The Modernization Project adds approximately 420 pounds of natural gas (feed line to the new hydrogen plant) and approximately 3,500 pounds of other flammables, including refinery process gas on the refinery side and hydrogen. The largest single containment of hydrocarbons would be 1,200 pounds in the pressure swing adsorption surge drums in the Praxair hydrogen plant while approximately 40,000 pounds of flammables in total would be present at the hydrogen plant. The shutdown of existing equipment also results in a reduction of approximately 12,000 pounds of flammables. Compared to the current total quantity of flammables at the Facility, as reported in the 2013 RMP, the Modernization Project results in an overall increase of 31,920 pounds of flammables, or approximately 0.03%, of the Baseline total, as shown in Table 4.13-3.

4.13.4.2.3.3.2 *Impacts from Increased Flammable Hydrocarbons and Hydrogen*

For flammable hydrocarbons and hydrogen, the distance to the level of concern is based on heat or a lower flammability limit rather than a toxic level. Even using the extremely conservative assumption that all 40,000 pounds of the flammable substances in the new hydrogen plant would be released and burned, the overpressure endpoint distance is 0.4 mile (0.6 km) from the new hydrogen plant, as shown in *Appendix 4.13-OCA*; this radius of exposure falls completely within the Project site boundary. Consequently, the impact from such an event would be less than significant.

The 2013 RMP reviewed the impact from the baseline condition; the report analyzed a 5,900,000 pound release of flammable hydrocarbons (from the pentane storage sphere and assumed a vapor cloud explosion), which was found to have a distance to a thermal level of concern of 1.4 miles (7,392 feet or 2.25 km) and a 160,000 pound release from a pentane railcar and vapor cloud explosion, which was found to have a distance to thermal level of concern of 0.4 miles (2,112 feet or 0.6 km).

This analysis assumed a worst case in which the largest possible amount of flammable substances from the hydrogen plant (40,000 pounds) was assumed to be released. This is significantly greater than the largest change in storage at the modified units of the Modernization Project (3,500 pounds). Although these smaller quantities of additional hydrocarbons located in other parts of the Refinery Process Area of the Facility may be closer to the fence line, the released quantities from these smaller releases would not contain enough energy to result in a significant thermal impact and would be within the worst-case thermal impact of the largest quantity release assessed above. This conclusion is based upon the general rule that the distances to the level of concern for thermal impacts from these smaller releases are much smaller than the distance for the worst case scenario described above. In addition, for each of the major Modernization Project changes or additions in stored flammable materials at components being modified (sulfur recovery unit and FCC FHT), the estimated distance to the flammable level of concern is less than the distance determined in the 2013 RMP for flammables at the existing Facility and remains within the Facility boundaries. Therefore, residential off-site receptors would not be exposed to safety hazards from releases of Modernization Project-related maximum stored flammable quantities and the impacts from such events would be less than significant.

4.13.4.2.3.4 *Terrorism*

Sabotage is one of the Public Safety issues that are evaluated when a RMP is updated. To reduce the possibility of sabotage or terrorism, various precautionary measures have been adopted. The standard security for the Facility to reduce the potential for these events includes a chain link fence surrounding the entire facility with controlled gate entrances, third-party security officers at all entrance locations, roving security officers, identification badges required for entry by all personnel, prior authorization of visitors by Facility personnel, and general awareness training for all employees.

Under the Marine Transportation Security Act, the Facility is regulated by the U.S. Coast Guard, Department of Homeland Security, as a Maritime Facility under 33 CFR Part 105. The Maritime Security level coordination and implementation used in the Facility is required under 33 CFR Part 105.230 and is used in place of the National Terrorism Advisory System, which replaced the color-coded Homeland Security Advisory System. Dependent on the specific Maritime Security Level at this facility, additional security measures are activated.

These activities may include stationing additional security officers at critical locations, additional sheriff or Richmond Police Department patrols, restricted parking, restricted access, additional vehicle searches, and other sensitive security measures to protect the facility. Because of these precautions included in the Maritime Security system, the threat from terrorism would be reduced, and the addition of the Modernization Project at the Facility would not increase the threat.

Given the above considerations, the Modernization Project new storage of EHS would be less than significant with the following mitigations:

> Mitigation Measure 4.13-8: Implement Mitigation Measures 4.13-4a, b, c, d, f; 4.13-5a, b, c; 4.13-6a, b; 4.13-7a, b, c, d, e, f, g, h, I, j; 4.13-11a, b, c.

4.13.4.3 Presence of Hazardous Materials within Vicinity of Schools

(C) Would the project emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school?

Impact 4.13-9: The Modernization Project facilities would lie entirely within the existing Facility and would not be within 0.25 mile of an existing or proposed school. However, past incidents resulting in releases of hazardous substances triggering shelter-in-place alerts have occurred when schools

were in session. With mitigation, this risk is reduced to less than significant. (LTS after Mitigation)

According to Education Data Partnership (2013),[21] the closest existing school to the Modernization Project is Washington Elementary School, located 0.32 mile south-southeast of the Facility boundary. Additionally, Peres Elementary School is located approximately 0.5 mile east of the Facility; Lincoln Elementary School is located 0.81 mile to the east-southeast; and Verde Elementary School is located 0.88 mile to the east. The location of Washington Elementary School, as well as other schools in the nearby vicinity, relative to the Facility, is shown in Figure 4.13-4.

A summary of the Facility's accident history is included in *Appendix 4.13-DET*. Since January 2003, there have been four CWS Level 3 events at Chevron that have triggered shelter-in-place orders for the nearby community. The most recent major incident, the August 6, 2012 fire, as well as another major incident on August 9, 2003, occurred when district schools were not in regular session. The other two CWS Level 3 events occurred during a week when school was in regular session; therefore, the shelter-in-place orders for the City of Richmond likely affected these schools. According to the School Accountability Report Cards (CDE, 2013),[22] each of the four schools described above has a School Safety Plan:

- Washington Elementary School has an emergency procedures manual in each classroom that details procedures to follow during emergencies, including chemical spills; in addition, disaster drills are conducted three times per year;
- Lincoln Elementary School conducts a shelter in place drill once a year, and emergency procedures, such as evacuation plans and maps, are posted in each classroom;
- Disaster drills are conducted monthly at Peres Elementary School; and
- Teachers, administrators and staff are trained by a California SEMS representative.

[21] Education Data Partnership is a partnership between the California Department of Education, EdSource (a statewide not-for-profit organization), and the Fiscal Crisis and Management Assistance Team (a state-funded entity).

[22] School Accountability Report Cards are required by California state law to be published for every public school. These report cards provide information on the performance and condition of each school and are maintained by the California Department of Education.



3/14/2014 C:\Users\cviolet\Documents\ArcGIS\Packages\Figure 4.13-41\v101\Figure 4.13-4.mxd

Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: CCLD, 2012; Ed-Data, 2013

Figure 4.13-4
Chevron Refinery Modernization Project EIR
Nearby Schools in the Vicinity of the Facility

- Drills are also conducted monthly at Verde Elementary School, and the school has a School Safety and Emergency Team.

In addition, each school in the West Contra Costa Unified School District, including those in the vicinity of the Facility, has a Readiness and Emergency Management Classroom Guide. This flip chart guide is located in every classroom and provides specific actions to be taken during emergency or disaster situations, including specific instructions regarding sheltering in place (Haney, 2014).

Although the CEQA threshold distance for a school relative to the Modernization Project is 0.25 mile, given the size and scale of the Facility operations, and the range of potential Project-related safety risks as discussed under Appendix G Criterion B impact analysis above in *Section 4.13.4.2,* this EIR concludes that the Modernization Project would, absent required Project Design Features and mitigation measures, result in increased risks to nearby residential, school, and other sensitive receptors. Increased risks to the occupants of schools, like the increased risks to the overall public, are discussed in *Sections 4.13.4.2* and *4.13.4.3*. With implementation of the Project Design Features and mitigation measures, including those listed for Criterion B above, this impact is reduced to a less-than-significant level.

Mitigation Measure 4.13-9a: Chevron will coordinate with the Contra Costa County Sheriff's Department, as owner and operator of the CWS, and other stakeholders, to work with local area schools (Washington Elementary School, Lincoln Elementary School, Peres Elementary School, Verde Elementary School) to ensure that their emergency response procedures and plans are adequate to minimize the risk to students in the event of a refinery incident. This shall include, as necessary, updating plans and procedures, providing emergency response equipment, and providing training to school staff. Chevron will coordinate with the Sheriff's Department and local area schools to ensure that the schools have operational National Oceanic and Atmospheric Administration weather radios and receive training on how to use them. Coordination will be completed prior to start of Modernization Project operations.

Mitigation Measure 4.13-9b: Implement Mitigation Measures 4.13-4a, b, c, d; 4.13-6a, b; 4.13-7a, b, c, d, e, f, g; 4.13-11a, b, c.

4.13.4.4 Assessment of Hazardous Material Sites

(D) Would the project be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

Impact 4.13-10: The Modernization Project would be located within the Facility, which is listed on the EnviroStor list of hazardous waste and substance sites compiled pursuant to Government Code Section 65962.5. With mitigation, the known hazardous materials releases on the site (all of which have been the subject of remediation activities under the oversight of the RWQCB), will not cause any impact warranting further mitigation. If unexpected contamination is discovered during Modernization construction, impacts would be mitigated to less-than-significant levels. (LTS after Mitigation)

Government Code Section 65962.5 is commonly referred to as the "Cortese List." The Cortese List is a compilation of the following lists:

- List of hazardous waste and substances sites from DTSC on the EnviroStor database.
- List of Leaking Underground Storage Tank sites by County and Fiscal Year from San Francisco Bay RWQCB on the GeoTracker database.
- List of solid waste disposal sites identified by the RWQCB with waste constituents above hazardous waste levels outside the waste management unit.
- List of "active" Cleanup and Abatement Orders and Cease and Desist Orders from the RWQCB.
- List of hazardous waste facilities subject to corrective action pursuant to Section 25187.5 of the Health and Safety Code, identified by DTSC.

The Facility is listed on DTSC's EnviroStor database. The Facility is listed because it has a RCRA permit for treating hazardous waste. The treatment facility is located at Mill and Channel Street. This area is not part of the Modernization Project, Project Design Features, or cumulative projects.

GeoTracker, maintained by the RWQCB, lists two Leaking Underground Storage Tank sites associated with Chevron. One site is 100 Chevron Way, within the Facility, and a second site is listed at 835 Castro Street (this site may be within the Facility, but sufficient information is not available on the GeoTracker

database to determine the exact location). The 100 Chevron Way site is listed as a diesel spill that was discovered, closed, and reported in 1990 and the case was closed in 1997 by the RWQCB. The 835 Castro Street site is listed as a diesel spill discovered, stopped, and reported in 1996 and closed in 1997. Closure of a site indicates that no further action is required by the regulatory agency.

The RWQCB does not list the Facility on the list for solid waste disposal sites.

The Facility is subject to RWQCB Order R2-2011-0036 (Order). This Order rescinds outdated Waste Discharge Requirements and updates requirements for continued maintenance and monitoring along with requirements for corrective action and water quality monitoring programs. The Modernization Project is located in areas of the Facility where the Order requires cap maintenance and groundwater monitoring to occur. Excavation within or reconfiguration of any existing waste management units (i.e., the landfarm/landfill, North Yard, Alkane, Effluent, and Reclamation sectors of the Facility) is prohibited without prior concurrence from RWQCB staff.

Chevron previously operated the Hensley Street Plant site at 940 Hensley Street adjacent to the Facility. The former plant site is subject to a Site Cleanup Requirements order by the RWQCB (Order 00-010). Investigation of soil and groundwater contamination has occurred at the site, including installation of groundwater monitoring wells. Some of these wells are within the Facility at or near the possible solar project. Groundwater monitoring is ongoing at this site in compliance with RWQCB requirements.

The Facility is not listed as a hazardous waste facility subject to corrective action pursuant to Section 25187.5 of the Health and Safety Code, as identified by DTSC.

The Modernization Project would be located within the Facility boundaries, where no public access is allowed. Within the Facility, various levels of soil and groundwater contamination by hazardous materials have been identified by various investigations; however, as discussed in detail in *Section 4.9, Hydrology and Water Quality*, migration of these hazardous materials off-site is prevented by structural and procedural control measures. In addition, any construction activities within regulated areas within the Facility would be subject to RWQCB approval and oversight and any newly discovered contamination would be required to be reported to the RWQCB and subject to RWQCB requirements for the protection of human health and the environment. For these reasons, the presence of hazardous materials at the Facility associated with the Modernization Project, even in areas listed on various government agency hazardous materials

site lists, would not result in risks to the public or to the environment. Therefore, impacts would be less than significant with the mitigation measures below.

Mitigation Measure 4.13-10a: If contamination is discovered during Modernization Project construction, the Facility will report the discovery to the City, the RWQCB, and any agency required to receive such notice under applicable law, and shall promptly manage, contain, treat, transport, and/or arrange for off-site disposal of such contaminated material as required by applicable law and existing RWQCB Order. Chevron shall also train construction workers to recognize contamination, and shall use authorized remediation contactors with trained workers to characterize and manage any contaminated media discovered during Modernization Project construction.

Mitigation Measure 4.13-10b: If Modernization Project construction occurs in areas subject to RWQCB Order R2-2011-0036, Chevron will first receive approval of the construction activities from the RWQCB, as required under the order, and report the approval conditions to the City. Chevron will comply with applicable regulatory requirements and RWQCB approval conditions in managing the Modernization Project construction activities.

4.13.4.5 Adopted Emergency Response or Evacuation Plans

(G) Would the project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

Impact 4.13-11: The Modernization Project is located within the existing Facility and is not introducing any hazardous materials not currently used at the Facility (as discussed in *Section 4.13.4.1*), so would not interfere with existing emergency plans for areas located outside of the Facility. The Modernization Project would be integrated into the Facility's emergency plan, described in *Section 4.13.2*, above. With mitigation, this impact is less than significant. (LTS after Mitigation)

4.13.4.5.1 *Emergency Response Programs of Outside Entities*

The City of Richmond maintains the Richmond EOP (City of Richmond, 2005), which is an extension of the California Emergency Plan. The City of Richmond's plan aims to protect the City's population and minimize losses during an emergency. In addition, the Richmond EOP aims to guide the effective and efficient use of resources during large-scale emergency situations. According to the Richmond EOP, state and local agencies use the California SEMS, which helps standardize emergency response efforts that span multiple jurisdictions; the Richmond EOP includes detailed information regarding the various levels of response and organization of SEMS. The Richmond EOP also discusses alerts and

notification systems, such as the CWS, as well as telephone and radio alert systems. A Hazard Analysis/Threat Summary is contained in the Richmond EOP, and includes natural disasters, transportation accidents, terrorism, civil unrest, and hazardous materials accidents. Petroleum refineries are specifically discussed with respect to earthquakes along the Hayward Fault as fires, contamination, and pipeline ruptures may occur. The current Richmond EOP was published in 2005, with revisions added in 2010. The City is currently in the process of updating the Richmond EOP (Gerk, 2014).

Contra Costa County Office of Emergency Services released the County EOP in May 2011 (OES, 2011). According to the document, the County EOP's objective is to "incorporate and coordinate all the facilities and personnel of the County and Operational Area member jurisdictions into an efficient organization capable of responding effectively to any emergency." In addition to instituting an emergency organization, the County EOP also outlines specific policies, procedures, and assignments of responsibility, and aims to coordinate the planning of the various emergency staff and service elements. The County EOP implements SEMS and the National Incident Management System to accomplish these objectives. According to the County EOP, the emergency management organization works with and acts as a liaison between government agencies, private sector entities, and volunteer groups, as applicable. The County EOP details procedures in responding to various threats and scenarios, including hazardous materials incidents. According to a County representative, the County EOP is currently in the process of being updated (Widger, 2014).

While other agencies, such as Cal/OSHA, the CSB, and the BAAQMD, are not primary first responders, they do have plans in place to assist other agencies and first responders with technical and other assistance during emergencies related to industrial accidents. In addition, these agencies assist in investigations of industrial accidents. For example, the BAAQMD currently has Incident Response Procedures, which are directed toward the BAAQMD's Compliance and Enforcement Division. The BAAQMD currently supports emergency response efforts by collecting air samples, by conducting air monitoring, laboratory analyses, engineering evaluations, and inspections, and by communicating with the community and media. According to their Work Plan for Action Items Related to Accidental Release from Industrial Facilities, the BAAQMD is reviewing and updating their current procedures and widening their scope in response to the August 6, 2012 fire at Chevron (BAAQMD, 2012). The BAAQMD aims to document their coordination and improve their communication strategies, both internally and with other agencies. Additionally, the BAAQMD plans to develop a coordinated message response program that would provide the community and media with consistent and up-to-date information during incidents.

The City of Richmond has published two guidance documents as emergency preparedness resources. A Community Guide to Emergency Preparedness (Community Guide) was published by the Richmond Fire Department Office of Emergency Services in May 2011 (RFD OES, 2011). The Community Guide contains information such as locations and contact information for local hospitals, transportation services, utilities, and petrochemical plants. It also provides information on the City of Richmond Alert and Warning Systems, which is used to signal residents to shelter in place in the event of a chemical release. Finally, the Community Guide provides guidance for how citizens should respond to federal terrorist threat levels.

In addition to the Community Guide, the City has published Business Emergency Planning Guidelines (Business Guidelines) (Richmond Fire Department, 2009). This document provides guidance for businesses and industry to draft their own business plans in order to protect lives and property in the event of an emergency situation. The Business Guidelines also direct businesses to coordinate with the Richmond Fire Department Office of Emergency Services. According to the Business Guidelines, business emergency plans should address: employee safety and basic survival; emergency operating procedures; emergency financial procedures; emergency data processing systems procedures; emergency procedures for storing, securing, and retrieving of records; emergency communications systems; emergency transportation systems; alternate office facilities; and procedures for working with local governments. Additionally, the Business Guidelines include a countermeasure checklist for hazardous materials that includes measures such as ensuring that containment systems are watertight, that spill release detectors and alarms are installed, and that explosion proof and/or inherently safe electrical systems and bonding are used in hazardous material storage areas (Richmond Fire Department, 2009).

Contra Costa County Emergency Plan Committee, including representatives from the Contra Costa County Sheriff's Department as well as the City of Richmond Emergency Services Coordinator, among others, has published a Model Emergency Plan for Schools in March 2001 (EPC, 2001). This document provides a template for schools to customize to their individual locations and circumstances. The template provides a checklist of procedures to follow during various emergencies, including, but not limited to, air pollution episodes, off-site chemical accidents, fires, and explosions. Publicly available information does not indicate whether the schools in the vicinity of the Facility have implemented a version of this model, or any other specific ERP.

Caltrans maintains a Transit Emergency Planning Guidance document published in July 2007 (Caltrans, 2007). The document focuses on four aspects of

emergency management: preparation, prevention, response, and recovery. One of the physical analyses done during the preparation stage of the response is a survey of potential toxic releases and fire risks in the vicinity of the transit assets. The plan discusses emergency drills, and indicates that a Safety, Security, and Emergency Preparedness Plan should be developed by each transit agency. Recommendations for the response phase include gathering the incident management teams and response personnel at designated meeting locations, as well as determining if partial or complete suspension of transportation services is necessary.

4.13.4.5.2 *Chevron Emergency Response Program*

Chevron maintains an ERP, which is reviewed annually by the Manager of the Chevron Fire Department. The Plan addresses all aspects of emergency response, including proper first-aid and medical treatment for exposures, evacuation plans and accounting for personnel after an evacuation, notification of local emergency response agencies and the public in the event of a release, and post-incident cleanup and decontamination requirements. The Plan also includes the chemical-specific emergency response procedures for releases of RMP-regulated chemicals.

The Facility also has local EAPs, which summarize the first actions that are to be taken in the event of an emergency and the means for reporting fires and emergencies. The EAP also has guidelines for sheltering-in-place, evacuations, and earthquakes, as well as maps with evacuation routes and meeting places. As described in *Chapter 3, Project Description, Section 3.4.1*, all Modernization Project facilities and equipment constructed so far were placed in or near existing and/or previously used process areas within the Refinery Process Area. All remaining construction for the Modernization Project would occur in these same existing and/or previously used areas. Thus, the Modernization Project would not physically interfere with existing emergency plans.

Finally, Emergency Operating Procedures, which are a part of the prevention program, are another critical component of emergency preparedness. These procedures outline the steps to be taken to control or shut down a process unit in the event of an emergency situation (e.g., fire, earthquake, release, etc.). Operators for the process must be trained in these procedures. Emergency Operating Procedures for the Modernization Project's new processes would have to be prepared and incorporated into revisions of the Facility's Safety Plan. Additional information regarding Chevron's ERP is documented above in *Section 4.13.2*.

The Modernization Project would be contained entirely within the existing Facility. Further, the Modernization Project is not introducing any hazardous substances not currently used at the Facility (as discussed in *Section 4.13.4.2.3*). Therefore, the Modernization Project would not interfere with emergency plans for areas located outside of the Project site.

Additionally, the Modernization Project would be integrated into the Facility's emergency plans and revised Safety Plan, would include provision of training to emergency responders as well as practice drills, and is located in areas with other process equipment or areas of previous construction activities for the 2008 Project. Therefore, once these revisions are made, the Modernization Project would not impair or interfere with the emergency plans described above or the other entities outside of the Facility. Therefore, the impacts to adopted ERPs or emergency evacuation plans would be less than significant with the mitigation specified below.

Mitigation Measure 4.13-11a: Update the Facility's emergency plan to assure that the Modernization Project would not impair implementation of the plan, and to assure that the plan is effective. Develop Emergency Operating Procedures for new and modified Modernization Project equipment. Revisions to the plan and procedures would include clear instructions to ensure all non-essential personnel stay outside of hazardous areas during an emergency. Incorporate revisions into a revised Safety Plan submitted to CCHS for approval and acceptance prior to commencement of Modernization Project operation, and report submission date and CCHS approval to the City.

Mitigation Measure 4.13-11b: Ensure Facility personnel and contractors are trained on the revised emergency procedures, including to ensure all non-essential personnel stay outside of hazardous areas during an emergency. Maintain records on initial training and annual refreshers that can be provided to the City or County upon request.

Mitigation Measure 4.13-11c: Chevron shall coordinate with the City, County, and other local and regional agencies, including BAAQMD and fire departments in neighboring communities, to plan and conduct periodic emergency response drills, to establish joint operations centers and joint information centers, and to establish communications networks and protocols for emergency response communications extending to these neighboring communities and agencies to further develop the infrastructure and readiness for mutual aid as between these various agencies and fire departments, in the event of emergency response incidents.

4.13.4.6 Hazards of Potential Wildland Fires

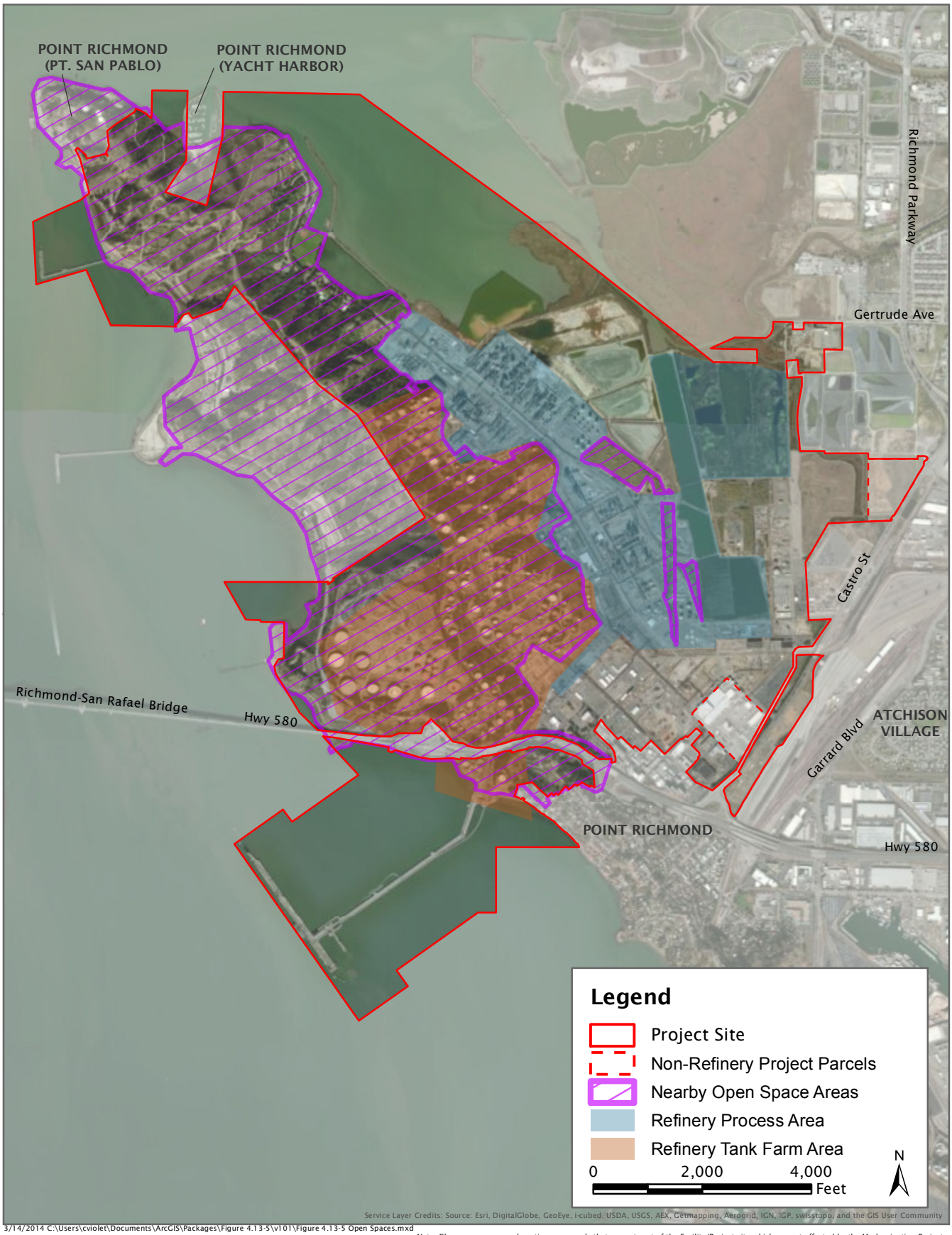
(H) Would the project expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

Impact 4.13-12: The Modernization Project is located in close proximity to areas of urbanized, non-native vegetated open space areas that are susceptible to fires. Potential accidents associated with the Modernization Project could cause a fire or explosion that can result in ignition of vegetation in these areas. Smoke generated from fires in these vegetated areas could also result in health impacts to people. Fires in the vegetated open space areas can be mitigated through the development and implementation of a fire protection plan for vegetated areas within the Facility that would include fuel management measures, construction and maintenance of fire breaks, and coordination of emergency response efforts. Implementation of these measures would make this impact less than significant. (LTS after Mitigation)

As indicated in Figure 4.13-5, the major components of the Modernization Project would be constructed entirely within the existing Refinery Process Area of the Facility, many of which are located in barren or paved areas. However, Figure 4.13-5 also shows large areas of vegetated open space near the processing areas of the Facility, including the ridge of hills that extends approximately four kilometers from the Tank Farm Area at the southeastern part of the Facility to the northwest tip of the peninsula and the flat vegetated open space to the northwest of the low-sulfur fuel oil flare. During the dry season, from approximately April through October, these vegetated open space areas are susceptible to fires. According to Chevron, the growth of vegetation in these areas is controlled to limit fire potential. In addition, the Facility has its own fire protection measures, including buffers between the process areas and fence lines.

As described in *Section 4.13.2.4.2.2*, the Facility supports its own Fire Department that is staffed with full-time and volunteer personnel trained to handle all types of emergencies, including wildland fires. The Facility is also is served by the Richmond Fire Department, as noted in *Section 4.14*, *Public Services*.

Despite these protections, fires in the vegetated open space areas at the Facility have the potential to occur, especially during potential flare, fire, or explosion incidents at the Facility. Depending on the weather conditions and the time of



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: Chevron (T38 r1 and T54)

Figure 4.13-5
Chevron Refinery Modernization Project EIR
Location of Modernization Project and Nearby Open Space Areas

year, fires in these vegetated open space areas could spread quickly and result in damage or loss to residents and structures near the boundaries of these vegetated open space areas (i.e., in the northwest part of the Point Richmond neighborhood south of the Project site boundary and at the Point San Pablo Yacht Harbor to the northwest of the Project Site boundary). Smoke from wildfires in these areas could also impact residents of nearby communities, including Richmond, North Richmond, and San Pablo. The August 6, 2012 fire resulted in a fire at the crude unit. Photographic evidence of the fire indicated a second fire started in the vegetated open space area to the northwest of the low-sulfur fuel oil flare shortly after ignition of the fire at the crude unit (Post, 2012; Poskanzer, 2012). The presence and location of the grass fire was confirmed by satellite images of the area from Google Earth before and after the incident, as shown in Figure 4.13-6. The images show an area of dry grass and green brush prior to the incident (in May 2012), and a large burned area of grass after the incident. It is estimated that the area consumed by the grass fire was approximately 20,000 square meters (i.e., about 5 acres) based on an estimate of the burned areas of vegetation shown in Figure 4.13-6. Photographs of this smoke plume indicate that the smoke stayed near ground level and was initially blown to the northwest and over San Pablo Bay; however, later photographs and wind direction data specific to the time of the incident indicate that the low-elevation winds shifted during the course of the incident, blowing the smoke back to the east and over Richmond and nearby communities.

As part of the Modernization Project, several new process units containing flammable materials would be constructed and several existing process units containing flammable materials would be modified. As indicated in *Section 4.13.4.1,* new inventories of flammable hydrocarbons and hydrogen in new or modified process units include the reactors, vessels, and lines (natural gas, process gas, and hydrogen) at the new hydrogen plant, natural gas and process gas lines to the new hydrogen plant, hydrogen product line, and three new vessels and associated piping in the FCC FHT recycle hydrogen train. These new inventories of flammable materials are associated with process equipment located in the vicinity of vegetated open space areas. In addition, the increase in Modernization Project utilization above the 89% rate in the Baseline (i.e., either 93% Utilization Scenario or the maximum 100% Utilization Scenario) would result in increased material throughput to existing units. Thus, the risk of a wildland fire in the vegetated open space areas near these existing and new units would be increased if a process accident associated with the new equipment were to occur unless mitigation described below is applied. Based on the August 6, 2012 fire, such fires have the potential to impact nearby communities.



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Source: Google, 2012

Figure 4.13-6
Chevron Refinery Modernization Project EIR
Open Space Area Near the LSFO Flare Before and After August 2012 Incident

Mitigation Measure 4.13-12: Chevron will update its fire protection plan to address vegetated open space areas adjacent to process areas, and to assure that Chevron Fire Department personnel are trained and equipped to serve as first responders to a fire in these vegetated areas. The plan will be provided to and accepted by the Richmond Fire Department prior to start of Modernization Project operations. The plan must include:

12a: Fuel management, including seasonal mowing, removal of brush, trimming of trees, or other measures to reduce fuel loads during the dry season (i.e., from April 1 through November 30, unless extended by the Richmond Fire Department) in areas within 100 feet of process areas.

12b: Construction and seasonal maintenance of appropriate fire breaks (e.g., maintenance of unvegetated areas) to minimize size of fire in vegetated open space areas, provided no new vegetative clearing shall be completed until surveys have been completed for protected plants and animals, and the absence of such resources has been confirmed.

12c: Maintenance of fire roads in vegetated open space areas to provide immediate access to emergency responders, including removal of potential obstacles and brush and leveling of dirt roads on steep hillsides following the end of each rainy season (approximately April or May).

12d: Emergency response coordination, including enhanced mutual aid, protocols to assure adequate firefighter responses to vegetated open space area fires as well as Facility area.

4.13.5 Cumulative Impacts

Impact 4.13-13: The Modernization Project, in conjunction with existing and reasonably foreseeable future activities within the Facility, and nearby industrial and transportation facilities, could lead to a cumulative increase in the risks of accidental release of acutely hazardous substances. This risk could be potentially significant within the Facility, but is unlikely to extend to any off-site industrial or transportation operations and is thus not cumulatively considerable with respect to such off-site uses. With mitigation, this risk is less than significant. (LTS after Mitigation)

CEQA requires that an EIR evaluate cumulative impacts when project impacts are "cumulatively considerable" (CEQA Guidelines, 14 CCR Div. 6 Chapter 3 Section 15130). The CEQA Guidelines define "cumulatively considerable" as meaning "the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects" (CEQA Guidelines, 14 CCR Div. 6

Chapter 3 Section 15065(a)(3)). This section evaluates the cumulative impacts on public safety.

The public safety cumulative analysis focuses on local and regional risk to the public from the use and storage of hazardous materials at industrial operations. The facility is located in Contra Costa County where many other hazardous materials are stored and managed, including the following:

- Two RISO and seven County ISO facilities (see Figure 4.13-7 for facilities nearby the Project site).
- Forty-two RMP facilities (see Figure 4.13-7 for facilities nearby the Project site).
- Over 2,460 active businesses with Hazardous Materials Business Plans.

Hazardous materials can also be transported in the area near the Facility, including the following as shown in Figure 4.13-8:

- Major interstates for trucking.
- Rail operations, including BNSF Railway yard in Richmond.
- Port of Richmond operations.
- Private terminal operations at Port of Richmond.

In addition, following the August 6, 2012 fire, federal, state, and local agencies have been evaluating the existing regulatory programs to determine whether improvements can be made to strengthen oversight of PSM and lessen the likelihood of accidental releases. In light of this ongoing assessment and in conjunction with the implementation of corrective actions and recommendations arising out of the August 6, 2012 fire, additional mitigation is required to ensure that the cumulative risk of accidental release from the Project, in combination with existing Facility operations, is less than significant.

> Mitigation Measure 4.13-13a: Prior to restarting construction of the Modernization Project, and again prior to commencement of Project operations, Chevron shall submit to the City a report describing the status of its compliance with all corrective action measures (including, but not limited to, compliance with probationary terms) imposed or agreed to as a result of the agency proceedings relating to the August 6, 2012 fire. As part of this report, Chevron shall describe its ongoing consultations with the agencies that investigated the August 6, 2012 fire, including Cal/OSHA, the CSB, and Contra Costa County, including any feedback or direction that has been provided by those agencies concerning implementation of the corrective action and agency recommendations and Chevron's response thereto.

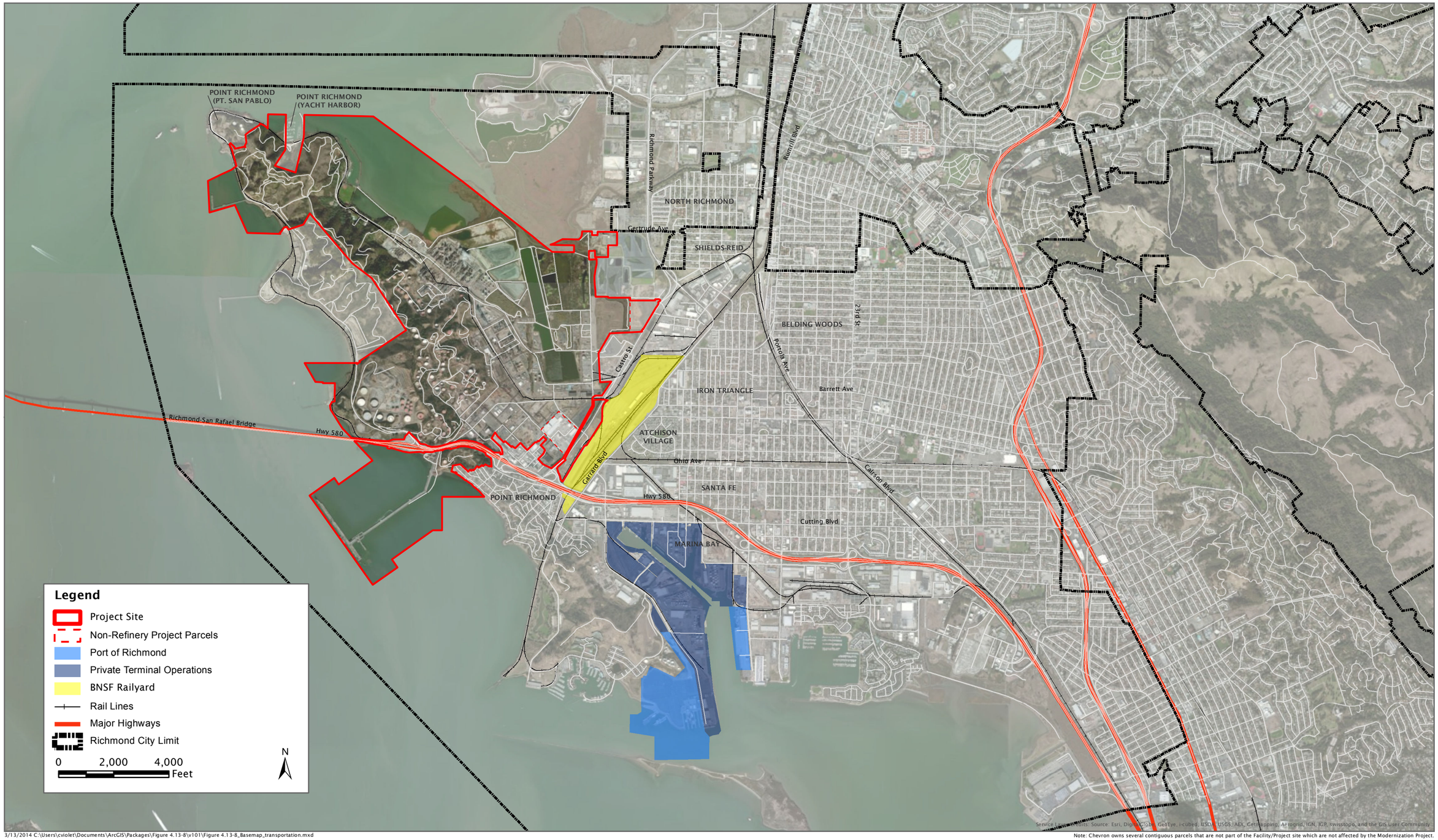


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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Sources: Chevron (T38 r1 and T54); CCHS, 2012a; CCHS, 2012b

Figure 4.13-7
Chevron Refinery Modernization Project EIR
RISO / ISO and RMP Facilities Nearby the Project Site



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Sources: Chevron (T38r1 and T54); City of Richmond, 2014; US Census Bureau, 2014; Contra Costa County Mapping Information Center, 2014

Figure 4.13-8
Chevron Refinery Modernization Project EIR
Transportation Facilities and Corridors Nearby the Project Site

Mitigation Measure 4.13-13b: Chevron will fund the costs of a qualified expert in refinery safety, to be selected and retained by the County and/or the City within the County's and/or City's discretion, to review the ISSAs, PHAs, LOPAs, and other safety documentation associated with events triggering such ISSAs, PHAs, or LOPAs. Chevron will also cooperate in providing access to Chevron documentation and facilities, as needed, for the expert, the County, and the City review. At such time as the RISO is amended, and to the extent this amendment requires Chevron to fund a new, full-time chemical process safety inspector to do inspections at the Facility, Chevron shall provide to CCHS and the City the level of funding required to hire a new, full-time chemical process safety inspector for the Facility, and thereafter shall no longer be required to fund a separate third-party expert for reviews of PHAs, ISSAs, LOPAs, or other inspections.

Mitigation Measure 4.13-13c: Chevron will complete the tri-annual safety audits required by RISO. In addition, upon request by the County and/or City, Chevron shall fund the costs of a qualified third-party expert in refinery safety to perform a safety or compliance audit that would be provided to the County and/or City for review.

Mitigation Measure 4.13-13d: Chevron will report to the City quarterly, and shall provide a copy of this report to the County, after Project approval on the status of the corrective actions taken to implement agency recommendations to Chevron resulting from the August 6, 2012 fire, as well as any corrective actions taken by Chevron as a result of its own investigation. To the extent that Chevron elects not to implement a recommendation made by an agency, Chevron shall include in these quarterly reports a detailed explanation of its rationale for doing so.

Mitigation Measure 4.13-13e: Chevron shall fund the City's coordination with the CSB, Cal/OSHA, the BAAQMD, and the EPA on their investigations regarding the Facility to the extent these agencies request City involvement or consultation.

Mitigation Measure 4.13-13f: Chevron shall designate a Facility Area Business Unit Manager as the management level position bearing responsibility for any and all decisions to not implement a recommendation made during an inspection or turnaround. Chevron shall also designate a Facility Area Business Unit Manager as the management level position bearing responsibility for the establishment of the parameters in the Integrity Operating Window program, as well as for any decisions to override, bypass, or otherwise disregard an alert or flag that arises through the Integrity

Operating Window program. The annual Reliability Program reports shall include clear identification of the individuals acting as Area Business Unit Managers to whom these accountabilities have been assigned. If the management position bearing any of these responsibilities changes within Chevron from the Area Business Unit Manager to another management-level job title, Chevron shall notify the City and include an update to this effect in its Reliability Program annual report.

Mitigation Measure 4.13-13g: Prior to the issuance of building and fire permits for the Project, Chevron shall provide to the City documentation demonstrating that it has completed implementation of (to Cal/OSHA's satisfaction) or otherwise discharged (through administrative appeal) all corrective or abatement actions resulting from Cal/OSHAs investigation following the August 2012 fire, and from Cal/OSHAs temporary leak seal investigation.

Mitigation Measure 4.13-13h: Chevron shall establish Integrity Operating Windows (IOWs) to monitor process temperatures for purposes of identifying process temperature increases above the baseline period (2008-2010) for any individual circuit affected by the Modernization Project (as indicated in the Reliability Analysis Appendix 4.13-REL). The IOW shall establish temperature "flags" for each temperature monitoring location based on industry-standard damage curves. Prior to implementation of the IOW temperature flags, Chevron shall provide information to the City and County regarding the flag trigger temperature levels and the basis for them, and provide the City and County an opportunity to review and comment on them before they are implemented. The IOW-2 temperature flag shall be triggered if the process temperature exceeds the established temperature for a cumulative 365 days, and shall require Chevron to perform a reliability analysis to evaluate, among other things, existing process conditions, flag dates for wall thickness, monitoring and inspection data, expected corrosion rates, metallurgy, existing damage mechanism reviews, and monitoring and inspection frequency. Chevron shall report the results of these reliability analyses in its annual Reliability Program report, and shall make process temperature data for all temperature monitoring locations within each process unit and circuit included in the Reliability Analysis (Appendix 4.13-REL) available for review by the City or County at the refinery. Chevron also shall include in its annual Reliability Program reports a listing of all events relating to process temperatures reaching levels that triggered a IOW-level 2 (defined by Chevron as a "slower acting event that requires technical evaluation and recommendations within one week") alert during the calendar year that is the subject of the annual report, as well as a description of the

resolution of each such event. Chevron shall report to the City and County within one week of any IOW-level 1 (defined by Chevron as a "fast acting event that requires operator action within a shift or two") alert event relating to IOW process temperature parameters for circuits affected by the Modernization Project (as indicated by the Reliability Analysis Appendix 4.13-REL).

4.13.6 Mitigation Monitoring and Reporting

4.13.6.1 Summary of CEQA Mitigation Monitoring and Reporting Program obligations

CEQA requires the City, as the lead agency, to adopt a Mitigation Monitoring and Reporting Program (MMRP) to ensure implementation of mitigation measures and conditions of project approval that avoid, minimize, or mitigate a significant adverse impact (Section 15097(a) of the CEQA Guidelines, 14 CCR Division 6 Chapter 3). CEQA also allows the lead agency to delegate this mitigation monitoring and reporting obligation to another public agency that accepts the delegation, but the lead agency remains responsible for ensuring that the measures are implemented. Chevron's Project Design Features and mitigation measures specified above would be included in the MMRP.

4.13.6.2 Contra Costa County Health Services Role in MMRP

The City has requested, and CCHS has agreed, to collaborate in the monitoring of Chevron's implementation of the Modernization Reliability Program Project Design Features and the related refinery safety mitigation measures identified in this EIR, implementation of which will be required as a condition of Modernization Project approval.

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4.14 PUBLIC SERVICES

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) changes to relevant plans and policies, including adoption of a new Richmond General Plan. These revisions do not change the 2008 EIR's conclusions that there are no significant adverse public services impacts for the Modernization Project.

IMPACT SUMMARY

- The Modernization Project would not result in significant adverse physical impacts associated with the provision of new or physically altered governmental facilities or the need for new or physically altered governmental facilities, the construction of which could cause significant adverse environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services. As a result, the Modernization Project would have no significant adverse public services impacts as defined by CEQA Guidelines Appendix G.
- The Modernization Project would not result in the need for new or physically altered police facilities in order to maintain the Richmond Police Department's ability to provide police protection services to the Facility and City of Richmond.
- The Modernization Project would not result in the need for new or physically altered fire service facilities in order to maintain the ability of the Richmond Fire Department to provide mutual aid fire suppression and emergency response services to the Facility or to serve other parts of the City.
- The Modernization Project would not result in the need for new or physically altered school facilities in order to maintain the ability of the West Contra Costa School District to adequately provide educational services to residents of the City of Richmond.
- The Modernization Project would not result in the need for new or physically altered governmental facilities in order to maintain performance objectives for other public services, such as libraries or hospitals. Parks and trails are discussed in *Section 4.15, Parks and Recreation*.
- Although not necessary to mitigate impacts, improvement measures are recommended to further minimize the already less-than-significant police and fire protection impacts of the Project.

4.14.1 Introduction

This section discusses local conditions for public services, including police, fire, emergency medical services, schools, and analyzes the potential impacts related to construction and operation of the Modernization Project.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities that could potentially affect public services. For example, as described in *Chapter 3, Project Description, Section 3.3,* construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

4.14.2 Setting

4.14.2.1 Regional and Project Setting

4.14.2.1.1 *Police Protection*

The Facility's Emergency Services Division, Security Department (Security Department) handles security response for the Facility. The Security Department is responsible for maintaining access control into and out of the Facility; conducting internal traffic control; investigating internal motor vehicle accidents, thefts, and drug and alcohol cases; and conducting contraband inspections. The

Security Department utilizes a contract security guard service inside the Facility to assist primarily with access control and security (Ayers, 2013).

During the morning and afternoon peak traffic periods, at times when major Facility turnarounds are occurring, and also during large construction projects such as the Modernization Project, the Security Department hires (on an overtime basis) personnel from the City of Richmond Police Department (Richmond Police Department) to provide traffic control at contractor gates (Ayers, 2013). The Facility also requests assistance from the Richmond Police Department for other incidents—typically involving burglaries, thefts, stolen vehicles, auto accidents, suspicious persons, and threatening telephone calls (Gagan, 2013). In 2012, the Richmond Police Department received approximately 33 calls for assistance to the Facility (Gagan, 2013).

The Richmond Police Department is located at 1701 Regatta Boulevard. The staffing varies depending on time of day and day of the week. Most personnel work during normal business hours, with the fewest working on weekends and swing and graveyard shifts. The Richmond Police Department's current authorized force is 198 sworn personnel (Gagan, 2013) comprising nine beats. Beat one covers the geographic area in which the Facility is located, and less than 1% of that beat's activities are associated with serving the Facility, on either an active or stand-by basis (Gagan, 2013).

Richmond Police Department response times vary, depending on the availability of personnel and type of call. The response system is based on priorities, and it maintains a response time of 3 to 5 minutes (or less) for top priority calls (e.g., robberies in progress, imminent danger to life).

4.14.2.1.2 *Fire Prevention and Protection: Chevron Fire Department*

The Security Department of the Richmond Facility operates its own internal fire department (Chevron Fire Department). The Chevron Fire Department consists of approximately 34 uniformed personnel. This organization is supplemented by a more than 300-person volunteer fire brigade. All operators at the Facility and all of the volunteer firefighters are trained to deal with emergencies typically associated with an oil refinery. The Chevron Fire Department has 21 vehicles, which vary from fire engines to quick-attack vehicles, equipped to respond to fire emergencies. Over the past 3 years, the average response time by the Chevron Fire Department to any location within the Facility has been 3 minutes or less (Hardin, 2013).

The Chevron Fire Department follows nationally recognized fire prevention standards, including those of the American Petroleum Institute, Uniform Fire

Code, Uniform Building Code, and National Fire Protection Association (Ayers, 2013). The application of these standards is discussed in *Section 4.13, Public Safety*.

4.14.2.1.3 *Emergency Medical Service: The Chevron Fire Department*

The Chevron Fire Department currently has 34 trained California Certified emergency medical technicians. The minimum number of emergency medical technicians on duty at any given time is 4, with as many as 13 to 15 on duty during a normal Monday–Friday work week (Hardin, 2013).

The Chevron Fire Department responds to approximately 400 (environmental, security, first aid, fire) calls per year. Of this number, about 80% involve minor incidents such as particles in eyes, minor sprains, and bee stings; the other 20% involve injuries of a more serious nature, such as broken bones, severe sprains, back injuries, head trauma, and burns (Ayers, 2013).

The Security Department has a direct line to American Medical Response ambulatory dispatch services. When required, American Medical Response provides transportation to local hospitals or to John Muir Hospital in Walnut Creek (the County trauma center). Further discussion of Chevron's on-site safety procedures and response is provided in *Section 4.13, Public Safety*.

The Richmond Fire Department provides emergency medical service to the Facility as a backup to Chevron's Fire Department. The Richmond Fire Department assists Chevron with medical emergencies only when they cannot be handled by Chevron and American Medical Response and if called by the Chevron Fire Department. There have been no incidents over the past 5 years in which the Richmond Fire Department responded to medical emergency calls at the Facility (Banks, 2013b).

4.14.2.1.4 *Fire Prevention and Protection: City of Richmond Fire Department*

The Richmond Fire Department currently staffs 97 personnel, which includes the Fire Prevention Bureau and administrative and secretarial staff. The Richmond Fire Department comprises seven engine companies and one truck company (Banks, 2013a).

The Richmond Fire Department responds to an average of approximately 11,000 calls per year, with approximately 50 calls per year related to industrial accidents. Approximately 80% of the industrial-related incidents are minor and 20% involve serious injuries (Banks, 2013a).

The Richmond Fire Department responds to fire and emergency medical events at the Facility only when called by the Chevron Fire Department (on average, no more than six times a year). When called, the Richmond Fire Department responds with four engines, one truck, and two Battalion Chiefs. In most instances in which the Richmond Fire Department is called, its role is to stand by at a Chevron Fire Station while Chevron firefighters handle the emergency, providing additional support if needed (Hardin, 2013). On two occasions, the Richmond Fire Department responded to incidents in which it did not engage in firefighting, but assisted the Chevron Fire Department with staging for emergency response. Over the past 6 years, the Richmond Fire Department has actively assisted in controlling emergencies on only two occasions—the August 6, 2012 fire and the 2007 fire at the Crude Unit (Banks, 2013b).

Four Richmond Fire Department stations are first-responding units for Chevron incidents: Station 61, at 140 W. Richmond in Pt. Richmond; Station 62, at 1065 7th Street; Station 67, at 1131 Cutting Boulevard; and Station 64, at 4801 Bayview Avenue. Each of these stations is staffed with four to seven firefighters. The average response time is between 2 and 5 minutes (Banks, 2013a).

In addition to responding to fire, rescue, and emergency medical incidents at the Facility, the Richmond Fire Department makes routine and regular fire inspections. On December 19, 2013, Chevron and the City entered into a 5-year Agreement for Fire Prevention Services under the terms of which Chevron would fund a full-time Fire Inspector II position to be embedded at the Facility. This Fire Inspector would review, analyze, issue, inspect, extend, and close all Fire Construction Permits, and maintain and renew as appropriate the Annual Operating Permit issued pursuant to the California Fire Code. The funding under the agreement compensates the City of Richmond for all personnel costs associated with the Fire Inspector II position as well as all permit fees (Judd, 2013). Chevron also has an ongoing contract with the City of Richmond for the services of one full-time on-site code enforcement officer for building and construction (Ayers, 2013).

4.14.2.1.5 *Fire Prevention and Protection: Mutual Aid Agreements*

Contra Costa County fire protection agencies assist each other in major emergencies that may be beyond the response capacity of any single agency under the terms of various “mutual aid” agreements. The Richmond Fire Department also has “automatic aid” agreements with all Contra Costa County fire departments and the El Cerrito Fire Department, which commits any fire engine from these departments to respond to a fire if any of their engines are closest to the fire at the time of a call, regardless of jurisdiction. Both mutual aid

and automatic aid agreements were used in response to the August 6, 2012 fire at the Facility (Banks, 2013b).

4.14.2.1.6 *Schools*

The Modernization Project is located within the Washington Elementary Attendance Area, which feeds to Portola Middle School and Kennedy High School. The middle and high schools have sufficient capacity to house students from new development; however, the enrollment at Washington Elementary School was 17 students over capacity in 2013-2014 and is projected to be 27 students over capacity by 2018-2019 (Jack Schreder & Associates, 2014). Therefore, students from any new residential development within the Washington Elementary Attendance Area would likely need to be transferred to another elementary school within the Kennedy High School Attendance Area. This school district has a transfer policy in place for all of its schools (King, 2014).

4.14.2.1.7 *Other Public Services and Facilities*

Other public facilities in the community include medical facilities, parks, and libraries. One hospital is located in Richmond—the 50-bed Kaiser Foundation Hospital, Richmond Campus, at 901 Nevin Avenue. However, there are 11 hospitals in Contra Costa County, and the next closest hospital is Doctors Hospital of San Pablo. The City of Richmond's Community Guide to Emergency Preparedness contains the locations and contact information for local hospitals. As described further in *Section 4.13*, *Public Safety*, Chevron's Emergency Response Program has plans and procedures in place for notifying employees, on-site and off-site emergency responders, government agencies, the community, and local hospitals in the event of a chemical release. The closest library is the West Side Branch at 135 Washington Avenue. Parks and trails are discussed in *Section 4.15, Parks and Recreation*.

4.14.2.2 Regulatory Setting

4.14.2.2.1 *Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan 2030), including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use, Plans, and Policies* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.14.3 Significance Criteria and Methodology

4.14.3.1 Significance Criteria

Consistent with Appendix G of the CEQA Guidelines, a project may be deemed to have a significant adverse impact on the environment with respect to Public Services if it would result in:

(A) Significant adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant adverse environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

- Police protection
- Fire protection
- Schools
- Parks
- Other public facilities

On the basis of these criteria, construction and operation of the Modernization Project would result in a significant adverse impact if it would increase the demands on police and fire services such that they were unable to maintain acceptable levels of service without a substantial need for new, altered, or expanded police or fire service facilities or equipment.

For the Richmond Police Department, an acceptable level of service involves a less than 5-minute response for “priority-one” calls. Response time varies for lower-priority calls depending on the severity. Each of the nine beats in Richmond is staffed by a minimum of one officer at all times, allowing rapid response times for “priority-one” calls. The Facility is located within beat one. In an emergency on Facility property, officers in beats one, five, and six can arrive in less than 5 minutes. Priority-one calls involve incidents that require an immediate police response in order to preserve life or where an immediate response would be essential to apprehend a felony suspect when a felony is less than 5 minutes old (Gagan, 2013).

For the Richmond Fire Department, an acceptable level of service involves responding to all emergencies within 6 minutes or less 85% of the time (Banks, 2013a).

The physical impacts on public roadways due to the traffic involved in the construction of the Modernization Project are considered in Impact 4.16-10 of

Section 4.16, Transportation and Traffic. Public service-related construction traffic concerns are addressed under Impact 4.14.1 below.

4.14.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of public services-related impacts is explained in the context of each impact, as discussed further below.

4.14.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

The Modernization Project could not be considered to have "no impact" in relation to any of the significance criteria listed above. Therefore, all of the criteria are discussed further below.

4.14.4 Impacts and Mitigation Measures

Impact 4.14-1: During the construction phase, the Modernization Project could result in an increase in the number of incidents necessitating calls to the Richmond Police Department and an increased need for the Richmond Police Department to deploy traffic control personnel. Increased employees during operation of the Modernization Project could result in the need for increased Richmond Police Department patrols. However, these increases would not trigger the need for new, altered, or expanded police service facilities or equipment. The impact would be less than significant and no mitigation is necessary. (LTS)

4.14.4.1 Construction

The Richmond Police Department anticipates that they would receive little or no increase in calls following the construction period as a result of the Modernization Project (Gagan, 2013). However, the increase in workers on the Project site during construction could result in additional calls to the Richmond Police Department. The current employee base of 1,200 full-time permanent employees and 400 contract employees is projected to be increased by an average of approximately 500 workers per day over the 2-year construction period, with a peak of 1,002 workers per day during the peak 6-month construction period (Chevron Transmittal #36O (Rev #3), 2014). This would be a temporary increase of approximately 84% of both on-site construction and operational workers at the peak of construction.

A proportionate 84% increase in the current average of 33 calls per year could result in approximately 14 additional calls to the Richmond Police Department during the peak 6 months of construction (approximately 2 calls per month) and a proportionately smaller addition during the rest of the construction period. An

increase of an estimated 2 calls for service each month to the Facility, which currently receives less than 1% of Richmond Police Department beat one activities, would not result in the need for new, altered, or expanded police service facilities or equipment, nor would it have any long-term impacts on the Richmond Police Department. As a result, the impact would be less than significant for both peak and non-peak construction periods.

4.14.4.2 Construction Traffic

Increased police services for traffic control could become an issue for the Richmond Police Department during the construction period because of the increased traffic by construction employees and equipment and material delivery trucks. However, any increased demand would not exceed the capacity of existing police services, so there would be no need for new, altered, or expanded police service facilities. Construction traffic impacts are discussed in *Section 4.16, Transportation and Traffic*.

4.14.4.3 Operation

Operation of the Modernization Project would result in the addition of 29 new permanent employees, and, as described in *Section 4.13, Public Safety*, depending on the Maritime Security level, could result in need for additional police services as additional security measures may be activated, including posting of additional security personnel at critical locations, increased Richmond Police Department patrols, restricted access and parking, and other sensitive security measures to protect the Facility. However, any increased demand would not exceed the capacity of existing police services, so there would be no need for new, altered, or expanded police service facilities or equipment and no long-term impacts on the Richmond Police Department.

As a result, this impact is considered less than significant under the CEQA Guidelines, and no mitigation is necessary. However, to further reduce this less-than-significant impact, the following improvement measure is recommended.

Improvement Measure 4.14-1:

1a: During the construction phase, Chevron shall hire additional security services as necessary to compensate for the increase in personnel on-site.

1b: Mitigation Measures 4.16-1 through 4.16-5 and Improvement Measure 4.16-1 through 9 (see *Section 4.16, Transportation and Traffic*) shall be implemented to reduce the demand for help from the Richmond Police Department for traffic-related issues.

Impact 4.14-2: Operation of the Modernization Project would contribute to the ongoing need for the Richmond Fire Department to provide mutual aid to the Facility. To effectively provide mutual aid, the Richmond Fire Department needs heavy rescue training and heavy rescue equipment to respond to fires and their associated environmental impacts, including emissions of air pollutants and hazardous materials releases. However, the ongoing need for mutual aid would not trigger the need for new, altered, or expanded fire service facilities or equipment. This impact would be less than significant and no mitigation is necessary. (LTS)

As described further in *Section 4.13, Public Safety*, the Richmond Fire Department works with Chevron Fire Department and with Contra Costa County Health Services in preparing for and responding to emergencies. This includes conducting emergency drills with the Facility and/or Contra Costa County Health Services to prepare for fires and/or hazardous materials releases. The ability of the Fire Department to provide such mutual aid services depends on the levels of staff training and the equipment available to it (Banks, 2013a).

As discussed in greater detail in *Section 4.13, Public Safety*, the Modernization Project would include new Facility equipment and operational practices that would require additional Richmond Fire Department and Chevron Fire Department training. The Richmond Fire Department and Chevron Fire Department would be required to participate in familiarity training at any new facilities (Ayers, 2013). Although the Modernization Project could incrementally increase the demand for services from the Richmond Fire Department, there would be no need for improved facilities. As a result, this impact is considered less than significant under the CEQA Guidelines, and no mitigation is necessary. However, to further reduce this less-than-significant impact, the following improvement measure is recommended.

> Improvement Measure 4.14-2: Chevron and the Richmond Fire Department shall establish an agreement that ensures training on new equipment and the acquisition of any necessary heavy equipment (e.g., large diameter hoses, large scale pumping equipment).

Impact 4.14-3: The Modernization Project could result in an increase in the number of calls to the Richmond Fire Department during the construction phase of the Project, and possibly more assistance calls for medical emergencies. However, these potential increases would not result in the need for new, altered, or expanded fire service facilities. The need for expanded Richmond Fire Department training and equipment is addressed

further in *Section 4.13, Public Safety*. This impact would be less than significant and no mitigation is necessary. (LTS)

According to staff from the Richmond Fire Department, no increase in fire emergency calls to the Fire Department resulting from construction and operation of the Modernization Project is anticipated (Banks, 2013a). Chevron also does not anticipate any increase in the current annual number of fire emergency calls to the Richmond Fire Department due to the temporary increase in workers during construction (Ayers, 2013). However, given the projected increase in the number of workers, an increase in medical emergencies during the construction period could be expected. Given the current system, the Chevron Fire Department has the primary responsibility for responding to medical emergencies at the Facility, and would, in most instances, handle the problems involving medical emergencies that would be associated with the additional personnel (Ayers, 2013).

On the basis of the projected increase in construction workers and the current annual number of calls to the Richmond Fire Department for both fire and medical emergencies, it is estimated that there would be approximately one additional call to which the Richmond Fire Department would be required to respond for medical emergencies during the peak 6-month construction period. As stated above, there have been no incidents over the past 5 years in which the Richmond Fire Department responded to medical emergency calls at the Facility, and the potential increase in one call for service to the Facility would not result in the need for new, altered, or expanded fire service facilities and therefore would not have a significant adverse impact on the Richmond Fire Department (Banks, 2013a).

Mitigation Measure 4.14-3: None required.

Impact 4.14-4: The Modernization Project would not result in an increase in need for new, altered, or expanded public service facilities such as schools, libraries, or hospitals. This impact would be less than significant and no mitigation is necessary. (LTS)

4.14.4.4 Libraries

The Modernization Project would not directly or indirectly induce substantial population growth in the area (see *Section 4.12, Employment, Population, and Housing*). Because the existing local labor pool is anticipated to be adequate for the construction activities, adequate numbers of construction workers currently reside within commuting distance, and additional permanent employees would be minimal, there would be no substantive increase in use of existing library

services. Therefore, no additional constraints would be placed on libraries as a result of the Modernization Project. No significant adverse physical impacts associated with providing new or altered library facilities would occur.

4.14.4.5 Schools

Construction and operation of the Modernization Project would not affect the ability of the West Contra Costa Unified School District to adequately provide educational services to residents of Richmond. Because the Modernization Project does not include a residential component, and potential population growth in Richmond due to temporary construction workers and the addition of 29 new permanent employees would be minimal, few additional children would be anticipated to enroll in Richmond schools because of the Modernization Project. In addition, temporary construction workers and permanent employees are anticipated to come from both the City of Richmond and various locations outside of the City of Richmond, further reducing potential impacts to the West Contra Costa Unified School District. Therefore, no new school facilities would be necessary to serve the Modernization Project, so no adverse environmental impacts from facility construction and operation would occur.

4.14.4.6 Hospitals

The Modernization Project would not directly or indirectly induce substantial population growth in the area (see *Section 4.12, Employment, Population, and Housing*). Because the existing labor pool is anticipated to be adequate for the construction activities, adequate numbers of construction workers currently reside within commuting distance, and additional permanent employees would be minimal, there would be no substantial increase in use of existing hospital services. As noted previously, an average of approximately 80 emergency calls per year are moved by American Medical Response to local and regional hospitals. The increase in temporary construction workers could potentially result in approximately 34 additional calls during the peak 6-month construction period and the increase in new permanent employees could result in approximately 1 additional emergency call per year. This projected level of increased emergency medical incidences would not result in a substantial change above existing levels. Therefore, no new physical facilities associated with hospitals would be needed as a result of the Modernization Project, and no significant adverse physical impacts associated with the provision of new or altered hospital facilities would occur.

Mitigation Measure 4.14-4: None required.

4.14.5 Cumulative Impacts

The geographic area considered for the analysis of cumulative public services impacts is the City of Richmond and the North Richmond Area, which is within an unincorporated area of Contra Costa County.

The Modernization Project, along with other anticipated growth and development in this area, would incrementally add to demand for public services. However, the Facility is staffed with both security and fire protection staff as a first response team. The City of Richmond public services personnel (Richmond Police Department and Richmond Fire Department) are used only to augment existing Facility Security and Fire departments. This need generally is of a temporary and sporadic nature and would not present a significant adverse cumulative impact.

As stated previously, construction and operation of the Modernization Project would not result in a need for any new, altered or expanded police, fire, school, library, or hospital facilities. Because the Modernization Project would have no significant adverse public services impacts under the CEQA Guidelines Appendix G thresholds, the Project would have no cumulatively considerable public services impacts. Accordingly, the Modernization Project, together with past, present, existing, pending, and reasonably foreseeable future projects, would not result in cumulatively considerable public services impacts.

See *Section 4.0, Introduction to Chapter and Methodology,* for a detailed discussion of the approach and methods of the cumulative analysis.

4.14.6 References—Public Services

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4.15 PARKS AND RECREATION

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) changes to relevant plans and policies, including the adoption of a new Richmond General Plan. These revisions do not change the 2008 EIR's conclusions that there are no significant adverse parks and recreation impacts for the Modernization Project.

IMPACT SUMMARY

- The temporary increase in construction labor force during construction of the Modernization Project could increase the use of nearby neighborhood parks and increase demand for use of the proposed segments of the Bay Trail along Western Drive. This impact would be less than significant and no mitigation is necessary.
- The Modernization Project does not include recreational facilities and would not require the construction or expansion of recreational facilities. Thus, the Project would have no impact related to construction or expansion of recreational facilities.

4.15.1 Introduction

This section establishes the existing conditions and identifies and evaluates potential impacts related to parks and recreational facilities that could result from construction and operation of the Modernization Project.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities. For example, as described in *Chapter 3, Project Description, Section 3.3,* construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

4.15.2 Setting

4.15.2.1 Regional and Project Setting

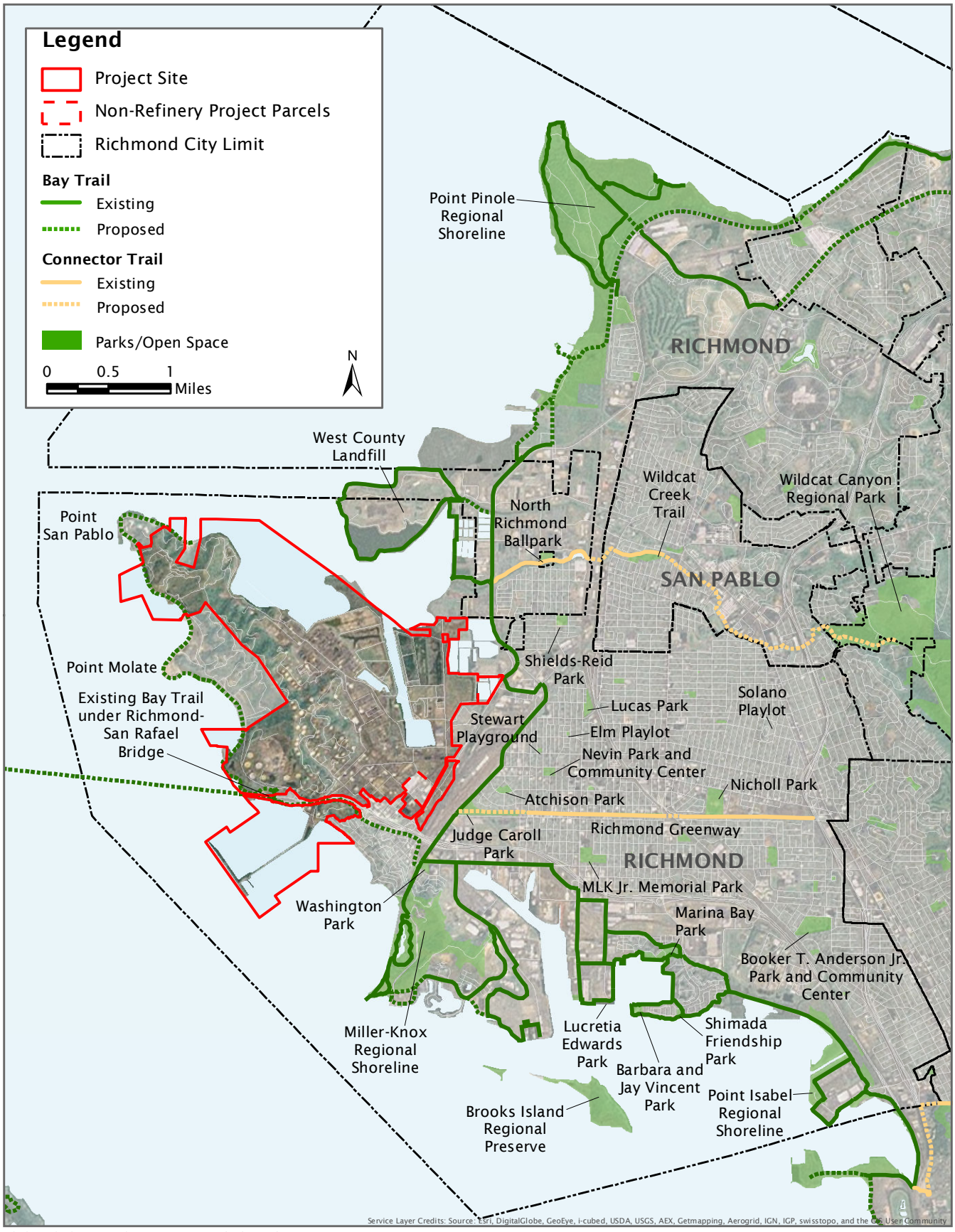
Regional and local parks and recreational facilities in the vicinity of the Project site are discussed below and shown on Figure 4.15-1.

4.15.2.1.1 *Regional Parks*

Within Alameda and Contra Costa Counties, the East Bay Regional Park District (EBRPD) manages more than 113,000 acres; 65 regional parks, recreation areas, wilderness, shorelines, preserves and land bank areas; 29 regional inter-park trails; 1,200 miles of trails within parklands; 11 freshwater swimming areas, boating and/or stocked fishing lakes and lagoons and a disabled accessible swimming pool; 40 fishing docks; three bay fishing piers; 235 family campsites; 42 youth camping areas; two golf courses; 2,082 family picnic tables; 1,707 group picnic tables; nine interpretive and education centers; and 18 child play areas. A total of 90% of EBRPD's lands are protected and operated as natural parklands (EBRPD, 2014a).

Regional parks within approximately 5 miles of the Project site include:

- **Brooks Island.** The 373-acre Brooks Island in San Francisco Bay is located to the south of the Project site just off the Richmond Inner Harbor. The Island is open for limited group guided tours and provides hiking trails and field archery ranges.
- **Miller/Knox Regional Shoreline.** This 295-acre area, located about 1 mile south of the Project site, includes a shoreline picnic area and swimming beach area on Dornan Drive in Point Richmond.
- **Point Isabel.** Point Isabel is a 21-acre landscaped park, located about 4 miles to the southeast of the Project site at the west end of Central Avenue in Richmond. Amenities include jogging trails and picnic areas.
- **Point Pinole Regional Shoreline.** Point Pinole is a 2,315-acre parkland, located approximately 4 miles to the northeast of the Project site next to the



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Note: Chevron owns several contiguous parcels that are not part of the Facility/Project site which are not affected by the Modernization Project.

Source: California Protected Area Dataset (CPAD), San Francisco Bay Trail Project and Chevron (T38r1)

Figure 4.15-1
Chevron Refinery Modernization Project EIR
Recreation Facilities within the Vicinity of the Project Site

- cities of Richmond, San Pablo, and Pinole. The park includes hiking, bicycling, and horse trails and a 1,250-foot fishing pier.
- **Tilden Park** (Not shown on Figure 4.15-1)**.** Tilden Park is a 2,077-acre regional park that provides amenities such as pony rides, a carousel, hiking trails, swimming and picnicking, a botanical garden, a golf course, and a nature area and farm. Tilden Park is located to the east of the Project site in the Berkeley Hills.
- **Wildcat Canyon** Wildcat Canyon Regional Park is a 2,427-acre park that has hiking, biking, and equestrian trails, and picnic facilities. It is located to the northeast of the Project site to the north of Tilden Park (EBRPD, 2014b).

4.15.2.1.2 *Local Parks*

The City of Richmond's Recreation and Parks Department manages the City's recreation and cultural programs and services. The Department oversees the operations of 12 community centers, a marina, aquatics programs, senior programs, youth programs, sports leagues and fitness centers, adult programs, arts programs, performances by the Oakland East Bay Symphony, festivals, after school programs, education programs, mentor programs, youth city government, disabled programs, and a convention center.

Neighborhood parks within the vicinity of the Project site, as shown on Figure 4.15-1, include Atchison Park (4.3 acres), located approximately 0.5 mile to the east of the Project site at Bissell Avenue and Curry Street; Washington Park (2.51 acres), located approximately 0.5 mile to the southeast of the Project site at 110 E. Richmond Avenue at Garrard Boulevard; Elm Play lot (0.5 acre), located approximately 0.75 mile to the east of the Project site at 8th Street and Elm Avenue; Stewart Playground (0.8 acre), located approximately 0.5 mile to the east of the Project site at 5th Street and Barrett Avenue; Solano Play lot (0.2 acre), located to the east of the Project site at 38th Street and Solano Avenue; Nevin Park and Community Center (4.38 acres), located approximately 1 mile to the east of the Project site at 598 Nevin Avenue at 6th Street; Judge Carroll Park (2.5 acres), located approximately 0.25 mile to the east of the Project site at West Cutting Boulevard and Garrard Boulevard; Lucas Park (7.14 acres), located approximately 1.25 miles to the northeast of the Project site at the terminus of Lucas Avenue near 10th Street; Shields-Reid Park (5.9 acres), located approximately 0.5 mile to the northeast of the Project site at 1410 Kelsey Street; North Richmond Ballpark (8.2 acres), located northeast of the Project site at 3rd Street and Da Villa; Martin Luther King Jr. Memorial Park and Community Center (13 acres), located approximately 1.25 miles to the southeast of the Project site at the northeast corner of the intersection of S. Harbor Way and Cutting Boulevard; Nicholl Park (21 acres), located approximately 2 miles east of the

Project site at MacDonald Avenue and 33rd Street; Booker T. Anderson Jr. Park and Community Center (22 acres), located approximately 3 miles to the

southeast of the Project site; Lucretia Edwards Park (2 acres), located approximately 2 miles to the southeast of the Project site at 1500 Marina Way; Barbara and Jay Vincent Park (6 acres), located approximately 2.5 miles to the southeast of the Project site at the end of the Peninsula in the Marina Area; and Shimada Friendship Park (3 acres), located approximately 2.5 miles to the southeast of the Project site at Peninsula Drive and Marina Bay Parkway (City of Richmond, 2012a). In addition, the existing entrance to the Richmond Greenway is located approximately 0.75 mile to the east of the Project site at Ohio Avenue and 6th Street. Once completed, the Richmond Greenway will run along the former Santa Fe railroad corridor parallel to Ohio and Chanslor Streets and connect to the San Francisco Bay Trail on the west with Ohlone Greenway and in the City of El Cerrito on the east (City of Richmond, 2014).

4.15.2.1.3 *San Francisco Bay Trail*

Senate Bill 100, authored by Bill Lockyer, was passed into law in 1987, and directed the Association of Bay Area Governments (ABAG) to develop a plan for a "ring around the Bay," including a specific alignment for the current Bay Trail. The Bay Trail, which includes approximately 310 miles of the proposed 500-mile alignment provides easily accessible recreational opportunities for outdoor enthusiasts, including hikers, joggers, bicyclists, and skaters. It also offers a setting for wildlife viewing and environmental education, and it increases public respect and appreciation for the Bay. It also has transportation benefits, providing a commute alternative for cyclists and connections to numerous public transportation facilities.

Depending on the location of its segments, the Bay Trail consists of paved multi-use paths, dirt trails, bike lanes, sidewalks, or city streets signed as bike routes.

Near the Project site, a designated Bay Trail segment is planned from the Point Richmond neighborhood to the Richmond/San Rafael Bridge and north along the shoreline of Point San Pablo Peninsula passing through Point Molate and the Winehaven District around to Point San Pablo as shown on Figure 4.15-1. This land is owned by Chevron and the City of Richmond with the exception of the Caltrans' Interstate 580 (I-580) corridor. Caltrans has built a Bay Trail segment under the Richmond/San Rafael Bridge that connects the south side of the toll plaza with Western Drive on the north side of I-580 as shown in Figure 4.15-1.

4.15.2.1.3.1 *North of Richmond/San Rafael Bridge*

In November 2009, by Resolution No. 2009-11-291, the East Bay Regional Park District Board of Directors authorized an agreement with Chevron to donate a

recreational easement across the two parcels of Chevron-owned lands, north of the Richmond/San Rafael Bridge, to accommodate the designated Bay Trail segments. The 20-foot-wide, 1.6-mile-long easement is planned to generally follow the former Richmond Beltline Railroad corridor across Chevron parcels along the Shoreline as shown in Figure 4.15-1. The agreement required EBRPD to develop an alignment for the trail as close to the original corridor as possible and to develop the legal descriptions required to finalize and to record the easement documents. On October 16, 2012, EBRPD awarded a contract to Nichols Consulting Engineers to develop a preferred alignment and the legal descriptions necessary to finalize and record the easements donated by Chevron. Nichols Consulting Engineers have completed their work which is currently under review by Chevron (Townsend, 2013).

4.15.2.1.3.2 *South of the Richmond/San Rafael Bridge*

In 2001, the Feasibility Study of Bay Trail Routes to the Point San Pablo Peninsula was completed to study the Bay Trail segment between the Point Richmond neighborhood and the constructed Bay Trail segment under the Richmond/San Rafael Bridge. The Steering Committee for the Feasibility Study reached a consensus that the Option 2 alignment, which ran from the end of Tewksbury Avenue over Chevron property bordering the I-580 corridor to reach the south side of the Richmond/San Rafael Bridge Toll Plaza area, represented the best route across Chevron-owned land (TRAC, 2013). At the time of publication of the 2008 EIR, enhanced security requirements imposed on the Facility (including the Long Wharf) as a result of the 9/11 terrorist attacks precluded further consideration in the Modernization Project. In 2008, Chevron agreed to provide a public easement over a portion of its property for this segment of the Bay Trail as part of the Community Benefits Agreement for the Renewal Project. Subsequently, Chevron entered into a separate letter agreement with the California State Lands Commission affirming its commitment to the City for the Bay Trail easement south of the Richmond/San Rafael Bridge.

On July 21, 2009, the Richmond City Council voted to award a contract to Questa Engineering to prepare a Project Study Report, looking at alternative alignments for the this Bay Trail segment. On July 10, 2012, the Richmond City Council adopted Resolution No. 85-12 to support the local consensus alignment for the this Bay Trail segment, and authorize the City Manager to execute the required Cooperative Agreement for Caltrans Project Initiation Document Assistance and CEQA/NEPA clearance. The local consensus alignment is the result of additional considerations related to enhanced post-9/11 security at the Facility, Caltrans Highway Design Standards and encroachment policies, and Americans with Disabilities Act design standards over the existing steep topography.

Completion of a Project Initiation Document approved by Caltrans represents consensus between Caltrans and the City of Richmond on the conceptual design so the City of Richmond can develop a funding plan to construct the Modernization Project. The City of Richmond is currently working with Caltrans on the Project Initiation Document (Camacho, 2013).

For further discussion of the Bay Trail, please see the discussion of Impact 4.10-2 in *Section 4.10 Land Use, Plans, and Policies*.

4.15.2.1.4 *Facility On-Site Recreational Facilities*

The Facility has extensive recreational facilities including a marina on San Pablo Bay and other facilities and activities (Health Quest gym, Rod & Gun Club, and sports leagues) that are available to employees and long-term, full-time contractors. Access to the Rod & Gun Club has been reduced and restricted for employees, contractors, and other visitors post-9/11 for security reasons.

4.15.2.2 Regulatory Setting

4.15.2.2.1 *City of Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan 2030), including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use, Plans, and Policies* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.15.2.2.2 *San Pablo Peninsula Open Space Study*

The San Pablo Peninsula Open Space Study designates a portion of the Project site to include a class I recreational trail and a class II recreational trail along the Bay. The following recommendations included in the Study that are applicable to recreation facilities on the Project site include:

- Interior trails throughout the Primary Study Area need to be jointly designed by the implementing agency(ies), Chevron, and other affected organizations or private entities, to ensure that Facility safety concerns are addressed.
- Chevron should be encouraged to work with potential park operators to transfer lands on the shore side of Western Drive to a public entity for park and recreation purposes.
- The obsolete railroad line running from the Project site toward Terminal 4 should be abandoned and considered for use as a Class I trail (LSA et al., 2005).

4.15.3 Significance Criteria and Methodology

4.15.3.1 Significance Criteria

Consistent with Appendix G of the CEQA Guidelines and the General Plan 2030, a significant recreation-related impact would occur if the Modernization Project would:

(A) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated; or

(B) Include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment.

4.15.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of parks and recreation-related impacts is explained in the context of each impact, as discussed further below.

4.15.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

Review and comparison of the Modernization Project to the environmental setting clearly show that the Project would create no impacts related to the following environmental topic listed in CEQA Guidelines Appendix G.

(B) Potential of the Project to include or require the construction or expansion of recreational facilities, which might have an adverse effect on the environment.

The Modernization Project does not include parks or recreational facilities, nor would the Project require the expansion or construction of any recreational facility. As is discussed in *Section 4.12, Employment, Population, and Housing*, no significant increase in local resident population and, correspondingly, no significant adverse impacts on local recreational facilities would occur as part of the operation of the Modernization Project. Thus, the Project would have no impact related to construction or expansion of recreational facilities.

4.15.4 Impacts and Mitigation Measures

Impact 4.15-1: The temporary increase in construction labor force during construction of the Modernization Project could increase the use of nearby neighborhood parks and increase demand for use of the proposed segments

of the Bay Trail along Western Drive. This impact would be less than significant and no mitigation is necessary. (LTS)

The Modernization Project would result in an approximate average of 500 workers per day over the 2-year construction period, with a peak of 1,002 workers per day during the peak 6-month construction period (Chevron Data Transmittal #36O (Rev #3), 2014). The measures and Project features designed to reduce Project impacts that are proposed as part of the Modernization Project and located outside the Process and Tank Farm areas or off the Project site, such as the Community Greenhouse Gas Reduction Program, Chevron's participation in Marin Clean Energy for some Chevron facilities, and the proposed ship/vessel upgrades, would not generate any significant new workers in the City of Richmond, either because no construction or operational activities are associated with these Project Design Features (Marin Clean Energy commitment) or because construction would occur outside of Richmond (replacement of ship and vessel engines) or because the jobs are expected to go to Richmond residents (e.g., the Community Greenhouse Gas Reduction Program). See *Section 4.3, Air Quality* and *Section 4.8, Greenhouse Gases*, for further discussion.

These workers could, during lunch times, temporarily increase the usage of local parks or the proposed segments of the Bay Trail along Western Drive. However, such a temporary impact would not be considered significant. Furthermore, time constraints getting to and from the work area within the Project site to local parks or to the Bay Trail along Western Drive would be a disincentive for workers to leave the Project site during work hours.

As is discussed in *Section 4.12, Employment, Population, and Housing*, no significant increase in local resident population would result from the Modernization Project. Correspondingly, no significant adverse impacts on local recreational facilities would occur as part of the operation of the Modernization Project.

Mitigation Measure 4.15-1: None required.

4.15.5 Cumulative Impacts

The geographic area considered for the parks and recreation cumulative analysis consists of the City of Richmond and the North Richmond Area, which is immediately northeast of the Project site in unincorporated Contra Costa County.

As stated in the Richmond General Plan 2030 EIR (General Plan 2030 EIR), the City of Richmond has a total of 4,312 acres of parklands and open space, which account for 22% of the land area in the City. Of these parklands, 4,029 acres are owned and operated by regional agencies, and 283 acres are City-owned

facilities or jointly used by the City and other public or private entities. The General Plan 2030 EIR further states that because the parks that serve the City of Richmond, including regional parks, far exceed the City's per-resident parkland standard (3 acres of local parkland per 1,000 residents), the City would be adequately served in the future. Additionally, provisions of the General Plan 2030 will ensure that future residential growth in the City provides a minimum of 3 acres of parkland per 1,000 residents, so that future park facilities will be provided commensurate with local growth in Richmond.

The small increase in local resident population resulting from the Modernization Project (as identified in *Section 4.12, Employment, Population, and Housing*), in conjunction with population and density of past, present, existing, pending, and reasonably foreseeable future development in the City, could result in a cumulative increase in the demand for parks and recreation facilities.

The General Plan 2030 EIR concludes that, although development under the General Plan 2030 could have an impact on existing parks and recreational facilities in the City due to increased use, implementation of the General Plan 2030 would not significantly accelerate the deterioration of existing recreational facilities or create a demand for the construction or expansion of park facilities. The General Plan 2030 EIR further concludes that the General Plan 2030 together with cumulative development would not result in significant cumulative impacts to park or recreational facilities in Richmond due to the supply of parkland and the City policies that require that private developers proposing residential subdivisions within the City either dedicate land for park facilities or pay a fee in lieu of providing parkland.

The amount of existing parkland in the City of Richmond, together with City policies that require dedication of land or payment of an in-lieu fee for future residential subdivisions to further reduce the impact from increased demand and use from development that may occur, would ensure that the Modernization Project, together with past, present existing, pending, and reasonably foreseeable future projects, would not result in significant cumulative impacts to parks and recreational facilities. As a result, the Modernization Project would not contribute to any significant adverse cumulative impacts to park or recreational facilities.

See *Section 4.0, Introduction to Chapter and Methodology,* for a detailed discussion of the approach and methods of the cumulative analysis.

4.15.6 References—Parks and Recreation

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4.16 TRANSPORTATION AND TRAFFIC

This section was not challenged in Court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; 2) the current baseline; and (3) changes to relevant plans and policies, including the adoption of a new Richmond General Plan. These revisions do not change the 2008 EIR's conclusions that there are no significant adverse traffic impacts for the Modernization Project.

IMPACT SUMMARY

- The transportation impacts of the Modernization Project would occur primarily during construction of the Project components. The construction phase of the Modernization Project would generate up to about 2,144 daily trips, including 537 AM peak hour trips and 509 PM peak hour trips, at the Facility.
- Project construction-generated increases in traffic volumes at the signalized study intersections of Castro Street/I-580 Westbound Ramps and Richmond Parkway/Gertrude Avenue would result in significant adverse impacts on peak hour traffic levels.
- Project construction-generated increases in traffic volumes, combined with traffic generated by the construction of Other Projects at the Facility and a major turnaround at the Facility, at the signalized study intersections of Castro Street/I-580 Westbound Ramps, Castro Street/General Chemical Access, Castro Street/Hensley Street, and Richmond Parkway/Gertrude Avenue would result in significant adverse impacts on peak hour traffic levels.
- Project construction-generated impacts on the above-noted intersections would be reduced to a less-than-significant level through mitigation measures that would include: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements.
- Project construction-generated increases in heavy truck traffic on area roadways could result in substantial damage or wear of public roadways. This impact would be reduced to a less-than-significant level through a mitigation measure that would require Chevron to repair any roads damaged as a result of Modernization Project construction activity.

- Operation of the Modernization Project following Project construction would generate about 94 new daily one-way truck trips because of increased import and export of materials to and from the Facility. Facility permanent employment levels would increase by 29 employees. This amount of added traffic is less than significant when compared to the Baseline and the 2030 traffic volumes within the study area intersections.

4.16.1 Introduction

This section discusses the existing transportation and traffic conditions at the Facility and its vicinity, and estimates the traffic that would be generated due to Modernization Project construction, and operation of the Project in the future.[1] This section also describes the traffic impacts and presents measures to mitigate significant traffic impacts of the Modernization Project.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities. For example, as described in *Chapter 3, Project Description, Section 3.3,* construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place,

[1] The analysis of potential transportation impacts is based information contained in the Traffic Impact Analysis for Chevron Modernization Project EIR memorandum (Fehr & Peers, February 2014), which is included in *Appendix 16*.

and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

4.16.2 Setting

4.16.2.1 Regional and Project Setting

4.16.2.1.1 *Roadway Network*

Regional access to the site is provided via Interstate 580 (I-580) and Interstate 80 (I-80). Local site access is provided via Castro Street and Richmond Parkway.

I-580 is a six-lane freeway in the vicinity of the Facility and connects I-80 east of the Modernization Project with U.S. Highway 101 in Marin County via the four-lane Richmond – San Rafael Bridge. The median lanes on I-580 are designated high-occupancy vehicle lanes during peak commute periods. The Facility is located on the northern side of the I-580/Castro Street interchange. The average daily traffic volume on I-580 at the Castro Street Interchange is about 69,000 vehicles (Caltrans, 2013).

I-80 is a major east-west freeway link providing access between Richmond and Oakland/San Francisco to the south and west, and Sacramento to the east. Through the City of Richmond, six travel lanes are provided on I-80. Drivers traveling to and from the northeast between I-80 and the Facility use the Richmond Parkway, which extends from I-80 near the northern limits of the City to I-580. The average daily traffic volume on I-80 just south of I-580 is about 268,000 vehicles (Caltrans, 2013).

Castro Street/Richmond Parkway is a major local road providing access to freeways in the cities of Richmond and San Pablo. It connects I-580 in the south (at Castro/Marine Streets interchange) and I-80 in the north (at Fitzgerald Drive/Richmond Parkway interchange). Facility Access Gates 31 (Mills Street) and 91 (General Chemical Access), which would be used during the Modernization Project construction, are located on Castro Street. The average daily traffic volumes on Castro Street and Richmond Parkway are about 23,600 vehicles and 14,800 vehicles, respectively (Richmond General Plan 2030 EIR, 2012b).

4.16.2.1.2 *Existing Traffic Conditions*

To assess existing traffic conditions on the local street network serving the Facility, existing intersection operating conditions were evaluated for the morning (7:00 AM to 9:00 AM) and evening (4:00 PM to 6:00 PM) peak periods at

the following 11 study intersections (see Figure 4.16-1), all of which are controlled by traffic signals, except as indicated below:

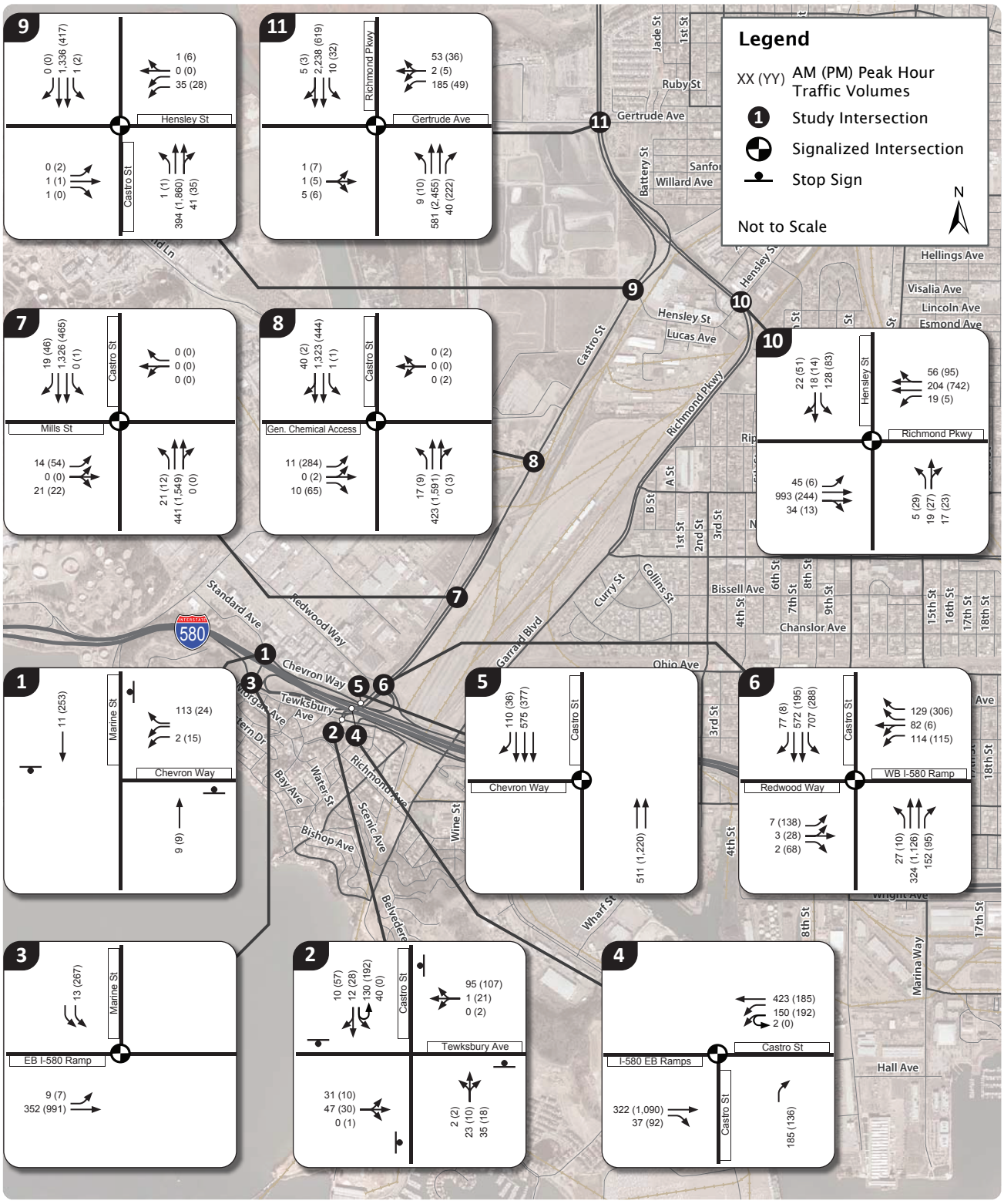
1. Chevron Way/Marine Street (all-way stop sign control)
2. Castro Street/Tewksbury Avenue (all-way stop sign control)
3. Marine Street/I-580 Eastbound Ramps
4. Castro Street/I-580 Eastbound Ramps
5. Castro Street/Chevron Way
6. Castro Street/I-580 Westbound Ramps (Gate 14)
7. Castro Street/Mills Street (Gate 31)
8. Castro Street/General Chemical Access (Gate 91)
9. Castro Street/Hensley Street
10. Richmond Parkway/Hensley Street
11. Richmond Parkway/Gertrude Avenue

To measure and describe the operating conditions of intersections, a rating system called Level of Service (LOS) is commonly used. Level of service is a qualitative description of an intersection's performance based on the average delay per vehicle. The levels range from LOS A, which indicates free-flow vehicular traffic conditions with little or no delay experienced by motorists, to LOS F, which indicates congested conditions with long delays. Table 4.16-1 presents the LOS criteria for the signalized and the unsignalized intersections.

The study intersections for this analysis, both signalized and unsignalized, were evaluated using the 2000 Highway Capacity Manual methodology (TRB, 2000). For signalized and four-way stop-controlled intersections, LOS is defined based on average delay (in seconds per vehicle) for the overall intersection. For side-street stop-controlled intersections, the average delay and LOS are reported for the movements subject to delay by conflicting vehicles (i.e., vehicles on the side street(s) and vehicles making left turns on the major street).

The Richmond General Plan 2030 (General Plan 2030) classifies Richmond Parkway and Castro Street as Routes of Regional Significance.[2] Per the West

[2] As described in the Richmond General Plan 2030, Routes of Regional Significance are roadways that: (1) connect to a regional highway/transit facility; (2) carry significant amount of traffic; (3) cross county boundaries; and/or (4) connect more than one region of the county.



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Source: Fehr & Peers, 2014

Figure 4.16-1
Chevron Refinery Modernization Project EIR
Existing Conditions
Lane Configurations and Peak Hour Volumes

TABLE 4.16-1 DEFINITIONS FOR INTERSECTION LEVEL OF SERVICE

Unsignalized Intersections			Signalized Intersections	
Description	Average Total Vehicle Delay (Seconds)	LOS Grade	Average Control Vehicle Delay (Seconds)	Description
No delay for stop-controlled approaches.	≤10.0	A	≤10.0	Free Flow or Insignificant Delays: Operations with very low delay, when signal progression is extremely favorable and most vehicles arrive during the green light phase. Most vehicles do not stop at all.
Operations with minor delay.	>10.0 and ≤15.0	B	>10.0 and ≤20.0	Stable Operation or Minimal Delays: Generally occurs with good signal progression and/or short cycle lengths. More vehicles stop than with LOS A, causing higher levels of average delay. An occasional approach phase is fully utilized.
Operations with moderate delays.	>15.0 and ≤25.0	C	>20.0 and ≤35.0	Stable Operation or Acceptable Delays: Higher delays resulting from fair signal progression and/or longer cycle lengths. Drivers begin having to wait through more than one red light. Most drivers feel somewhat restricted.
Operations with increasingly unacceptable delays.	>25.0 and ≤35.0	D	>35.0 and ≤55.0	Approaching Unstable or Tolerable Delays: Influence of congestion becomes more noticeable. Longer delays result from unfavorable signal progression, long cycle lengths, or high volume to capacity ratios. Many vehicles stop. Drivers may have to wait through more than one red light. Queues may develop, but dissipate rapidly, without excessive delays.
Operations with high delays, and long queues.	>35.0 and ≤50.0	E	>55.0 and ≤80.0	Unstable Operation or Significant Delays: Considered to be the limit of acceptable delay. High delays indicate poor signal progression, long cycle lengths and high volume to capacity ratios. Individual cycle failures are frequent occurrences.

TABLE 4.16-1 DEFINITIONS FOR INTERSECTION LEVEL OF SERVICE

Unsignalized Intersections			Signalized Intersections	
Description	Average Total Vehicle Delay (Seconds)	LOS Grade	Average Control Vehicle Delay (Seconds)	Description
				Vehicles may wait through several signal cycles. Long queues form upstream from intersection.
Operations with extreme congestion, and with very high delays and long queues unacceptable to most drivers.	>50.0	F	>80.0	Forced Flow or Excessive Delays: Occurs with oversaturation when flows exceed the intersection capacity. Represents jammed conditions. Many cycle failures. Queues may block upstream intersections.

Source: TRB, 2000.

Contra Costa Transportation Advisory Committee (WCCTAC) and the City of Richmond, signalized and unsignalized intersections on Routes of Regional Significance are considered to be functioning under acceptable conditions if the service level is LOS D or better.[3]

Existing peak hour traffic volumes for the study intersections were collected in September 2011. During weekday peak traffic hours, all 11 study intersections currently operate at an acceptable LOS D or better (see Table 4.16-2).

Although renovation work is currently underway on I-580 between the Facility and Richmond Bridge, this renovation work is anticipated to be completed in late 2014, prior to the anticipated start of Modernization Project construction in January 2016 (Caltrans, 2014). There are no other traffic-related improvements that are anticipated to change traffic conditions in 2016 relative to the conditions measured in 2011. The year 2016 was selected for the analysis of

[3] The West County Action Plan 2009 Update (WCCTAC, 2009) establishes a Multi-Modal Traffic Service Objective of LOS D or better for intersections on Routes of Regional Significance. The Richmond General Plan 2030 policies stipulate that LOS standards shall comply with the West County Action Plan, which is part of the 2009 Countywide (Contra Costa County) Transportation Plan.

TABLE 4.16-2 INTERSECTION PEAK HOUR TRAFFIC LEVEL OF SERVICE OPERATIONS – EXISTING CONDITIONS (2011)

No.	Intersection	Traffic Control[a]	AM Peak Hour Delay[b]	AM Peak Hour LOS	PM Peak Hour Delay[b]	PM Peak Hour LOS
1.	Chevron Way/Marine Street	AWSC	5.7	A	8.5	A
2.	Castro Street/Tewksbury Avenue	AWSC	8.3	A	9.3	A
3.	Marine St./I-580 Eastbound Ramps	Signal	1.9	A	17.5	B
4.	Castro Street/I-580 Eastbound Ramps	Signal	17.5	B	50.9	D
5.	Castro Street/Chevron Way	Signal	2.1	A	1.0	A
6.	Castro Street/I-580 Westbound Ramps	Signal	20.9	C	36.2	D
7.	Castro Street/Mills Street	Signal	6.5	A	7.9	A
8.	Castro St./General Chemical Access	Signal	8.3	A	17.0	B
9.	Castro Street/Hensley Street	Signal	6.1	A	12.6	B
10.	Richmond Pkwy./Hensley Street	Signal	11.8	B	8.6	A
11.	Richmond Pkwy./Gertrude Avenue	Signal	18.2	B	25.5	C

[a] AWSC = all-way stop-controlled intersection; Signal = traffic signal-controlled intersection.
[b] Average overall intersection control delay (seconds per vehicle) reported for signalized and all-way stop-controlled intersections.
Source: Fehr & Peers, 2014.

construction traffic impacts because the expected peak traffic period of the Modernization Project construction period would be during the first quarter of 2016. Intersection volumes in 2016 were interpolated using the 2011 measured traffic volumes and forecast growth rates developed using the Contra Costa Transportation Authority (CCTA) travel demand model (CCTA model), as described in more detail below, to calculate the adjusted traffic Baseline. The impact of the Modernization Project was estimated by evaluating how intersection levels of service would change with the addition of construction-related traffic to this Baseline.[4]

[4] This approach to adjusting the existing conditions baseline to account for environmental conditions as they will exist at the time of project implementation is consistent with the California Supreme Court's ruling in *Neighbors for Smart Rail vs. Exposition Metro Line Construction Authority* (2013) 57 Cal.4th 439, 452 (holding that

4.16.2.2 Regulatory Setting

4.16.2.2.1 *LOS Standard for Intersections on Routes of Regional Significance*

As stated above, WCCTAC and City of Richmond stipulate that the standard for acceptable traffic operating conditions at signalized and unsignalized intersections on Routes of Regional Significance is LOS D or better.

4.16.2.2.2 *Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan 2030), including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use, Plans, and Policies* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.16.3 Significance Criteria and Methodology

4.16.3.1 Significance Criteria

Consistent with Appendix G of the CEQA Guidelines, a project may be deemed to have a significant adverse impact on the environment with respect to traffic and transportation if it would:

(A) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit;

(B) Conflict with an applicable congestion management program, including, but not limited to level of service standard and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways;

(C) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks;

(D) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment);

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under CEQA "an existing conditions analysis may take account of environmental conditions that will exist when the project begins operations.")

(E) Result in inadequate emergency access; or

(F) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

Consistent with WCCTAC and City of Richmond requirements, this EIR identifies an impact as significant if:

- The project would cause a signalized study intersection to deteriorate from LOS D or better to LOS E or LOS F.
- At a signalized study intersection where the level of service is LOS E, the Project would cause the average control delay to increase by more than five seconds or deteriorate to LOS F.
- At a signalized study intersection where the level of service is LOS F, the Project would cause the average control delay to increase by more than five seconds.
- The project would cause an unsignalized study intersection to operate at LOS F and after Project completion cause the intersection to satisfy the Caltrans peak hour traffic volume signal warrant.

4.16.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of transportation and traffic related impacts is explained in the context of each impact, as discussed further below.

4.16.3.2.1 *Traffic Sources*

The following three primary sources of traffic generation would be associated with the Facility over the Modernization Project construction period (expected to occur over 24 months):

- **Modernization Project Construction.** Project construction including the construction of hydrogen plant replacement, sulfur removal improvements, hydrogen plant tie-ins.
- **Refinery Operations.** Normal day-to-day operations of the Facility, which would continue through the duration of Modernization Project construction. Existing Refinery Operations traffic is part of the Setting for this analysis, discussed below. Changes to operations-related traffic generation, following Project construction, would be minor, as described below.

- **Periodic Facility Maintenance.** Facility maintenance activities, including shutdowns for maintenance of major Facility components ("turnarounds"), which are anticipated to occur during Modernization Project construction;

See *Section 4.3, Air Quality* and *Section 4.8, Greenhouse Gases*, for a discussion of potential impacts of measures and Project Design Features designed to reduce Project impacts that are proposed as part of the Modernization Project and located outside the Refinery Process and Tank Farm areas or off the Project site, such as measures included in the Community Greenhouse Gas Reduction Program, Chevron's participation in Marin Clean Energy for some Chevron facilities, and the proposed ship/vessel upgrades.

This analysis examines traffic associated with Modernization Project construction as the basis for determining the significance of direct Project impacts. Because changes to Refinery Operations-related traffic generation following Modernization Project construction would be minimal (i.e., the Project would create approximately 29 permanent jobs), the Project itself would not result in any significant adverse traffic impacts. This job creation level, and resulting trip level, is conservatively estimated assuming 100% Facility utilization.[5]

Accordingly, the remainder of this analysis considers post-Project operations-related traffic generation as a potential cumulative impact in relation to past, present, and reasonably foreseeable future projects. Cumulative impacts associated with construction of Other Projects (Other Projects include construction worker and truck traffic associated with other construction projects that would coincide with Modernization Project construction, as defined in *Appendix 16, Traffic Study*) and major turnarounds are likewise addressed, as are the very minor increases in traffic volumes associated with post-Project Refinery Operations.

The traffic study considered the following scenarios:

- Baseline conditions
- Baseline Plus Project Construction conditions

[5] For the Project operations, the analysis assumes 100% utilization of the Facility, which does not cause any significant impacts. Therefore, the 93% Utilization Scenario would also not cause any significant impacts and was not specifically analyzed. See *Section 4.0, Introduction to Chapter and Methodology* for a discussion of Facility utilization.

- Baseline Plus Project Construction Plus Other Projects Construction conditions
- Baseline Plus Project Construction Plus Other Projects Construction Plus Major Facility Turnaround conditions
- Future 2030 conditions (assuming Refinery Operations, and changes to existing operations-related traffic generation, following Modernization Project construction)

For the cumulative (2030) scenario, the Modernization Project would be in its operational phase (i.e., construction of its components would have been completed). The year 2030 was chosen for the cumulative scenario due to the availability of traffic projections for that year from regional transportation authorities, because the Modernization Project would have been fully operational for many years as of that time, and because this 2030 projection includes regional growth factors by expert agencies that are considered representative of long-term conditions. Specifically, the 2006 CCTA Model was used to identify 2030 conditions. The CCTA Model forecast includes the most up-to-date information regarding City and County land use and transportation improvement information for both Contra Costa and Alameda Counties and the greater Bay Area. The CCTA Model uses Association of Bay Area Governments (ABAG) Projections 2009 (ABAG, 2009) for land use and employment. The City of Richmond Preferred General Plan Alternative land use assumptions (Richmond General Plan 2030 EIR, 2012b) were used in the CCTA model in order to more accurately reflect expected growth in Richmond. Operation of the Facility following Modernization Project construction would generate about 94 new daily one-way truck trips because of increased import and export of materials to and from the Facility. As discussed in *Section 4.12, Employment, Population, and Housing,* Facility permanent employment levels would increase by 29 employees.

4.16.3.2.2 *Trip Generation*

The trip generation associated with the Modernization Project, Other Projects, and major facility turnarounds was obtained from estimates provided by Chevron. These estimates provide information regarding the construction-related vehicle and truck trips. Vehicle and truck traffic estimates are provided, as well as the total passenger-car equivalents.[6] Table 4.16-3 presents the estimated increase in peak daily traffic during the construction period. The table includes

[6] Passenger-car equivalent represents the number of passenger cars displaced by each truck in the traffic stream. One truck is the equivalent of two passenger cars for this analysis.

TABLE 4.16-3 MODERNIZATION PROJECT: ESTIMATED DAILY TRIP GENERATION, BY QUARTER, FOR PROJECT CONSTRUCTION, OTHER PROJECTS, MAJOR TURNAROUNDS

	2015				2016				2017			
Quarter	**1st**	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**
WORKER VEHICLES												
Project Construction												
Craft Labor Vehicle Traffic					2,000	1,940	1,340	850	650	370	370	370
Construction Support[b]					34	34	34	20	20	10	10	10
Total Project Construction Auto Vehicle One-Way Trips Per Day[c]	0	0	0	0	**2,034**	**1,974**	1,374	870	670	380	380	380
Other Projects												
Craft Labor Vehicle Traffic	1,415	1,435	1,423	1,389	1,349	1,333	1,333	1,333	20	20	20	0
Total Other Project Auto Vehicle One-Way Trips Per Day	**1,415**	**1,435**	**1,423**	**1,389**	**1,349**	**1,333**	**1,333**	**1,333**	**20**	**20**	**20**	**0**
Major Facility Turnarounds[d]												
Craft Labor Vehicle Traffic					3,550							
Miscellaneous Turnaround Support[b]					32							
Total Turnaround Auto Vehicle One-Way Trips Per Day					**3,582**							
Total Auto Vehicle One-Way Trips Per Day	1,415	1,435	1,423	1,389	**6,905**	3,307	2,707	2,203	690	400	400	380
Vehicle Summary By Facility Gate												
Gate 91 (Construction and Turnaround Contractors)	92	110	99	68	5,087	1,795	1,255	801	621	360	360	342
Gate 31 (Construction and Turnaround Support)	10	12	11	8	565	199	139	89	69	40	40	38
Kelham Warehouse Trips	274	274	274	274	274	274	274	274				

TABLE 4.16-3 MODERNIZATION PROJECT: ESTIMATED DAILY TRIP GENERATION, BY QUARTER, FOR PROJECT CONSTRUCTION, OTHER PROJECTS, MAJOR TURNAROUNDS

	2015				2016				2017			
Quarter	**1st**	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**
Hensley Warehouse Trips	1,039	1,039	1,039	1,039	1,039	1,039	1,039	1,039				
TRUCKS												
Project Construction												
Materials traffic (One-Way Truck Trips)					55	22	12	12	4	154	154	154
Total Project Construction Passenger-Car Equivalents Per Day[c,e]	**0**	**0**	**0**	**0**	**110**	**44**	**24**	**24**	**8**	**308**	**308**	**308**
Other Projects												
Materials Traffic (One-Way Truck Trips)	194	202	180	174	174	170	170	170	8	8	8	0
Total Other Projects Passenger-Car Equivalents Per Day[e]	**388**	**404**	**360**	**348**	**348**	**340**	**340**	**340**	**16**	**16**	**16**	**0**
Major Facility Turnarounds[d]												
Materials Traffic (One-Way Truck Trips)					40							
Total Turnaround Passenger-Car Equivalents Per Day[e]					**80**							
Total Truck One-Way Passenger-Car Equivalents Per Day	*388*	*404*	*360*	*348*	***538***	*384*	*364*	*364*	*24*	*324*	*324*	*308*
Truck (passenger-car equivalent) Summary By Facility Gate												
Gate 31 (Construction and Turnaround Materials, and Refinery Operation Deliveries)	226	242	198	186	376	222	202	202	24	324	324	308
Kelham Warehouse Trips	34	34	34	34	34	34	34	34				
Hensley Warehouse Trips	128	128	128	128	128	128	128	128				
Total Project Construction Passenger-Car Equivalent Volumes[c]	**0**	**0**	**0**	**0**	**2,144**	**2,018**	**1,398**	**894**	**678**	**668**	**668**	**668**

TABLE 4.16-3 MODERNIZATION PROJECT: ESTIMATED DAILY TRIP GENERATION, BY QUARTER, FOR PROJECT CONSTRUCTION, OTHER PROJECTS, MAJOR TURNAROUNDS

	2015				2016				2017			
Quarter	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Total Volumes	1,803	1,839	1,783	1,737	7,503	3,691	3,071	2,567	714	724	724	668

[a] All vehicle and truck trips are shown as one-way trips per day. A round trip equals two trips. See Traffic Impact Analysis for Chevron Modernization Project EIR memorandum (February, 2014), in *Appendix 16, Traffic Study* for a breakdown of estimated daily traffic associated with separate individual projects.

[b] Miscellaneous construction support include lunch wagons, fueling, parts runs, etc.

c Construction related trips (either vehicle or passenger-car equivalent) equals ONLY Project traffic. This is the basis for traffic impact evaluations and is shown reversed above.

[d] Major turnarounds do not result from the Modernization Project and are shown here to provide an idea of total variability in Facility traffic. Totals reflect peak periods, and therefore are not at these levels for the entire quarter. Estimated durations of turnarounds vary from 18 to 38 days per turnaround. Turnaround schedules are subject to change (estimated traffic is based on Richmond Facility long-range shut-down schedule, as of January 29, 2007). This analysis assumes that peak turnaround would coincide with peak activity generated by Project construction and other projects.

[e] Passenger-car equivalent factor of 2.0 used per the Highway Capacity Manual 2000.

Source: Chevron Data Transmittal #36O (Rev #3), 2014; Chevron Data Transmittal #5 (Rev #3), 2014; Fehr & Peers, 2014.

estimates not only for Modernization Project construction traffic, but also estimates for trip generation associated with major turnarounds and other projects, and to be conservative assumes these activities would occur during the same periods as Project construction. Major turnarounds, in particular, can be scheduled at various times of the year, but for analytical purposes it has been assumed that a major turnaround could occur in the first quarter of 2016 (when Modernization Project construction traffic is estimated to be at its highest level).

Table 4.16-4 presents the AM and PM peak hour traffic generation estimates for the peak 2016 construction period of the Modernization Project, the Other Projects that occur during the peak construction activity, and the major facility turnarounds that occur during the peak construction activity. The highest daily volume of traffic that can be expected to occur over the course of planned Project construction (i.e., if a major turnaround were to occur) is estimated to be about 7,503 passenger-car equivalents.

4.16.3.2.3 *Trip Distribution*

The trip distribution of the construction-related vehicle trips was based on the existing directional split of the vehicles currently entering/leaving Gate 91 from/to North and South. A previous study (Cleaner Fuels Project Circulation Analysis) for the Chevron Facility was used to identify the trip distribution of the construction-related trucks. The resulting trip distribution of the construction-related traffic is shown in Table 4.16-5.

4.16.3.2.4 *Trip Assignment*

The AM and PM peak hour peak construction-generated trip generation estimates were applied to the distribution paths described above, and the construction period trips were assigned to Gates 91 and 31, with the majority of the trips oriented to/from Gate 91. The assigned Modernization Project construction trips were added to 2016 Baseline AM and PM peak hour volumes to derive the 2016 with-Project traffic volumes and to determine Project-specific construction impacts to study area intersections.

4.16.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

Consideration of the Modernization Project clearly shows that the Project would create no impacts related to the environmental topics listed below.

(C) Potential of the Project to result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks.

TABLE 4.16-4 FACILITY CONSTRUCTION TRAFFIC ESTIMATES (DURING PEAK CONSTRUCTION ACTIVITY, FIRST QUARTER 2016)

			AM Peak Hour (Vehicle/Hr)		PM Peak Hour (Vehicle/Hr)	
Project	**Type**	**Daily**	**In**	**Out**	**In**	**Out**
Project Construction	Vehicle	2,034	509	0	0	509
	Trucks	110	28	0	0	0
	Subtotal	*2,144*	*537*	*0*	*0*	*509*
Other Projects	Vehicle	1,349	338	0	0	338
	Trucks	348	87	0	0	0
	Subtotal	*1,697*	*425*	*0*	*0*	*338*
Major Facility Turnaround	Vehicle	3,582	896	0	0	896
	Trucks	80	20	0	0	0
	Subtotal	*3,662*	*916*	*0*	*0*	*896*
Total Trips		**7,503**	**1,878**	**0**	**0**	**1,743**

[a] Peak construction activity during the first quarter of 2016, based on Chevron Construction Traffic Estimates (see Table 4.16-3). All trips are presented in passenger-car equivalents.

[b] For peak hour trip generation, assume all inbound trips occur during the AM peak hour and all outbound trips occur during the PM peak hour, as shown:

- Half of the vehicle trips arrive at 6:00 AM for a 10-hour shift, departing at 4:00 PM.
- Half of the vehicle trips arrive at 7:00 AM for a 10-hour shift, departing at 5:00 PM.
- Assume all trucks are inbound in the AM and outbound in the PM.
- Assume half trucks arrive at 7:00 AM and depart at 3:00 PM, half arrive at 6:00 AM and depart at 2:00 PM. (Therefore, no trucks during the PM peak hour analysis period.)

Sources: Chevron Data Transmittal #36O (Rev #3), 2014; Chevron Data Transmittal #5 (Rev #3), 2014; Fehr & Peers, 2014.

TABLE 4.16-5 TRIP DISTRIBUTION – CONSTRUCTION TRAFFIC

	Trip Distribution	
Construction Trips	**North**	**South**
Vehicle	20%	80%
Truck	80%	20%

Source: Fehr & Peers, 2014.

There are no airports located within the vicinity of the Project site, nor is the Project site located within any flight paths. The Modernization Project would not involve aircraft and would not be near an airport, and the Project structures would not intrude into aircraft flight paths or air traffic spaces. Therefore, the

Modernization Project would have no impact on air traffic patterns that results in substantial safety risks.

(D) Potential of the Project to substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)

The Modernization Project would not involve redesign or reconfiguration of roadways. Measures that are needed to mitigate traffic volume impacts would eliminate any increase in hazard due to added trucks and worker automobiles accessing the Facility. There would be no incompatible uses, nor would there be roadway design changes. Therefore the Project would have no impact on road hazards. See Impact 4.16-12 below regarding safety at rail crossings.

(E) Potential of the Project to result in inadequate emergency access

The Modernization Project would not involve obstruction, redesign, or reconfiguration of roadways. The Modernization Project would temporarily increase congestion during construction on roadways adjacent to the Project site. However, mitigation measures presented in this Draft EIR (Mitigation Measures 4.16-1 through 4.16-9) would reduce congestion on these roadways. As a result, emergency vehicles would experience similar or less delay than under Baseline (2016) conditions and emergency vehicle response times would not be affected. Therefore, the Project would have no impact on emergency access. See *Section 4.13, Public Safety.*

(F) Potential of the Project to conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities

The Modernization Project would not involve obstruction, redesign or reconfiguration of roadways and would not affect the use of the roadway network by automobiles or bicycles, nor would it affect bus routes or bicycle racks. Proposed measures to mitigate the impacts of Modernization Project traffic would eliminate any increase in hazards to bicyclists through improvements to traffic flow during peak hours during Project construction. Given that there would be little or no adverse impact on population, there would be no increase in transit demand. The Project would have no adverse impact on adopted policies, plans, or programs supporting alternative transportation

(transit, bicycles, etc.). As a greenhouse gas mitigation measure, the Project includes the Proposed Community Greenhouse Gas Reduction Program, which is anticipated to include funding for programs to improve bicycle and pedestrian access within the City of Richmond (see Section 4.8, *Greenhouse Gases*).

4.16.4 Impacts and Mitigation Measures

4.16.4.1 Baseline Conditions

Modernization Project impacts are analyzed by comparing conditions with and without Project-generated traffic. The "without Project" (2016 Baseline) scenario represents reasonably foreseeable conditions in 2016 without the addition of Modernization Project construction traffic. Current Refinery Operations would continue through the duration of Modernization Project construction, and existing traffic counts conducted at area intersections and projected for Baseline conditions reflect the current operations. As described above, the highest Modernization Project construction-generated traffic volumes would be expected to occur in the first quarter of 2016. Therefore, the traffic impacts associated with the Project construction traffic were assessed under 2016 conditions.

Intersection volumes under Baseline conditions were interpolated using forecast growth rates developed using the CCTA model. The CCTA model was checked to ensure that it includes other planned and approved development projects within the City of Richmond expected to generate traffic in the year 2016 (see *Appendix 16, Traffic Study*), and it was determined that the CCTA model growth forecasts encompass the planned and approved development projects. Table 4.16-6 shows the results of the intersection operations analysis for 2016 Baseline conditions.

As shown, under 2016 Baseline conditions (without Project), all study intersections are expected to operate at acceptable LOS C or better during the AM peak hour. During the PM peak hour, 8 of the 11 study intersections are estimated to operate at acceptable LOS D or better during both peak hours. The three intersections projected to operate at an unacceptable service (LOS E or F) during the PM peak hour are as follows:

- Castro Street/I-580 Eastbound Ramps
- Castro Street/Redwood Way/I-580 Westbound Ramps
- Richmond Parkway/Gertrude Avenue

4.16.4.2 Baseline Plus Project Construction Conditions

Table 4.16-7 shows the results of the intersection operations analysis for the weekday AM and PM peak hours under Baseline Plus Project Construction

TABLE 4.16-6 INTERSECTION PEAK HOUR TRAFFIC LEVEL OF SERVICE OPERATIONS—BASELINE CONDITIONS

	Intersection	Traffic Control[a]	AM Peak Hour Delay[b]	AM Peak Hour LOS	PM Peak Hour Delay[b]	PM Peak Hour LOS
1.	Chevron Way/Marine Street	AWSC	5.9	A	8.5	A
2.	Castro Street/Tewksbury Avenue	AWSC	8.7	A	9.6	A
3.	Marine St./I-580 Eastbound Ramps	Signal	2.5	A	25.6	C
4.	Castro Street/I-580 Eastbound Ramps	Signal	16.2	B	**127.2**	**F**
5.	Castro Street/Chevron Way	Signal	2.0	A	0.9	A
6.	Castro Street/I-580 Westbound Ramps	Signal	25.3	C	**74.8**	**E**
7.	Castro Street/Mills Street (Gate 31)	Signal	7.6	A	9.9	A
8.	Castro St./General Chemical Access (Gate 91)	Signal	8.6	A	22.8	C
9.	Castro Street/Hensley Street	Signal	8.4	A	33.0	C
10.	Richmond Pkwy./Hensley Street	Signal	13.1	B	10.1	B
11.	Richmond Pkwy./Gertrude Avenue	Signal	21.1	C	**85.5**	**F**

Note: **Bold** type indicates intersection operating at an unacceptable LOS E or LOS F.
[a] AWSC = all-way stop-controlled intersection; Signal = traffic signal-controlled intersection.
[b] Average overall intersection control delay (seconds per vehicle) reported for signalized and all-way stop-controlled intersections.
Source: Fehr & Peers, 2014.

conditions. As shown, under Baseline Plus Project Construction conditions, all intersections would operate at acceptable levels during the AM peak period. Eight of the 11 study intersections are forecast to operate at acceptable LOS D or better during the PM peak hour. The three intersections projected to operate at an unacceptable service (LOS E or F) during the PM peak are as follows:

- Castro Street/I-580 Eastbound Ramps
- Castro Street/Redwood Way/I-580 Westbound Ramps
- Richmond Parkway/Gertrude Avenue

The Modernization Project impact at the intersection of Castro Street/I-580 Eastbound Ramps would be less than significant because LOS conditions would remain unchanged at LOS F, with average delay remaining the same.

Impact 4.16-1: Modernization Project construction-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Castro Street/I-580

TABLE 4.16-7 INTERSECTION PEAK HOUR TRAFFIC LEVEL OF SERVICE OPERATIONS—BASELINE PLUS PROJECT CONSTRUCTION CONDITIONS

	Intersection	Traffic Control[a]	AM Peak Hour		PM Peak Hour	
			Delay[b]	LOS	Delay[b]	LOS
1.	Chevron Way/Marine Street	AWSC	5.9	A	8.5	A
2.	Castro Street/Tewksbury Avenue	AWSC	8.7	A	9.6	A
3.	Marine St./I-580 Eastbound Ramps	Signal	2.5	A	35.0	C
4.	Castro Street/I-580 Eastbound Ramps	Signal	18.4	B	127.2	F
5.	Castro Street/Chevron Way	Signal	1.9	A	1.5	A
6.	Castro Street/I-580 WB Ramps	Signal	29.5	C	**94.7**	**F**
7.	Castro Street/Mills Street (Gate 31)	Signal	10.0	A	10.8	B
8.	Castro St./General Chemical Access (Gate 91)	Signal	50.0	D	34.3	C
9.	Castro Street/Hensley Street	Signal	9.2	A	47.4	D
10.	Richmond Pkwy./Hensley Street	Signal	13.1	B	10.1	B
11.	Richmond Pkwy./Gertrude Avenue	Signal	29.6	C	**99.5**	**F**

Note: **Bold** type indicates significant adverse impact.
[a] AWSC = all-way stop-controlled intersection; Signal = traffic signal-controlled intersection.
[b] Average overall intersection control delay (seconds per vehicle) reported for signalized and all-way stop-controlled intersections.
Source: Fehr & Peers, 2014.

Westbound Ramps. This impact would be reduced to a less-than-significant level after mitigation. (LTS with Mitigation)

Project construction-related traffic is projected to add a substantial amount of traffic to the critical movements of the Castro Street/I-580 Westbound Ramps intersection, which would result in a significant worsening of its operating conditions (from LOS E to LOS F during the PM peak hour).

Mitigation Measure 4.16-1: Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) and Caltrans to provide modified traffic control implemented at the intersection of Castro Street/I-580 Westbound Ramps during peak arrival and departure times in the PM peak hour. The modified traffic control shall be accomplished by one or more of the following methods: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal timing plan that would be in operation during specified peak

commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs of Richmond police officers or other law enforcement personnel to provide the traffic control under above-cited methods (1) or (3).

Implementation of Mitigation Measure 4.16-1 above would improve intersection operating conditions to LOS D during the PM peak hour, reducing the impact to a less-than-significant level.

Impact 4.16-2: Modernization Project construction-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Richmond Parkway/Gertrude Avenue. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Modernization Project construction-related traffic is projected to add a substantial amount of traffic to the critical movements of the Richmond Parkway/Gertrude Avenue intersection, which would result in a significant worsening of its operating conditions. (The intersection would continue to operate at LOS F during the PM peak hour with the Project increasing average intersection delay by about 14 seconds.)

Mitigation Measure 4.16-2: The following measures shall be implemented at the intersection of Richmond Parkway/Gertrude Avenue:

2a: Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) to provide modified traffic control during peak arrival and departure times in the PM peak hour. The modified traffic control shall be accomplished by one or more of the following methods: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs of law enforcement personnel to provide the traffic control under above-cited methods (1) or (3).

2b: During the peak congestion periods, through the use of traffic cones (and flaggers as needed), Chevron shall reconfigure the southbound (Richmond Parkway) approach to the intersection to provide one shared left-through lane, one through lane, and one shared right-through lane.

Implementation of Mitigation Measures 4.16-2a and 4.16-2b above would improve intersection operating conditions to LOS E during the PM peak hour, reducing the impact to a less-than-significant level.

4.16.4.2.1 *Evaluation of Impacts Associated with Other Projects Expected to Overlap with Project Construction*

Potential traffic impacts associated with Other Projects are also addressed, specifically during the first quarter of 2016. (Estimated daily traffic generation for those elements was shown in Tables 4.16-3 and 4.16-4.)

Chevron has identified a number of other projects, such as the Long Wharf Maintenance and Efficiency Project, and the Storage Tank Replacement Project, for which construction is expected to occur during Modernization Project construction. In addition, construction of the Hensley Street and Kelham Warehouse project (located east of Castro Street), would coincide with the Modernization Project construction.[7]

The impacts of the added traffic associated with those Other Projects was evaluated to determine if new or more severe impacts beyond those identified under Impacts 4.16-1 and 4.16-2 above would require mitigation beyond Mitigation Measures 4.16-1 and 4.16-2.

Table 4.16-8 shows the results of the intersection operations analysis for the weekday AM and PM peak hours under Baseline Plus Project Construction Plus Other Projects conditions. As shown, all intersection would operate at acceptable levels during the AM peak period. Seven of the 11 study intersections are forecasted to operate at acceptable LOS D or better during the PM peak hour. The four intersections projected to operate at an unacceptable service (LOS E or F) during the PM peak are as follows:

- Castro Street/I-580 Eastbound Ramps
- Castro Street/Redwood Way/I-580 Westbound Ramps
- Castro Street/Hensley Street
- Richmond Parkway/Gertrude Avenue

[7] See *Traffic Impact Analysis for Chevron Modernization Project EIR* memorandum (February, 2014), in *Appendix 16*, for a list of all Other Projects.

TABLE 4.16-8 INTERSECTION PEAK HOUR TRAFFIC LEVEL OF SERVICE OPERATIONS—BASELINE PLUS PROJECT CONSTRUCTION PLUS OTHER PROJECTS CONDITIONS

	Intersection	Traffic Control[a]	AM Peak Hour Delay[b]	AM Peak Hour LOS	PM Peak Hour Delay[b]	PM Peak Hour LOS
1.	Chevron Way/Marine Street	AWSC	5.9	A	8.5	A
2.	Castro Street/Tewksbury Avenue	AWSC	8.7	B	9.6	A
3.	Marine St./I-580 Eastbound Ramps	Signal	2.8	A	35.0	C
4.	Castro Street/I-580 Eastbound Ramps	Signal	21.0	C	127.1	F
5.	Castro Street/Chevron Way	Signal	1.8	A	1.6	A
6.	Castro Street/I-580 WB Ramps	Signal	32.3	C	**137.1**	**F**
7.	Castro Street/Mills Street (Gate 31)	Signal	10.8	B	10.8	B
8.	Castro St./General Chemical Access (Gate 91)	Signal	54.7	D	35.0	C
9.	Castro Street/Hensley Street	Signal	9.8	A	**91.2**	**F**
10.	Richmond Pkwy./Hensley Street	Signal	21.3	C	11.7	B
11.	Richmond Pkwy./Gertrude Avenue	Signal	43.8	D	**108.9**	**F**

Note: **Bold** type indicates significant adverse impact.

[a] AWSC = all-way stop-controlled intersection; Signal = traffic signal-controlled intersection.

[b] Average overall intersection control delay (seconds per vehicle) reported for signalized and all-way stop-controlled intersections.

Source: Fehr & Peers, 2014.

The Modernization Project impact at the intersection of Castro Street/I-580 Eastbound Ramps would be less than significant, because level-of-service conditions would remain unchanged at LOS F, with average delay remaining the same.

Impact 4.16-3: Modernization Project Construction Plus Other Projects conditions-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Castro Street/I-580 Westbound Ramps. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Modernization Project construction-related traffic combined with Other Project construction-related traffic is projected to add a substantial amount of traffic to the critical movements of the Castro Street/I-580 Westbound Ramps intersection,

which would result in a significant worsening of its operating conditions (from LOS E to LOS F during the PM peak hour).

Mitigation Measure 4.16-3: Mitigation Measure 4.16-1 shall be implemented.

Implementation of Mitigation Measure 4.16-3 above would improve intersection operating conditions to LOS E during the PM peak hour, reducing this impact to a less-than-significant level.

Impact 4.16-4: Modernization Project Construction Plus Other Projects conditions-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Castro Street/Hensley Street. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Modernization Project construction-related traffic combined with Other Project construction-related traffic is projected to add a substantial amount of traffic to the critical movements of the Castro Street/Hensley Street intersection, which would result in a significant worsening of its operating conditions (from LOS C to LOS F during the PM peak hour).

Mitigation Measure 4.16-4: The following measure shall be implemented at the intersection of Castro Street/Hensley Street:

Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) to provide modified traffic control during peak arrival and departure times in the PM peak hour. The modified traffic control shall be accomplished by one or more of the following methods: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs of law enforcement personnel to provide the traffic control under above-cited methods (1) or (3).

Implementation of Mitigation Measure 4.16-4 above would improve intersection operating conditions to LOS C during the PM peak hour, reducing this impact to a less-than-significant level.

Impact 4.16-5: Modernization Project Construction Plus Other Project conditions-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Richmond Parkway/Gertrude Avenue. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Modernization Project construction-related traffic combined with Other Project construction-related traffic is projected to add a substantial amount of traffic to the critical movements of the Richmond Parkway/Gertrude Avenue intersection, which would result in a significant worsening of its operating conditions. (The intersection would continue to operate at LOS F during the PM peak hour with the Project increasing average intersection delay by about 23 seconds).

Mitigation Measure 4.16-5: Mitigation Measure 4.16-2 shall be implemented.

Implementation of Mitigation Measure 4.16-5 would improve intersection operating conditions to LOS E during the PM peak hour, reducing this impact to a less-than-significant level.

4.16.4.2.2 *Evaluation of Impacts Associated with Other Projects and the Major Turnaround Assumed to Overlap with Project Construction*

Potential traffic impacts associated with Other Projects and a major facility turnaround are also addressed, specifically during the first quarter of 2016. (Estimated daily traffic generation was shown in Tables 4.16-3 and 4.16-4.)

In addition to the Other Projects that would coincide with the Modernization Project, this analysis assumes that a major turnaround could occur during the first quarter of 2016 coinciding with the peak activity generated by the Project and other projects. The impacts of the added traffic associated with those Other Projects and the major turnaround were evaluated to determine if new or more severe impacts beyond those identified under Impacts 4.16-1 through 4.16-5 above would require mitigation beyond Mitigation Measures 4.16-1 through 4.16-5.

Table 4.16-9 shows the results of the intersection operations analysis for the weekday AM and PM peak hours under Baseline Plus Project Construction Plus Other Projects Plus Major Turnaround conditions. As shown, nine of the 11 study intersections would operate at acceptable levels during the AM peak period. Six of the 11 study intersections are forecasted to operate at acceptable LOS D or better during the PM peak hour. The five intersections projected to operate at an unacceptable service (LOS E or F) during either or both peak hours are as follows:

TABLE 4.16-9 INTERSECTION PEAK HOUR TRAFFIC LEVEL OF SERVICE OPERATIONS—BASELINE PLUS PROJECT CONSTRUCTION PLUS OTHER PROJECTS PLUS MAJOR TURNAROUND CONDITIONS

	Intersection	Traffic Control[a]	AM Peak Hour Delay[b]	AM Peak Hour LOS	PM Peak Hour Delay[b]	PM Peak Hour LOS
1.	Chevron Way/Marine Street	SSSC	5.9	A	8.5	A
2.	Castro Street/Tewksbury Avenue	AWSC	8.7	B	9.6	A
3.	Marine St./I-580 Eastbound Ramps	Signal	3.2	A	35.0	C
4.	Castro Street/I-580 Eastbound Ramps	Signal	35.7	D	127.1	F
5.	Castro Street/Chevron Way	Signal	1.6	A	2.6	A
6.	Castro Street/I-580 WB Ramps	Signal	44.6	D	**123.5**	**F**
7.	Castro Street/Mills Street (Gate 31)	Signal	19.2	B	13.1	B
8.	Castro St./General Chemical Access (Gate 91)	Signal	**>150**	**F**	**>150**	**F**
9.	Castro Street/Hensley Street	Signal	12.2	B	**125.3**	**F**
10.	Richmond Pkwy./Hensley Street	Signal	21.3	C	11.7	B
11.	Richmond Pkwy./Gertrude Avenue	Signal	**69.4**	**E**	**109.8**	**F**

Note: **Bold** type indicates significant adverse impact.

[a] AWSC = all-way stop-controlled intersection; Signal = traffic signal-controlled intersection.

[b] Average overall intersection control delay (seconds per vehicle) reported for signalized and all-way stop-controlled intersections.

Source: Fehr & Peers, 2014.

- Castro Street/I-580 Eastbound Ramps (PM only)
- Castro Street/Redwood Way/I-580 Westbound Ramps (PM only)
- Castro Street/General Chemical Access (AM and PM)
- Castro Street/Hensley Street (PM only)
- Richmond Parkway/Gertrude Avenue (AM and PM)

The Modernization Project impact at the intersection of Castro Street/I-580 Eastbound Ramps would be less than significant (level-of-service conditions would remain unchanged at LOS F, with average delay remaining the same).

Impact 4.16-6: Modernization Project Plus Other Projects Plus Major Turnaround conditions-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Castro Street/I-580 Westbound Ramps. This

impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Modernization Project construction-related traffic combined with other project construction- and major turnaround-related traffic is projected to add a substantial amount of traffic to the critical movements of the Castro Street/I-580 Westbound Ramps intersection, which would result in a significant worsening of its operating conditions (from LOS E to LOS F during the PM peak hour).

Mitigation Measure 4.16-6: Mitigation Measure 4.16-1 shall be implemented.

Implementation of Mitigation Measure 4.16-6 would improve intersection operating conditions to LOS E during the PM peak hour, reducing this impact to a less-than-significant level.

Impact 4.16-7: Modernization Project Plus Other Projects Plus Major Turnaround conditions-generated increases in traffic volumes would result in a significant adverse impact to AM and PM peak hour traffic operations at the signalized study intersection of Castro Street/General Chemical Access (Gate 91). This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Modernization Project construction-related traffic combined with other project construction- and major turnaround-related traffic is projected to add a substantial amount of traffic to the critical movements of the Castro Street/General Chemical Access (Gate 91) intersection, which would result in a significant worsening of its operating conditions (from LOS C or better to LOS F).

Mitigation Measure 4.16-7: The following measures shall be implemented, in consultation with the Public Works Director or his designer, at the intersection of Castro Street/General Chemical Access:

7a: During the AM peak period, through the use of traffic cones (and flaggers as needed), Chevron shall reconfigure the northbound (Castro Street) approach to the intersection to provide two left-turn lanes and one shared right-through lane. The inbound approach on General Chemical Access shall also be reconfigured to provide two receiving lanes.

7b: During the PM peak period, through the use of traffic cones (and flaggers as needed), Chevron shall reconfigure the eastbound (General Chemical Access) approach to the intersection to provide two exclusive right-turn lanes and one exclusive left-turn lane.

7c: Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) to provide modified traffic control during peak arrival and departure times in the AM and PM peak hours. The modified traffic control shall be accomplished by one or more of the following methods: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs of law enforcement personnel to provide the traffic control under above-cited methods (1) or (3).

Implementation of Mitigation Measures 4.16-7a through 4.16-7c would improve intersection operating conditions to LOS D during both AM and PM peak hours, reducing this impact to a less-than-significant level.

Impact 4.16-8: Modernization Project Plus Other Projects Plus Major Turnaround conditions-generated increases in traffic volumes would result in a significant adverse impact to PM peak hour traffic operations at the signalized study intersection of Castro Street/Hensley Street. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Modernization Project construction-related traffic combined with other project construction- and major turnaround-related traffic is projected to add a substantial amount of traffic to the critical movements of the Castro Street/Hensley Street intersection, which would result in a significant worsening of its operating conditions (from LOS C to LOS F during the PM peak hour).

Mitigation Measure 4.16-8: Mitigation Measure 4.16-4 shall be implemented.

Implementation of Mitigation Measure 4.16-8 would improve intersection operating conditions to LOS D during the PM peak hour, reducing this impact to a less-than-significant level.

Impact 4.16-9: Modernization Project Construction Plus Other Projects Plus Major Turnaround conditions-generated increases in traffic volumes would result in a significant adverse impact to AM and PM peak hour traffic operations at the signalized study intersection of Richmond Parkway/ Gertrude Avenue. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Project construction-related traffic combined with Other Project construction- and major turnaround-related traffic is projected to add a substantial amount of traffic to the critical movements of the Richmond Parkway/Gertrude Avenue intersection, which would result in a significant worsening of its operating conditions (from LOS C to LOS E during the AM peak hour). The intersection would continue to operate at LOS F during the PM peak hour with the Project increasing average intersection delay by about 34 seconds.

Mitigation Measure 4.16-9: Mitigation Measure 4.16-2 shall be implemented.

Implementation of Mitigation Measure 4.16-9 would improve intersection operating conditions to LOS B during the AM peak hour and LOS E during the PM peak hour, reducing this impact to a less-than-significant level.

4.16.4.2.3 *Improvement Measures*

Although not necessary to mitigate Impacts 4.16-1 through 4.16-9 to less-than-significant levels, the City would request that Chevron consider implementing one or more of the following measures. Implementation of these improvement measures would further minimize Impacts 4.16-1 through 4.16-9.

Improvement Measure 4.16-1 through 9: Chevron shall implement one or more of the following measures to further reduce Modernization Project construction impacts by reducing construction-related traffic trips during the AM and PM peak hours.

1 through 9a: Chevron shall stagger the hours of operation of the craft labor so that the construction-related traffic would be distributed over the peak and non-peak hours of traffic operation.

1 through 9b: Chevron shall promote the use of car-sharing by the craft labor.

1 through 9c: Chevron shall coordinate the schedule among construction of the Modernization Project, construction of the other projects, and the major facility turnaround to minimize combined traffic generation on any single day.

4.16.4.2.4 *Mitigation Threshold Analysis*

A threshold analysis was performed to identify the two levels of increased traffic that would: (1) trigger each specific mitigation measure identified above for the four study intersections at which the Project construction-generated increases in traffic volumes would result in a significant adverse impact to traffic operations

during the peak hours; and (2) cause the failure of Mitigation Measures 4.16-1 through 4.16-9 (i.e., require additional measures to reduce traffic impacts to less-than-significant levels). These thresholds were calculated based on the increase in passenger-car equivalent vehicle volumes for the movement or approach direction requiring improvement. The threshold increase in passenger-car equivalent vehicle volumes was measured against the 2016 Baseline passenger-car equivalent vehicle volumes. The threshold increase in passenger-car equivalent vehicle volumes was then compared to the estimated distribution of Project construction traffic for that location, in order to identify the total trip generation (in both passenger-car equivalent vehicle volumes and truck volumes) of the Project construction that would trigger the need for the specific mitigation measure. See *Appendix 16, Traffic Study* for more details about the mitigation threshold analysis.

Impact 4.16-10: Modernization Project construction-generated increases in heavy truck traffic on area roadways could result in substantial damage or wear of public roadways. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

The use of big trucks to transport equipment and material during construction to and from the Project work sites could affect road conditions on the designated haul routes by increasing the rate of road wear. The degree to which this impact would occur depends on the roadway design (pavement type and thickness) and the existing condition of the road. Freeways, such as I-580, are designed to handle a mix of vehicle types, including heavy trucks. The Modernization Project's impacts are expected to be negligible on those roads. Arterials, such as Castro Street and Richmond Parkway, are likewise designed to handle a mix of vehicle types. However, because of the potential for excessive road wear due to Project construction trucks, measures are identified to mitigate this potentially significant adverse impact.

> Mitigation Measure 4.16-10: Chevron shall repair any roads damaged as a result of Modernization Project construction activity to a structural condition equal to that which existed prior to construction activity. Prior to Project construction, City of Richmond Public Works Department or the Director's designated representative would document road conditions for all routes that would be used by Project construction-related vehicles. The City would also document road conditions after Project construction is completed. The pre- and post-construction conditions of the haul routes shall be reviewed, and Chevron or contractor(s), and staff of the Public Works Department, would enter into an agreement prior to construction that details the pre-

construction conditions and the post-construction requirements of a rehabilitation program.

Impact 4.16-11: Modernization Project construction plus other projects plus major turnaround conditions generated increases in traffic volumes would add new trips to the intersections at Richmond Parkway and Pittsburg Avenue and Richmond Parkway and Parr Boulevard. These intersections currently operate at LOS A and C or better. While not expected, it is possible that the addition of new trips could result in a significant adverse impact to AM and PM peak hour traffic operations at these intersections. This impact, if any, would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

Mitigation Measure 4.16-11: These intersections are maintained by the County, and thus the City has no independent jurisdiction to enforce any requirement to mitigate impacts at these intersections. However the City and Chevron shall coordinate with the Contra Costa County Department of Public Works to implement the following mitigation measure at the intersections of Richmond Parkway and Pittsburg Avenue and Richmond Parkway and Parr Boulevard:

11a: Collect traffic data at the Richmond Parkway/Pittsburg Avenue and Richmond Parkway/Parr Boulevard intersections two weeks after start of construction during the AM and PM peak commute periods (6:00 to 9:00 a.m. and 4:00 to 6:00 p.m.). If traffic data indicate that either or both intersections operate below the established standard (i.e., LOS E or LOS F), Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) in coordination with the Contra Costa County Public Works Department to implement one or more of the of the following during the construction period:

1. Provide modified traffic control during the peak AM and/or PM peak commute periods. The modified traffic control shall be accomplished by one or more of the following methods:
    a. Posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers)
    b. Programming an alternate signal timing plan that would be in operation during the peak commute periods
    c. Posting traffic control officers to manually control traffic movements during peak commute periods

2. Using cones and/or flaggers, temporarily reconfigure the lane assignments at the intersection during peak AM and/or PM peak commute periods. Chevron shall pay the full cost of this measure, including costs of law enforcement personnel to provide the traffic control under above-cited methods 1(a) or 1(c).

4.16.4.3 Safety Hazards

Impact 4.16-12: The Modernization Project could increase the potential for traffic and emergency response hazard from non-compliant signage at the Richmond Lane railroad crossing. This impact would be reduced to a less-than-significant level after mitigation. (LTS after Mitigation)

The BNSF Railway (BNSF) Richmond yard is located immediately east of the Project site. There is one spur crossing entering the Facility from the BNSF yard. The crossing is identified as Richmond Lane. CPUC No. 132-0.15-C, CC-1050, Federal DOT No. 768293E. The BNSF Richmond yard is located immediately east of the Facility.

During past inspections, California Public Utilities Commission's Rail Crossings Engineering Section staff noted the above- referenced highway-rail at-grade crossings did not have the required Emergency Notification Information. Additionally, the Commission requires that all construction located near the rail track comply with the Commission's General Orders.

Mitigation Measure 4.16-12: Chevron shall post the correct emergency information at the Richmond Lane rail spur crossing in accordance with GO 75-D and evidence of compliance shall be provided to the City prior to issuance of any building or grading permits.

All construction located near the rail track within the Project site shall comply with the Public Utilities Commission's General Orders (GO). Details on the Commission's General Orders are located here: http://www.cpuc.ca.gov/crossings. These General Orders consist of:

- GO 26-D: Clearances on railroads and street railroads as to side and overhead structures, parallel tracks and crossings
- GO 72-B: Construction and Maintenance - Standard types of pavement construction at railroad grade crossings
- GO 75-D: Warning Devices for at-grade railroad crossings
- GO 88-B: Alterations of railroad crossings

- GO 118: Construction, reconstruction and maintenance of walkways and control, of vegetation adjacent to railroad tracks.

4.16.5 Cumulative Impacts

The cumulative 2030 scenario,[8] which is defined by the horizon year of the CCTA countywide travel demand model, was assessed to determine long-term traffic impacts associated with buildout conditions in the area. The locations and sizes of the major development projects envisioned in the county and cities' general plans have been programmed into the CCTA Model, which reflects regional growth based on projections that are consistent with forecasts by ABAG. In the vicinity of the Project, the 2030 scenario accounts for the completion and occupancy of the proposed Hensley Street and Kelham Warehouse Redevelopment Project.

Under 2030 conditions, operation of the Facility would generate additional truck trips due to an incremental increase of import and export of materials to and from the Facility. Facility permanent employment levels would increase by 29 employees due to operation of the Modernization Project. The level of traffic increase due to operation of the Modernization Project would be insignificant when compared to the projected 2030 traffic volumes at the study area intersections.

Traffic operating conditions on Project-used roadways in 2030 would be adversely affected by growth in population and employment in the area. Table 4.16-10 presents intersection operations for the weekday AM and PM peak hours under 2030 conditions. As shown, under 2030 conditions, 3 of the 11 study intersections are forecast to operate at acceptable LOS D or better during both peak hours. The eight intersections projected to operate at an unacceptable level of service (LOS E or F) during one or both peak hour are:

- Marine Street/I-580 Eastbound Ramps (LOS F in PM peak hour)
- Castro Street/I-580 Eastbound Ramps (LOS F in PM peak hour)
- Castro Street/I-580 Westbound Ramps (LOS E in the AM peak hour and LOS F in the PM peak hour)
- Castro Street/Mills Street (LOS E in PM peak hour)

[8] For the Project operations, the analysis assumes 100% utilization, which does not cause any significant impacts. Therefore, the 93% Utilization Scenario would also not cause any significant impacts and was not specifically analyzed.

TABLE 4.16-10 INTERSECTION PEAK HOUR TRAFFIC LEVEL OF SERVICE OPERATIONS—2030 CUMULATIVE CONDITIONS (WITH AND WITHOUT THE PROJECT)

	Intersection	Traffic Control[a]	AM Peak Hour		PM Peak Hour	
			Delay[b]	LOS	Delay[b]	LOS
1.	Chevron Way/Marine Street	AWSC	5.9	A	8.5	A
2.	Castro Street/Tewksbury Avenue	AWSC	9.2	B	9.8	A
3.	Marine St./I-580 Eastbound Ramps	Signal	3.6	A	126.4	F
4.	Castro Street/I-580 Eastbound Ramps	Signal	52.5	D	>150	F
5.	Castro Street/Chevron Way	Signal	1.7	A	1.1	A
6.	Castro Street/I-580 Westbound Ramps	Signal	57.6	E	>150	F
7.	Castro Street/Mills Street	Signal	10.3	B	75.0	E
8.	Castro St./General Chemical Access	Signal	8.4	A	93.1	F
9.	Castro Street/Hensley Street	Signal	12.6	B	>150	F
10.	Richmond Pkwy./Hensley Street	Signal	78.1	B	54.0	D
11.	Richmond Pkwy./Gertrude Avenue	Signal	48.7	D	>150	F

[a] AWSC = all-way stop-controlled intersection; Signal = traffic signal-controlled intersection.
[b] Average overall intersection control delay (seconds per vehicle) reported for signalized and all-way stop-controlled intersections. Average delay on the highest-delay movement/approach reported for side-street stop-controlled intersections.
Source: Fehr & Peers, 2014.

- Castro Street/General Chemical Access (LOS F in PM peak hour)
- Castro Street/Hensley Street (LOS F in the PM peak hour).
- Richmond Parkway/Hensley Street (LOS E in the AM peak hour).
- Richmond Parkway/Gertrude Avenue (LOS F in the PM peak hour).

For the cumulative (2030) scenario, the Project would be in its operational phase (i.e., construction of its components would have already been completed).

Table 4.16-11 presents the new trips that would be generated by the Facility after completion of construction. Operation of the Facility following Project construction would generate about 94 new daily one-way truck trips because of increased import and export of materials to and from the Facility. Facility permanent employment levels would increase by 29 employees, resulting in a maximum of 58 new daily commuter trips. The additional truck trips would be

TABLE 4.16-11 FACILITY PROJECT OPERATIONS TRAFFIC ESTIMATE

			AM Peak Hour (Vehicle/Hr)		PM Peak Hour (Vehicle/Hr)	
Project	**Type**	**Daily**	**In**	**Out**	**In**	**Out**
Project Operations [a]	Workers[a]	58	29	0	0	29
	Trucks[b]	188	10	9	9	10
	Total	**246**	**39**	**9**	**9**	**39**

[a] Trips generated by 29 net new worker trips. Half arrive during the AM peak hour and half depart during the PM peak hour.

[b] Truck trips in passenger-car equivalents. Trucks arrive and depart uniformly throughout a typical weekday.

Source: Chevron Data Transmittal #36O (Rev #3), 2014; Fehr & Peers, 2014.

spread over the operating hours of the day and are expected to occur primarily during off-peak traffic hours.

The Project's contribution to the above-cited unacceptable levels of service were determined on the basis of reasonably conservative assumptions that 48 new passenger-car equivalent trips would occur during the peak traffic hours. The Project contribution would be less than 1% and that level of additional vehicles on area roadways during peak traffic hours would be within the typical fluctuation in day-to-day traffic volumes and would not be noticed by most drivers; therefore, its impact on traffic operating conditions would not be cumulatively considerable.

See *Section 4.0, Introduction to Chapter and Methodology,* for a detailed discussion of the approach and methods of the cumulative analysis.

4.16.6 References—Transportation and Traffic

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4.17 UTILITIES AND SERVICE SYSTEMS

This section was not challenged in court and is not a subject of the peremptory writ issued on March 14, 2011. However, the revisions to this section reflect: (1) changes in the project description; (2) the current baseline; and (3) changes to relevant plans and policies, including the adoption of a new Richmond General Plan and new East Bay Municipal Utilities District Urban Water Management Plan. These revisions do not change the 2008 EIR's conclusions that there are no significant adverse impacts for utilities and services.

IMPACT SUMMARY

- With mitigation, the Modernization Project would have less-than-significant adverse impacts on the utilities and services systems.
- The Modernization Project would not exceed any limitations in applicable wastewater and stormwater permits, or require or result in the construction of new or expanded water or wastewater treatment facilities, the construction of which could cause significant adverse environmental impacts.
- The Modernization Project would not require, or result in the construction of new or expanded stormwater drainage facilities, the construction of which could cause significant adverse environmental impacts.
- The Modernization Project would result in a net increase in water usage. However, sufficient existing water supplies are available to serve the Modernization Project under the 93% Utilization Scenario. Sufficient existing water also exists to serve the Modernization Project under the 100% Utilization Scenario.
- The Facility operates its own wastewater treatment system. With the proposed water reuse Project Design Feature, the Modernization Project would result in no net increase in industrial wastewater under the 93% Utilization Scenario, but would result in an increase in industrial wastewater under the 100% Utilization Scenario. This increase under the 100% Utilization Scenario is identified as a significant water quality impact in *Section 4.9, Hydrology and Water Quality,* and mitigation is required to implement wastewater reduction strategies so that after mitigation no increase in wastewater generation would occur. As a result, the Modernization Project would not significantly impact the wastewater treatment facility's capacity to serve the Modernization Project's projected demand. In addition, the Modernization Project would result in a minimal increase in sanitary wastewater and would not impact the City of Richmond Sanitary Sewer District's ability to meet wastewater treatment requirements.

- Solid waste generated from Modernization Project construction and operation would not adversely affect landfill capacity. The Project would not affect the Facility's ability to continue to comply with federal, State, and local statutes and regulations related to solid waste.

4.17.1 Introduction

This section presents a discussion of utility and service systems, and analyzes the potential impacts related to construction and operation of the Modernization Project. The following types of utilities and infrastructure are addressed here: municipal water supply, wastewater, and solid waste. Potential impacts relevant to stormwater runoff, wastewater, and surface water quality are discussed in *Section 4.9, Hydrology and Water Quality*. Electricity, natural gas, and energy-related supply and demand impacts are discussed in *Section 4.6, Energy*. Generation and disposal of hazardous waste is discussed in *Section 4.13, Public Safety*.

The Modernization Project includes new equipment and modifications of existing equipment, which would primarily be developed on the Project site within the Refinery Process and Tank Farm areas, with two exceptions. First, during construction, two staging areas would be located within the Project site, outside of the Refinery Process and Tank Farm areas. One would be located south of the Refinery Process Area and the second would be located northeast of the Refinery Process Area (see Figure 3-1 in *Chapter 3, Project Description*). The second exception would be certain mitigation measures and Project features designed to reduce Project impacts, including the proposed ship/vessel upgrades discussed in *Section 4.3, Air Quality*, and greenhouse gas reduction measures proposed as part of the Modernization Project located outside the Refinery Process and Tank Farm areas, such as measures included in the Community Greenhouse Gas Reduction Program and Chevron's participation in Marin Clean Energy for some Chevron facilities, as discussed in *Section 4.8, Greenhouse Gases*.

Most of the construction for the Modernization Project has already occurred, including most of the intensive pile-driving and soil disturbance activities. For example, as described in *Chapter 3, Project Description, Section 3.3,* construction of the new hydrogen plant is approximately 48% complete. Most major equipment, such as the steam reformer furnaces, hydrogen recovery vessels, and the pressure swing adsorption recovery units, are already in place, and most of the required footings and foundations are also installed. The remaining construction activities would recommence if the Modernization Project is approved and last approximately 2 years.

4.17.2 Setting

4.17.2.1 Regional and Project Setting

4.17.2.1.1 *Municipal Water Supply*

Potable water is provided to properties within Richmond by the East Bay Municipal Utility District (EBMUD). EBMUD obtains approximately 90% of its municipal water supply from the Mokelumne River, and 10% originates as runoff from the protected watershed lands in the East Bay area. The water supply system consists of a network of reservoirs, aqueducts, water treatment plants, pumping plants, and distribution facilities. Annual precipitation and stream flow in the Mokelumne River watershed are extremely variable from month-to-month and from year-to-year. Approximately 1.34 million people are served by EBMUD's water system in the District's 321-square-mile service area (EBMUD, 2010).

In addition, EBMUD has been recycling water at its main wastewater treatment facility since the early 1970s (EBMUD, 2010). Recycled water is suitable for land uses that do not require potable water sources, such as golf course and other outdoor irrigation, some agricultural activities, and some industrial processing. Incentives used by EBMUD to encourage customers to utilize recycled water include rate discounts on recycled water, and low-interest loans used to retrofit buildings so that they can accommodate recycled water.

There are six water treatment plants in the EBMUD water supply and distribution system. Combined, the six plants have a treatment capacity of over 375 million gallons per day (MGD) (EBMUD, 2013a). The Orinda Water Treatment Plant, which supplies potable water to Richmond and the Project site, has a maximum treatment capacity of 200 MGD and currently treats an average of 135 MGD (operating at approximately 70% capacity) (RWQCB, 2013).

EBMUD's system storage facilities, in tandem with its regulatory program implementation tools, generally allows EBMUD to continue serving its customers during dry-year events. EBMUD also has regulatory authority and can, for example, require rationing based on the projected storage at the end of September each year. By using regulatory tools such as rationing and incentivized water rates in the first dry year of potential drought, EBMUD attempts to minimize rationing in subsequent years if a drought persists while continuing to meet customer demand, environmental mandates (e.g., current and subsequent-year fishery flow release requirements), and obligations to downstream agencies. EBMUD's primary regulatory tools are set forth in its Water Service Regulations (Section 28), and for example provide for special restrictions on water use during a water shortage emergency (EBMUD, 2013b).

4.17.2.1.2 *Municipal Water Demand*

The demand for water in EBMUD's service area is projected to increase to 230 MGD by the year 2040. This projection assumes that the existing and future EBMUD water conservation program would reduce annual demand by 62 MGD and the existing and future water recycling program would decrease water demand by 20 MGD. EBMUD's 2010 Urban Water Management Plan (UWMP) was adopted on June 28, 2011 by the EBMUD Board of Directors to meet year 2040 district-wide demand (EBMUD, 2010). The UWMP sets minimum performance goals for water supply in the service area including reliability, flexibility, and the minimization of water rationing. Key components of the UWMP are water conservation and water recycling. The UWMP concludes that EBMUD has sufficient water supplies to meet projected 2040 demands during normal rainfall years. Notwithstanding water conservation and recycling programs, EBMUD's current supply is insufficient to accommodate projected 2040 water demand during single- and multi-year droughts. EBMUD's state- mandated Urban Water Shortage Contingency Plan sets a framework for meeting water demand during drought years. The Contingency Plan includes an ongoing effort to seek supplemental water supplies, water rationing measures, measures to increase system water supply efficiency, and emergency services agreements with neighboring water districts.

4.17.2.1.3 *Wastewater and Sewer Treatment*

The Facility is located in the Richmond Sewer District, which is one of three sewer districts that services areas within Richmond. The City of Richmond and Richmond Sewer District own the Richmond Municipal Sewer District Water Pollution Control Plant (Richmond Plant) (RWQCB, 2013). The Richmond Sewer District is managed by Veolia Water, a private water services company specializing in the outsourced management of water services for municipal or industrial customers (City of Richmond, 2013b).

The wastewater collection system in Richmond consists of approximately 187 miles of sanitary sewer collection pipes, 13 lift/pump stations, and associated infrastructure that carry wastewater from homes and businesses to the Richmond Plant located at 601 Canal Boulevard, Richmond (City of Richmond, 2012b).

The average dry weather flow treated at the Richmond Plant is approximately 8.1 MGD**,** and the peak wet weather capacity of the Richmond Plant is 20 MGD. At times, peak wet weather flows exceed secondary treatment capacity, as the system is influenced by the infiltration of stormwater drainage. Wastewater is treated at a secondary level with some additional level of treatment following the secondary process. The main treatment process consists of bar screens, grit

removal chambers, primary clarifiers, activated sludge basins, secondary clarifiers, and chlorine contact basins (RWQCB, 2013).

In 2010, damage to the Richmond Plant's anaerobic digester that serves the Facility was discovered after the City received complaints about odors. The City is currently developing an approach to making necessary improvements to the Richmond Plant. The City has recently completed environmental review of, and intends to complete, a wet weather storage project that is designed to address the problem. By constructing a new pump station and pipeline, diversion box, and wet weather storage tank, the City can eliminate wet weather overflows that result from the 10-year, 24-hour storm into the Richmond Inner Harbor (City of Richmond, 2013a).

The West County Wastewater District (WCWD) operates a sewage treatment plant for the City of San Pablo, parts of Richmond, El Sobrante, Pinole, and other unincorporated areas of western Contra Costa County. The WCWD plant's dry weather capacity is approximately 12.5 MGD; flow is currently at approximately 8 MGD. During wet weather, flows increase dramatically, and the plant has a system of equalization basins to store wet weather flows for processing. The plant's wet weather capacity is approximately 21 MGD (WCWD, 2013).The WCWD shares an outfall pipe with the Richmond Plant. The WCWD imposes controls on industrial users on effluent discharged to the sanitary sewer system. The WCWD provides a supply of up to 6 MGD of secondary-treated wastewater to EBMUD for its North Richmond Water Reclamation Facility (City of Richmond, 2012a).

4.17.2.1.4 *Non-Hazardous and Recyclable Solid Waste*

Refuse collection and disposal in the City of Richmond is provided by Richmond Sanitary Service and is taken to the Integrated Resource Recovery Facility (IRRF), a combined waste transfer station and materials recovery facility located just off the Richmond Parkway at 101 Pittsburg Avenue in North Richmond. The IRRF, operated by West County Resource Recovery Inc., a division of Richmond Sanitary Service, is located at the site of the former West Contra Costa Landfill, which was closed in September of 2006. As a materials recovery facility, or recycling plant, the IRRF processes both the curbside recyclables from the West County Recycles program and the commercial recycling materials collected from West County businesses. Solid waste that is sent to this facility is sent to the Potrero Hill Landfill in Solano County, also operated by Richmond Sanitary Service.

As of 2007, the Potrero Hills Landfill's remaining permitted capacity is estimated to be approximately 13,872,000 cubic yards (64.5% of the original capacity). The current Potrero Hills Landfill Solid Waste Facility Permit, issued on February 14,

2012, provides that the landfill's estimated closure date is February 2048 (CalRecycle, 2013).

The Contra Costa Environmental Health Division is certified by the California Integrated Waste Management Board (CIWMB) as the Local Enforcement Agency for solid waste in Contra Costa County. The goal of the Local Enforcement Agency is to protect the public health and safety of the citizens of Contra Costa County and the environment through the enforcement of minimum standards for the collection, handling, storage, and disposal of residential, commercial, and industrial solid waste for the protection of air, water, and land from pollution and nuisance. The Local Enforcement Agency is responsible for ensuring that all solid waste disposal facilities and medical waste generators comply with applicable local, State, and federal codes and regulations.

The Regional Integrated Waste Management Plan state law (Assembly Bill [AB] 939) enacted in 1989 established an integrated waste management planning process, including requirements for counties and cities to meet adopted waste diversion goals for source reduction, recycling, and composting programs. It required municipal and state agencies to divert the amount of waste going to landfills by 25% by the year 1995 and by 50% by the year 2000.

The West Contra Costa Integrated Waste Management Authority is a joint powers agency created by the cities of El Cerrito, Hercules, Pinole, Richmond, and San Pablo. The Authority is responsible for ensuring that facilities within its jurisdiction meet the requirements of AB 939. The Authority has been able to reduce the waste streams from its member cities by approximately 29% to 37% between 1995 and 1998; however, based on current data, a diversion rate could not be accurately determined by the CIWMB for the year 2000. The estimated diversion rate for 2001 was 41% but the CIWMB has not reviewed this diversion rate and, therefore, the rate is subject to change. In 2002, the unincorporated portions of Contra Costa County diverted 49%, an amount that the CIWMB approved as a good faith effort toward attaining a 50% diversion rate. As of 2006, West County Wastewater District had a diversion rate of 51% (City of Richmond, 2012a).

AB 939 also requires that each county prepare and adopt a Countywide Integrated Waste Management Plan, which must include a Source Reduction and Recycling Element and a Household Hazardous Waste Element prepared by each city in the county; Contra Costa County has adopted such a Plan. In addition, the Richmond General Plan 2030 (General Plan 2030) promotes waste reduction and recycling in Policy CN5.3 and Action CN5.D.

4.17.2.1.5 *Project Setting*

The Facility activities require the use of municipal water (potable and recycled), generate domestic sewage, and generate solid, non-hazardous waste. (Facility hazardous waste generation is addressed in *Section 4.13, Public Safety*.)

4.17.2.1.5.1 *Municipal Water Use and Reuse*

The Facility total average water use during the 2008-2010 period was 11.3 MGD.[1] This total was comprised of a combination of fresh and recycled water supplied by EBMUD. Use of EBMUD recycled water displaces use of EBMUD fresh water, saving fresh water for other uses within the EBMUD service area). Approximately 6.9 MGD of fresh water (average 2008-2010 rate) was supplied by EBMUD via a 16-inch pipe feed to the Facility (Chevron Data Transmittal #45B (Rev#6), 2014). Of the total 11.3 average MGD during 2008-2010, an additional 3.9 MGD (average 2008-2010 rate) of tertiary-treated recycled water was provided by EBMUD from its North Richmond Water Reclamation Plant for use in Chevron's cooling towers (Chevron Data Transmittal #45B (Rev #6), 2014). The North Richmond Water Reclamation Plant obtains processed effluent from the West Contra Costa Sanitary District.

The EBMUD Richmond Advanced Recycled Expansion Plant started operation in June 2010. By the second half of 2010, EBMUD was supplying approximately 2 MGD of reclaimed wastewater from the Richmond Advanced Recycled Expansion Water Project for use in the Facility's boiler feed water applications. Annualized over the 2008-2010 period, the water contribution from the Richmond Advanced Recycled Expansion facility accounted for approximately 0.4 MGD of the total average 11.3 MGD of EBMUD water used at the Facility during the 2008-2010 period, replacing approximately 0.4 MGD of EBMUD fresh water during that period.

After the initial start-up period in 2010, the Facility's use of water from EBMUD's Richmond Advanced Recycled Expansion plant increased to approximately 3.4 MGD for both 2011 and 2012, with an equivalent reduction in fresh water usage, so that by 2011-12, EBMUD freshwater usage had been decreased to an average of 3.9 MGD.[2] (Chevron Data Transmittal #45B (Rev #6), 2014).

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[1] This total includes all Refinery Operations and water use at the Long Wharf.

[2] Because the Richmond Advanced Recycled Expansion facility provided 0.4 MGD annualized average over the 2008-10 period, the increase to an average supply of 3.4 MGD in 2011-12 represents an increase in recycled water use of 3.0 MGD (and related decrease in fresh water use) relative to 2008-10. Therefore, the baseline is considered 3.9 MGD fresh water and 7.3 MGD recycled water (3.9 MGD from the North Richmond Water Reclamation Plant + 3.4 MGD from the Richmond Advanced Recycled Expansion facility), for a total of 11.3 MGD of EBMUD water (numbers do not sum exactly due to rounding).

The most common industrial water reuse application is for cooling, but reclaimed water can also be used for boiler feedwater, as process water, and for washdown. Other uses of recycled water are dust control and soil compaction during construction, as well as landscape irrigation.

4.17.2.1.5.2 *Domestic Sewage Treatment*

The Facility discharges sanitary sewage to the Richmond Municipal Sewer District treatment facility located at 601 Canal Boulevard, Richmond (Chevron Data Transmittal #15, 2011).

4.17.2.1.5.3 *Non-Hazardous and Recyclable Waste*

The Facility currently generates approximately 13,000 metric tons of non-hazardous solid waste per year, all of which is in the form of Class III trash (Chevron Data Transmittal #45C (Rev #1), 2013). This waste is managed in large bins and is currently removed from the Facility by Richmond Sanitary Service and taken to the IRRF at the site of the former West Contra Costa Landfill. Non-hazardous solid waste is then disposed at the Potrero Hills Landfill.

The generation and disposal of hazardous waste is discussed earlier in this EIR, in *Section 4.13, Public Safety*.

The Facility has a Waste Minimization Plan, and makes continuing efforts to reduce the amount of solid hazardous and non-hazardous waste generated. Pre-job planning to reduce the amount of soil requiring disposal, source reduction of solids, and testing and segregation of hazardous wastes with a focus on recycle are ongoing activities in the Facility. In addition, the Facility has emphasized a paper reduction program to eliminate unnecessary reports and copies of printed material. It also segregates paper and cardboard products for recycling. The current diversion rate of the Facility is nearly 50% (Chevron Richmond, 2013).

4.17.2.1.5.4 *Industrial Wastewater*

The Facility has its own industrial wastewater treatment system. During periods of dry weather such as the summer months, almost all wastewater comes from the various processing plants. Sources of this process wastewater include cooling tower blowdown, condensed steam used for process heating, and plant washup water. Process wastewater is treated in the Facility effluent treatment system prior to release into the Bay (Chevron Data Transmittal #45D, 2013).

The Regional Water Quality Control Board (RWQCB) 2011 National Pollutant Discharge Elimination System permit lists the 2006 through 2010 average discharge from the Facility as 6.6 MGD, with a reported single-day maximum

flow of 27.5 MGD (RWQCB, 2011). For the period of 2008-2010, Chevron reported average dry-weather daily discharges of 4.92 MGD in 2008, 5.03 MGD in 2009, and 5.77 MGD in 2010.[3] The system's capacity is based on process effluent streams only and does not include additional capacity for non-process streams. While there are no prescribed flow limits, the Facility is responsible for monitoring influent flows to the wastewater treatment system and mitigating any potential impacts to the effluent discharge (Chevron Data Transmittal #45D, 2013).

4.17.2.2 Regulatory Setting

4.17.2.2.1 *Senate Bill 610 and Senate Bill 221*

The purpose and legislative intent of Senate Bill (SB) 610 and SB 221 was to preclude projects from being approved without specific evaluations being performed and documented by the local water provider to ensure that sufficient water is available to serve the project. SB 610 primarily affects the Water Code and SB 221 principally applies to the Subdivision Map Act. The laws took effect on January 1, 2002. SB 610 requires the preparation of a Water Supply Assessment (WSA) for designated types of larger-scale projects.[4] A WSA evaluates the water supply available for the project based on anticipated system demand and supplies in normal, dry, and multiple dry-year scenarios. Since the Modernization Project would result in an increase in water use, a WSA was prepared and is discussed further below.

4.17.2.2.2 *Assembly Bill 797*

In 1983, the Urban Water Management Planning (UWMP) Act (AB 797) was adopted as part of the California Water Code (Section 10610-10610.4), directing urban water suppliers to develop water management plans to work toward the efficient use of available supplies. Urban water suppliers are required to adopt an

[3] During the wet season, in addition to the average process wastewater, large amounts of rainfall also enter the wastewater treatment system. The Refinery has the ability to segregate and divert certain streams of storm water to minimize unnecessary loading of the wastewater treatment system (Chevron Data Transmittal #45D, 2013).

[4] All projects that meet any of the following criteria require a WSA: (1) a proposed residential development of more than 500 dwelling units; (2) a proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 ft^2 of floor space; (3) a proposed commercial office building employing more than 1,000 persons or having more than 250,000 ft^2 of floor space; (4) a proposed hotel or motel, or both, having more than 500 rooms; (5) a proposed industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area; (6) a mixed-use project that includes one or more of the projects specified in this subdivision; or (7) a project that would demand an amount of water equivalent to, or greater than, the amount of water required by a 500 dwelling unit project.

UWMP at least once every 5 years in effort to ensure reliable water service at all times. The UWMP Act was last amended by AB 2409 in 2010.

EBMUD first adopted an UWMP in 1985 and was last updated in 2010. EBMUD's 2010 UWMP sets minimum performance goals for water supply in the service area including reliability, flexibility, and the minimization of water rationing. Key components of the UWMP are water conservation and water recycling.

EBMUD's demand projections assume both densification and land use changes in all land use classifications, including industrial land uses, thus increasing overall EBMUD demand. In Table 4-1 of the 2010 UWMP, EBMUD projects water demands over time, accounting for estimated variations in demand usage. The 2010 UWMP also projects quantities of recycled water served by EBMUD recycled water projects in Table 5.5 and water conservation and goals in Figure 6-1 of the UWMP. For planning purposes, the demands are estimated in 5-year increments, but it is recognized that actual incremental amounts may occur stepwise. An increase in usage by one customer in a particular customer class does not require a strict gallon-for-gallon increase in conservation by other customers in that class, as in actuality the amount of potable demand, conservation and recycled water use EBMUD-wide will all vary somewhat. Periodically EBMUD updates the demand projections to reconcile these variations, and the UWMP is updated as appropriate at each 5-year cycle.

4.17.2.2.3 *Senate Bill 365 (Chapter 980, Statutes of 1993)*

Existing provisions of the California Water Code declare that the use of potable water for certain non-potable uses "is a waste or an unreasonable use of water." SB 365, which amends and expands the Water Code to strengthen the provision that the use of potable water for the irrigation of residential landscaping, floor-trap priming, cooling towers, or air-conditioning devices, is wasteful and unsound if reclaimed water suitable for these purposes is available. SB 365 also gives the power to any public agency, including a State agency, City or County, district, or any other political subdivision of the state, to require the use of reclaimed water for these purposes if certain conditions are met. The conditions that must be met are:

- Reclaimed water meeting the requirements of existing law (Section 13550 of the Water Code) is available to the user;
- The use of reclaimed water does not cause any loss of diminution of any existing water right;
- Public health concerns regarding exposure to mist or spray must be addressed, if appropriate;

- The water user must prepare an engineering report pursuant to Title 22 regulations governing the use of reclaimed water.

The requirements of the law are applicable to all new industrial facilities and subdivisions for which the Department of Health Services has approved the use of reclaimed water, and for which a building permit is issued on or after March 15, 1994, or, if a building permit is not required, new structures for which construction begins on or after this date.

4.17.2.2.4 *Assembly Bill 325*

In September 1990, Governor Pete Wilson signed AB 325 directing the Department of Water Resources to adopt a Model Local Water Efficient Landscape Ordinance by January 1, 1992. A Model Water Efficient Landscape Ordinance was created by an advisory taskforce of interested stakeholders such as landscape and construction industry professionals, members of environmental protection groups, water agencies and state and local government. The Model Water Efficient Landscape Ordinance promotes the values and benefits of landscapes while recognizing the need to invest water and other resources as efficiently as possible; established a structure for designing, installing, and maintaining water efficient landscapes in new projects; and established provisions for water management practices and water waste prevention for established landscapes. Cities and counties are required to enforce the ordinance as it applies to new and rehabilitated public and private landscapes that require a permit and on developer installed residential landscapes. The ordinance does not apply to landscapes under 2,500 square feet, homeowner-installed residential landscapes, cemeteries, registered historical sites and ecological restoration and mined reclamation areas without permanent irrigation systems.

4.17.2.2.5 *Assembly Bill 939*

The Regional Integrated Waste Management Plan state law (AB 939) enacted in 1989 established an integrated waste management planning process, including requirements for counties and cities to meet adopted waste diversion goals for source reduction, recycling, and composting programs. It required municipal and state agencies to divert the amount of waste going to landfills by 25% by the year 1995 and by 50% by the year 2000. In 2002, unincorporated portions of Contra Costa County diverted 49%, an amount that the California Integrated Waste Management Board approved as a good faith effort toward attaining a 50% diversion rate.

4.17.2.2.6 *City of Richmond General Plan 2030*

Consistency with the City of Richmond General Plan 2030 (General Plan 2030), including Plan elements relevant to this section, is addressed in *Section 4.10, Land Use* and in *Appendix 4.10, Consistency Evaluation of Relevant General Plan Goals, Policies, and Actions*. There are no inconsistencies between the Modernization Project and the General Plan 2030.

4.17.3 Significance Criteria and Methodology

4.17.3.1 Significance Criteria

Consistent with Appendix G of the CEQA Guidelines, a significant adverse impact on the environment with respect to utilities and service systems would occur if the Modernization Project would:

(A) Exceed wastewater treatment requirements of the RWQCB;

(B) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant adverse environmental impacts;

(C) Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant adverse environmental impacts;

(D) Not have sufficient water supplies available to serve the Project from existing entitlements and resources, or require new or expanded water entitlements;

(E) Not result in a determination by the wastewater treatment provider that serves or may serve the Project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments;

(F) Not be served by a landfill with sufficient permitted capacity to accommodate the Project's solid waste disposal needs; or

(G) Not comply with federal, state, and local statutes and regulations related to solid waste.

4.17.3.2 Impact Assessment Methodology

The methodology used to evaluate the significance of utilities and service systems impacts is explained in the context of each impact, as discussed further below.

4.17.3.3 CEQA Guidelines Appendix G Topics Not Discussed Further in this EIR

Review and comparison of the Modernization Project to the environmental setting indicates that the Project would create no impacts related to the following environmental topics listed in CEQA Guidelines Appendix G.

(A) Potential of the Project to exceed wastewater treatment requirements of the RWQCB

This threshold requires consideration of a project's impact on public utility sewage conveyance and treatment facilities. Although the Facility lies within Richmond Sewer District's service area, the Facility collects, treats, and discharges all industrial wastewater and stormwater using its own private facilities (sanitary waste management is discussed below under criterion "E" below).

As discussed in greater detail in *Section 4.9, Hydrology and Water Quality*, the Modernization Project is proposing to implement two water reuse Project Design Features that would off-set any increases in industrial wastewater that would be generated by the Modernization Project 93% Utilization Scenario, and would result no net increase in industrial wastewater generation associated with the Facility operation. However, as described in *Section 4.9, Hydrology and Water Quality*, the Modernization Project 100% Utilization Scenario would increase wastewater generation and this increase is identified as a significant adverse impact to water quality. However, the increase in wastewater generation would not affect any public utility sewage conveyance or treatment facilities, and therefore would have no impact on public facilities. For a discussion of the Facility's private wastewater treatment system and the ability of that system to meet the treatment requirements of the RWQCB, see *Section 4.9, Hydrology and Water Quality*.

(B) Potential of the Project to require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant adverse environmental impacts

The Modernization Project would be constructed and its operations conducted entirely within those areas of the Facility that are already served by the Facility's

existing water and wastewater collection and treatment systems. The Modernization Project would include two water reuse Project Design Features: 1) the stripped sour water reuse in the distillation and reforming Area; and 2) stripped sour water reuse in the South Isomax area (described in more detail in *Section 4.9, Hydrology and Water Quality*). No other new or expanded water or wastewater treatment facilities are proposed. The Modernization Project would not include new water and wastewater treatment facilities, the construction of which could cause significant adverse environmental impacts because the new project design features described above would consist of minor equipment installations and associated modifications to operations.

(C) Potential of the Project to require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant adverse environmental impacts

The Modernization Project would be constructed and its operations conducted entirely within those areas of the Facility that are already served by the existing stormwater collection and treatment system. Additionally, stormwater runoff is not anticipated to increase as a result of the Modernization Project as there would be no significant changes in impervious surfaces or the drainage pattern of the site (see also *Section 4.9, Hydrology and Water Quality*). The Modernization Project would not involve the construction of new or expanded stormwater drainage facilities, the construction of which could cause significant adverse environmental impacts. There would be no impact.

(E) Potential of the Project to result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the Project's projected demand in addition to the provider's existing commitments

The Facility collects, treats, and discharges all wastewater and stormwater using its own facilities, with the exception of sanitary sewage.

Sanitary Sewage. The Facility discharges sanitary waste to the City of Richmond's Sanitary Sewer District. The Modernization Project is estimated to increase permanent employment by 29 people, as discussed in *Section 4.12, Employment, Population, and Housing*. This translates to an average increase of approximately 725 gallons per day[5] in additional sanitary wastewater load to the City of Richmond wastewater treatment system, or approximately a 1.0% increase in the

[5] Based on the assumption that each new person uses about 25 gallons of water per day and generates a similar sanitary wastewater load (25 gallons x 29 = 725 gallons per day).

sanitary wastewater from the Facility.[6] The Modernization Project would cause minimal change to the sanitary sewer discharge levels and would not adversely affect the capacity of the Richmond Sewer District's facility. There would be no impact.

On-site Wastewater Treatment. As discussed in greater detail in *Section 4.9, Hydrology and Water Quality*, the Modernization Project is proposing to implement two water reuse Project Design Features that would reduce wastewater generation and off-set increases in wastewater related to the 93% Utilization Scenario. However, the 100% Utilization Scenario would result in a net increase in wastewater generation of 0.06 MGD (21 million gallons per year). The Facility's treatment plant manages average dry weather flows of up to 5.77 MGD (during the 2008-10 period) but has the ability to manage much larger flows because it was designed to treat stormwater flows of over 20 MGD. Therefore, the plant could accommodate a 0.06 MGD increase in industrial process water and would require no modifications to accommodate this relatively small increase in wastewater generation.

The remaining criteria are discussed below under Impacts 4.17-1 through 4.17-3.

4.17.4 Impacts and Mitigation Measures

Impact 4.17-1: Solid waste generated from Modernization Project construction and operation would not adversely affect landfill capacity. The Project would not affect the Facility's ability to continue to comply with federal, State, and local statutes and regulations related to solid waste. This impact would be less than significant and no mitigation is necessary. (LTS)

Solid waste is expected to be generated during construction of the Modernization Project facilities. Construction and demolition wastes would include materials such as asphalt, concrete, metals, and other site preparation materials, as well as typical construction debris such as packaging materials. It is anticipated that no additional solid waste would be generated during Modernization Project operations beyond the amount currently generated at the Facility.

All construction waste would be disposed of in accordance with established procedures and applicable regulatory requirements. Non-hazardous construction wastes would be sent to the Potrero Hills Landfill in Solano County, which has sufficient capacity (see *Section 4.17.2*, above). In addition, the Facility has an

[6] The addition of 29 permanent workers as a result of the Modernization Project represents a 0.9% increase above the 2008-2010 3-year average number of Refinery workers (3,060 workers) (Chevron Data Transmittal #5 (Rev #3), 2014).

ongoing recycling program that would be employed during the construction of the proposed components of the Project and demolition of the hydrogen plant. It is not expected that the construction or operation of the Project components would affect the City's ability to maintain compliance with AB 939 requirements. Thus, the impacts from solid waste generation and disposed would be less than significant and no mitigation is necessary. However, the following improvement measure is recommended to further minimize this already less-than-significant impact.

> Improvement Measure 4.17-1: Prior to issuance of a demolition, grading, or building permit, Chevron shall submit a Debris Recovery Plan and Debris Recovery Report demonstrating that at least 50% of the construction and demolition debris generated on the jobsite is reused, recycled, or otherwise diverted. The Debris Recovery Plan shall be submitted to the City for review and approval.

Impact 4.17-2: Implementation of the Modernization Project would result in an increase in water use. However, under the 93% Utilization Scenario, there would be sufficient water supplies available to serve the Modernization Project from existing entitlements and resources. This impact would be less than significant and no mitigation is necessary. (LTS)

Water is used at the Facility and in the process plants for various reasons. Some examples of these water uses are:

- Water is used to generate steam, which is injected into distillation columns for improved product separation.
- Water is injected into the process to wash out salts from heat exchangers.
- Water is injected into the crude oil to remove salt.
- Water is used in heat exchangers to cool down parts of the process.
- Water is used in boiler to make steam.
- Water is used in employee kitchens and bathrooms.

The water utilized for these operations is a combination of fresh water and recycled water. Fresh water is provided to the facility by EBMUD. The recycled water consists of tertiary-treated water from EBMUD's North Richmond Water Reclamation Plant, and reclaimed water from EBMUD's Richmond Advanced Recycled Expansion Water Project.

The Modernization Project would increase the Facility's consumption of municipal water over current usage in two ways:

1. Increased usage for industrial processes. These industrial uses are described in more detail below. Both the 93% and the 100% Utilization Scenarios would increase water usage over the baseline condition.
2. Increased usage associated with adding new employees. The Modernization Project would result in the addition of 29 new permanent jobs at the Facility (Chevron Data Transmittal #5 (Rev #3), 2014). The addition of these employees would result in a slight increase in the demand for water associated with some increase use of restroom and kitchen facilities. This increased use is estimated to be 0.0007 MGD.[7]

The Modernization Project would require more water use for additional hydrogen production and cooling tower water to achieve final product specifications. In addition, increased utilization of the plant would increase water use (i.e., the processing of more crude and gas oil requires more water). However, the Modernization Project also includes changes that would save water, including recovery and reuse of condensate water[8] and water reuse Project Design Features that would offset some of the increased water use of the Project. The two water reuse Project Design Features include: 1) the stripped sour water reuse in the distillation and reforming area; and 2) stripped sour water reuse in the South Isomax area. Both of these Project Design Features are described in more detail in *Section 4.9, Hydrology and Water Quality*.[9]

Even with the Project components and water re-use Project Design Features described above, the Modernization Project would increase the Facility's consumption of water over the baseline municipal water usage. The 93% Utilization Scenario would result in a net increase in total water use of 0.7 MGD (Chevron Data Transmittal #45B (Rev#6), 2014), for an estimated total of 11.9 MGD.[10]

In 2007 a WSA was prepared by EBMUD to evaluate the potential increased water use demand of the Project. Based on the findings of the WSA, the estimated increase of 0.7 MGD in water use for the Project falls within the demand projections and overall plans for water service, conservation, and recycling

[7] Each of the 29 new employees is estimated to use 25 gallons per day (725 per day total) (NCDER, 2014). 725 gallons per day equals 0.0007 MGD.

[8] This condensate recovery project component is described in Table 3-1 in Section 3.0, Project Description.

[9] The generation of sour water and operation of sour water strippers are further described in *Appendix 3, Overview of Oil Refining Process*; (see also Chevron Data Transmittal #47B (Rev #3), 2014).

[10] The 0.7 and 1.4 MGD increases are total estimated net water use increases and consider new industrial uses, additional employees, process modifications, and water re-use Project Design Features.

contemplated by the EBMUD UWMP. In 2014, EBMUD confirmed that its 2007 WSA for the Project continues to be valid and that adequate existing supplies are available for a 0.7 MGD increase in water usage for Refinery Operations (see *Appendix 4.17*). Since there is adequate water supply available for the 0.7 MGD increase estimated for the 93% Utilization Scenario, this is a less-than-significant impact.

Mitigation Measure 4.17-2: None required.

Impact 4.17-3: Implementation of the Modernization Project under the 100% Utilization Scenario would result in an increase in water use. However, under the 100% Utilization Scenario, there would be sufficient water supplies available to serve the Modernization Project from existing entitlements and resources. This impact would be less than significant. No mitigation is necessary. (LTS)

Under the 100% Utilization Scenario, the Modernization Project would result in an increase of 1.4 MGD of water usage, for a total of 12.7 MGD of EBMUD fresh and recycled water. In 2014, EBMUD confirmed that its 2007 WSA for the Project continues to be valid and existing supplies are available for the 1.4 MGD increase in water usage for the Facility. Since there is an adequate water supply for the 1.4 MGD estimated increase under the 100% Utilization Scenario, this would be a less-than-significant impact.

Mitigation Measure 4.17-3: None required.

4.17.5 Cumulative Impacts

The geographic area considered for utilities is the area within the City of Richmond and the North Richmond area, which is within an unincorporated area of Contra Costa County. The service areas of the Potrero Hills Landfill and the EBMUD facilities are also considered. Because the Modernization Project includes only a negligible increase in sanitary sewage generation (associated with the 29 new employees) that can be accommodated by the Richmond Municipal Sewer District Water Pollution Control Plant, the Project would not cumulatively contribute to wastewater utility impacts and a detailed analysis of these cumulative impact topics is not required by CEQA.

Because the Modernization Project would not generate any material increase in non-hazardous solid waste generation during Project operations and would contribute only short-term construction-related non-hazardous solid wastes to the Potrero Hills Landfill, which has substantial long-term capacity to accept non-hazardous solid wastes, the Project would likewise not contribute to any

cumulative solid waste landfill impacts and a detailed analysis of this issue is not required by CEQA.

The Modernization Project and other projects (see cumulative project list in *Appendix 4.0, Cumulative Projects*) would produce waste due to demolition of obsolete facilities (such as tanks) that would be replaced. Note that the steel from the demolished tanks and obsolete facilities would be recycled. The construction and operation of the Modernization Project, or of other cumulative refinery projects, would have less-than-significant adverse impacts on solid waste disposal facilities or services, because there is adequate landfill capacity for the solid waste that would be produced in the construction and operational phases of the Project.

The Modernization Project would increase the Facility's consumption of water over current municipal water usage. However, estimated water use for the Modernization Project under the 93% and 100% Utilization Scenarios falls within the demand projections and overall plans for water service, conservation, and recycling contemplated by the EBMUD UWMP. One of the main purposes of the UWMP is to consider cumulative water needs and plan for these needs. Since the Modernization Project is consistent with the UWMP, it would not contribute to a significant cumulative impact.

See *Section 4.0, Introduction to Chapter and Methodology,* for a detailed discussion of the approach and methods of the cumulative analysis.

4.17.6 References—Utilities and Service Systems

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CHAPTER 5.
CEQA STATUTORY SECTIONS

This chapter has been updated from the 2008 EIR.

This chapter describes California Environmental Quality Act (CEQA) statutory conclusions related to construction and operation of the Modernization Project. *Section 5.1* of this chapter discusses significant adverse unavoidable impacts. *Section 5.2* considers the potential for growth-inducing impacts. *Section 5.3* discusses any significant irreversible environmental changes from the Modernization Project.

The significant adverse impacts of the Modernization Project and the mitigation measures that would be adopted as conditions of approval of the Modernization Project are presented and discussed in detail in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures,* of this document. *Chapter 4* also describes impacts found to be less than significant and areas of "no impact."

5.1 SIGNIFICANT ADVERSE UNAVOIDABLE IMPACTS

Implementation of the Modernization Project would result in no significant adverse unavoidable impacts, as described in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*.

5.2 GROWTH-INDUCING IMPACTS

Consistent with Section 15126.2(d) of the CEQA Guidelines, a project is considered growth-inducing if it could directly or indirectly foster economic or population growth or the construction of additional housing. Examples of projects likely to have significant adverse growth-inducing impacts include extensions or expansions of infrastructure systems beyond what is needed to serve project-specific demand, and development of new residential subdivisions or industrial parks in areas that are currently only sparsely developed or are undeveloped.

The Modernization Project could result in a very small increase in population due to additional temporary and permanent jobs at the Facility. As described in *Section 4.12*, *Employment, Population, and Housing*, 29 new permanent employees would be added as a result of the operation of the Modernization Project (Chevron Data Transmittal #5 (Rev#3), 2014). However, as is discussed in Impact 4.12-1, the housing vacancy rate in the Bay Area, and Richmond specifically, would be sufficient to meet this potential demand for housing. The

temporary addition of the construction workforce to the Facility would not be considered a significant adverse growth-inducing impact of the Modernization Project because it is anticipated that the bulk of the construction workforce would be drawn from the construction labor pool available in Richmond and the rest of the Bay Area. A Modernization Project Labor Agreement was approved between with the Contra Costa Building and Construction Trade Union and Chevron in July 2013. This agreement specifies that Chevron and the Building Trades are committed to hire qualified local residents. All current Bay Area residents would be expected to commute rather than move to Richmond. Therefore, that portion of the new construction jobs that would be filled by current Bay Area residents would have no growth-inducing impact in Richmond. In addition, the fraction of the construction workforce for the Modernization Project that would be drawn from outside the Bay Area would be on a temporary basis and would not permanently increase population in the Richmond area.

Moreover, the Project would not facilitate development intensification on adjacent sites nor have an impact on the rate of growth due to births. Thus, the Modernization Project would not directly or indirectly induce population growth.

5.3 REFERENCES—CEQA STATUTORY SECTIONS

Chevron Data Transmittal #5 (Rev #3): Cumulative Projects Traffic & Construction, 2014.

CHAPTER 6.
ALTERNATIVES ANALYSIS

6.1 INTRODUCTION

The California Environmental Quality Act (CEQA) and the CEQA Guidelines require an Environmental Impact Report (EIR) to describe a "reasonable range" of alternatives to the proposed project that would feasibly attain "most" of a project's objectives "but would avoid or substantially lessen any of the significant effects of the project" (14 Cal. Code Regs. Section 15126.6(a)).

Per the CEQA Guidelines, an EIR should explain how the project alternatives were selected for analysis. It should also briefly identify alternatives that were considered but dismissed from detailed consideration in the EIR. Among the factors that may be used to eliminate alternatives from detailed consideration are: (1) failure to meet most of the project objectives; (2) infeasibility; or (3) inability to avoid significant environmental impacts (14 Cal. Code Regs. Section 15126.6(c)). In addition, an EIR need not evaluate alternatives that the lead agency reasonably determines cannot achieve the project's "underlying fundamental purpose" (In re Bay-Delta Programmatic Envt'l Impact Report Coordinated Proceedings (2008) 43 Cal.App.4th 1143, 1165).

The EIR must evaluate the comparative merits of the alternatives selected for detailed analysis. The discussion of alternatives should include sufficient information about each alternative to allow evaluation, analysis, and comparison with the proposed project (14 Cal. Code Regs. Section 15126.6(d)). If an alternative would cause one or more significant effects not caused by the proposed project, such effects must be discussed, but in less detail than the significant effects of the project. Alternative locations need be evaluated only to the extent that an alternative location would "avoid or substantially lessen any of the significant effects of the project" and "infeasible" locations need not be evaluated as long as the EIR describes the basis for this infeasibility conclusion (14 Cal. Code Regs. Section 15126.6(f)).

A "No Project" alternative must also be identified and evaluated in the EIR (14 Cal. Code Regs. Section 15126.6(e)). The purpose of the "No Project" alternative is to compare the impacts of the proposed project with the impacts likely to occur if the project is not implemented. If the "No Project" alternative is the environmentally superior alternative, the EIR must also identify an environmentally superior alternative among the other alternatives described in the EIR (14 Cal Code Regs Section 15126.6(e)(2)).

6.2 PROJECT OVERVIEW FOR ALTERNATIVES EVALUATION

In 2011, Chevron submitted to the City a new application for the Chevron Refinery Modernization Project (Modernization Project or Project)—that excluded several components of the Chevron Hydrogen and Energy Renewal Project (2008 Project). The City began work on this EIR to comply with the Appellate Court Decision and to analyze the potential environmental impacts that could result from the Modernization Project.

The 2008 Project was much larger than the Modernization Project and proposed a number of discrete Facility improvements, including some components that had independent utility (i.e., components that could proceed even if other components did not proceed). The Modernization Project scales back and excludes several components of the 2008 Project. All remaining Modernization Project components are inter-related and inter-dependent in achieving the Project objective of increasing the Facility's capacity to handle higher sulfur content in crude and gas oils.

As described and defined further in *Chapter 3, Project Description*, the Modernization Project includes the following components:

1. Hydrogen Plant Replacement
2. Sulfur Removal Improvements
3. Project Design Features

The Modernization Project would also include ancillary piping and infrastructure to tie the Project components described above to existing Facility equipment. A list of the major equipment to be installed or modified as part of the Modernization Project is shown in Table 3-1 (Modernization Project Components) in *Chapter 3, Project Description*.

The fundamental purpose of the Modernization Project is to improve the reliability, safety, and integrity of the Facility in manner that allows it to process crude oil blends and externally sourced gas oils containing higher levels of sulfur than those currently being processed. The Modernization Project's Facility modifications would also implement a more efficient hydrogen production process that uses less energy and produces more concentrated hydrogen, which in turn improves the efficiency of other hydrogen-dependent steps in the refining process, such as sulfur removal.

Although the Appellate Court Decision found no deficiencies with respect to the 2008 EIR's alternatives analysis, it has been updated in this EIR to reflect the scaled-down scope of the Modernization Project's proposed Facility improve-

ments. It is also noted that the Appellate Court Decision confirmed that Praxair's hydrogen export and pipeline project, described in *Chapter 3, Project Description* and *Section 4.0, Introduction to Chapter and Methodology*, is a separate project for purposes of CEQA and appropriately considered only as part of this EIR's cumulative impacts analysis. CEQA does not require an EIR to analyze alternatives to separate projects that are addressed in that EIR's cumulative impacts analysis (Cal. Pub. Res. Code Section 21100(b); 14 Cal. Code Regs. Sections 15126.6; 15130).

As described in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*, after mitigation, the Modernization Project would not result in any significant adverse environmental impacts. Notwithstanding the absence of significant adverse impacts, this EIR still considers the "No Project" alternative, as well as a range of feasible alternatives that emerged from the public scoping process.

Chevron's objectives for the Modernization Project, as also set forth in *Chapter 3, Project Description*, are as follows:

- Modernize, enhance equipment reliability, and enhance the integrity of the Facility by replacing older equipment with newer, cleaner, and inherently safer systems and equipment that is consistent with the Richmond Industrial Safety Ordinance.
- Enhance the Facility's flexibility to process crude oil blends and externally sourced gas oils[1] containing higher levels of sulfur than those currently being processed, enabling Chevron to continue producing transportation fuels and lubricant base oils in compliance with low-sulfur State and federal standards.
- Replace the existing hydrogen production plant with a larger, more modern plant that is more energy-efficient, produces higher purity hydrogen, and has sufficient capacity to meet the Facility's hydrogen needs and for potential export.[2]
- Ensure that there is no net increase in emissions of greenhouse gases and CAPs compared to the baseline period, through a combination of: replacing

[1] "Externally sourced" gas oils are purchased for use as feedstock at the Facility, and are also called "imported" or "purchased" gas oils. The Facility crude unit also produces gas oils as an internal feedstock for further processing into end products. *Chapter 3, Project Description, Section 3.3,* provides a description of the Modernization Project's effect on the Facility's ability to process gas oil from both internal and external sources.

[2] Praxair Corporation, the owner and operator of the Hydrogen Plant Replacement, has separately sought authorization from the County and other jurisdictions to construct a hydrogen pipeline for export and sale of hydrogen not used by Chevron to third-party customers, including refineries and potentially other facilities in the East Bay. The Praxair export project was determined to be appropriately considered as a separate project in the Appellate Court Decision.

some existing equipment with new Modernization Project components that are more energy-efficient and lower-emitting; installing emissions reduction Project Design Features in the Modernization Project; and implementing specific, feasible mitigation measures as described in this EIR.

- Ensure that there is no net increase in health risks in residential areas associated with TACs from Facility operations as compared to the baseline period, using a combination of project components, Project Design Features, and mitigation measures, consistent with the methodology for assessing non-nominal risks established by the BAAQMD.[3]
- Maintain the Facility's current throughput processing capacity.

6.3 SUMMARY OF MODERNIZATION PROJECT IMPACTS RELEVANT TO EVALUATION OF ALTERNATIVES

Potentially significant adverse environmental impacts that would result from the Modernization Project have been evaluated in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*, of this EIR. The mitigations and impact conclusions are summarized in *Chapter 2, Executive Summary*, which includes a summary chart of impact conclusions for all topic areas in Table 2-1. This EIR concludes that there are no significant adverse unmitigated impacts from the Modernization Project.

6.3.1 Air Quality and Greenhouse Gases

With respect to air quality impacts, the Modernization Project includes Chevron's commitment to no net increase over operational Baseline CAPs and greenhouse gas emissions, and no net increase over operational Baseline health risks from TAC emissions. To help achieve this no net increase commitment, the Modernization Project includes Emission Reduction Project Components and Project Design Features (described in *Chapter 3, Project Description*) to ensure that CAP emissions and risks from TAC emissions do not exceed 2008-2010 Baseline levels. The Modernization Project would also achieve no-net-increase in greenhouse gas emissions relative to Baseline conditions through a combination of these Emission Reduction Project Components and Project Design Features, as well through implementation of other specific, feasible mitigation measures. Baseline emissions, CAP emissions, greenhouse gas emissions, and risks from TAC emissions are summarized below and discussed in greater detail in *Sections 4.3, Air Quality*, and *4.8, Greenhouse Gases*.

[3] For a discussion of the Modernization Project's cumulative impacts related to health risks from toxic air emissions, see *Section 4.3, Air Quality*.

6.3.1.1 Air Quality

The Modernization Project would not result in any significant adverse direct, indirect, or cumulative air quality impacts. During construction, the Modernization Project would result in potentially significant, adverse, localized construction dust-related air quality impacts and short-term emissions of ozone precursors (i.e., nitrogen oxides (NO_x) and reactive organic gases), but all such impacts would be mitigated to less-than-significant levels by implementing BAAQMD-recommended basic dust control measures and other recommended mitigation measures. Modernization Project construction activities would not, however, result in TAC or particulate matter less than 2.5 microns in diameter (i.e., fine particulates) ($PM_{2.5}$) emissions that exceed applicable significance thresholds. During operation, depending on the Project scenario being considered (i.e., 93% or 100% Utilization), the Modernization Project's emission of CAPs, volatile organic compounds (VOCs), and TACs would either be less than significant or mitigated to less-than-significant levels, and would achieve the Project objectives of no net increase in CAPs and greenhouse gases, and health risk from TACs, as explained in *Section 4.3, Air Quality*.

6.3.1.2 Greenhouse Gases

As explained in *Section 4.8, Greenhouse Gases*, with implementation of the Project Design Features and other mitigation measures, the Modernization Project's greenhouse gas emissions impact would achieve Chevron's goal of no net increase of greenhouse gas, and related impacts would be less than significant under applicable BAAQMD emission thresholds.

6.3.2 Energy

The Modernization Project would result in additional consumption of energy, but it would be offset by the increased self-generation of electricity at the refinery. The amount of imported electricity is not expected to change at the 93% and 100% Utilization Scenarios. Therefore construction of new facilities and sources of electricity and distribution infrastructure would not be required. Similarly, the Modernization Project's increased consumption of natural gas would not require construction of new facilities and sources of natural gas and distribution infrastructure. Accordingly, the Project's direct, indirect, and cumulative impacts on energy resources would be less than significant and no mitigation measures are required, as explained in *Section 4.6, Energy*.

6.3.3 Public Safety

During construction, the Modernization Project's potential significant adverse impacts related to the transport, use and disposal of hazardous materials and

hazardous waste would be mitigated to less-than-significant levels. As compared to 2008-2010 Baseline conditions, during operation, the Modernization Project would transport and use greater quantities of hazardous materials and transport and generate greater quantities of hazardous waste. However, no new types of hazardous materials would be introduced and no new types of hazardous wastes would be generated. The quantity of Project-related hazardous materials stored at the Facility would be less than maximum quantities currently stored at the Facility. Recommended mitigation measures would reduce potentially significant adverse impacts related to the Modernization Project's transport, use and generation of hazardous materials and waste to less-than-significant levels, as explained in *Section 4.13, Public Safety*. The Modernization Project would also increase the risks of accidental releases of hazardous substances, but his impact would be mitigated to a less-than-significant level, as explained in *Section 4.13, Public Safety*.

6.3.4 Transportation and Traffic

The Transportation impacts related to the construction and operation of the Modernization Project would occur primarily during Project construction, which would generate up to about 2,042 daily trips at the Facility. As explained in *Section 4.16, Transportation and Traffic*, the Project's potentially significant adverse direct, indirect, and cumulative impacts related to transportation and traffic would be mitigated to less-than-significant levels.

6.3.5 Land Use

The construction and operation of the Modernization Project would cause no direct, indirect or cumulative significant adverse impacts related to land use, as explained in *Section 4.10, Land Use, Plans, and Policies*.

6.3.6 Aesthetics

The construction and operation of the Modernization Project would cause no direct, indirect or cumulative significant adverse impacts related to aesthetic resources, as explained in *Section 4.1, Aesthetics, Visual Quality, Light, and Glare*. However, implementation of recommended mitigation measures would further reduce any Project-related aesthetic impacts further below applicable significance thresholds.

6.3.7 Noise

Construction and operation of the Modernization Project would result in noise impacts that either would be less than significant or would be reduced to a less-than-significant level with the implementation of the identified mitigation measures, as explained in *Section 4.11, Noise*. After mitigation, the Project would

result in no direct, indirect, or cumulative significant adverse impacts related to noise.

6.3.8 Employment Population and Housing

The Modernization Project would cause no direct, indirect or cumulative significant adverse impacts related to Employment, Population and Housing, as explained in *Section 4.12, Employment, Population, and Housing*.

6.3.9 Public Services

As explained in *Section 4.14, Public Services*, the Modernization Project would not result in direct, indirect or cumulative significant adverse impacts that would reduce the service ratios, response times, or other performance objectives for any of the public services below acceptable levels. Moreover, the Modernization Project would not result in the need for new police or fire facilities in order to maintain the Richmond Police Department's or Fire Department's ability to provide police protection, fire suppression, or emergency services to the Facility and the City. The Modernization Project would not result in the need for new school facilities in order adequately provide educational services to residents of the City, nor would it significantly impact library or hospital services. Although not necessary to mitigate impacts, mitigation measures are recommended to further minimize the already less-than-significant police and fire protection impacts of the Modernization Project.

6.3.10 Parks and Recreation

The Modernization Project would cause no direct, indirect or cumulative significant adverse impacts related to Parks and Recreation, as explained in *Section 4.15, Parks and Recreation*.

6.3.11 Utilities

As explained in *Section 4.17, Utilities and Service Systems*, with mitigation, the Modernization Project would cause no direct, indirect or cumulative significant adverse impacts on utilities and services systems. Although the Project would result in a net increase in water usage, sufficient existing water supplies are available to serve the Modernization Project under the 93% Utilization Scenario and potential significant adverse impacts to water supplies under the 100% Utilization Scenario would be mitigated to a less-than-significant level.

The Facility operates its own wastewater treatment system. With the proposed water reuse Project Design Feature, the Modernization Project would result in no net increase in industrial wastewater under the 93% Utilization Scenario, but would result in a net increase under the 100% Utilization Scenario. Although this

100% Utilization Scenario net increase is potentially significant, after mitigation no increase in wastewater generation would occur.

6.3.12 Agricultural Resources

Construction and operation of the Modernization Project would result in no direct, indirect or cumulative significant adverse impacts to agricultural or forestry resources, as explained in *Section 4.2, Agricultural Resources*.

6.3.13 Biological Resources

As explained in *Section 4.4, Biological Resources*, with mitigation, the Modernization Project would not cause any direct, indirect or cumulative significant adverse impacts to biological resources, including sensitive habitats or special-status plant or animal species. Potential impacts to biological resources could result if additional wastewater or pollutant discharges into bay waters were to occur, but all such impacts would be mitigated to less-than-significant levels.

6.3.14 Geology, Soil, Seismicity, and Mineral Resources

As explained in *Section 4.7, Geology, Soil, Seismicity, and Mineral Resources*, the Modernization Project's compliance with standard regulatory controls would reduce all potentially significant adverse direct, indirect, and cumulative impacts related to geology, soil, and seismicity to less-than-significant levels. Moreover, the Modernization Project would not result in substantial soil erosion or the loss of topsoil, nor would it result in the loss of availability of a locally important mineral resource recovery site.

6.3.15 Cultural Resources

As explained in *Section 4.5, Cultural Resources*, construction and operation of the Modernization Project would not cause a direct, indirect or cumulative significant adverse impact to any historical, archeological, paleontological or cultural resources. There is a remote possibility that an unexpected archeological or paleontological resource could be discovered during remaining Project construction activities on previously developed portions of the Project site. Any such impact would be mitigated to less-than-significant levels through implementation of recommended mitigation measures.

6.3.16 Hydrology

As explained in *Section 4.9, Hydrology and Water Quality*, with mitigation, the Modernization Project would not cause any direct, indirect or cumulative

significant adverse impacts related to water quality, surface or groundwater supplies, stormwater drainage or capacity, or flooding.

6.4 ALTERNATIVES CONSIDERED BUT DISMISSED FROM CONSIDERATION IN THIS EIR OR ALTERNATIVES SCREENING PROCESS

In accordance with CEQA Guidelines Section 15126.6(c), this EIR identifies alternatives that were considered and eliminated from more detailed consideration. The following alternatives have been considered but screened from further analysis, for reasons discussed below:

6.4.1 Alternative Modernization Project Location

The Modernization Project proposes to construct physical improvements to an existing industrial Facility on a previously industrialized Project site. Moreover, as described in *Chapter 3, Project Description*, substantial portions of the Modernization Project's proposed Facility improvements commenced construction in the time between the 2008 Project approval and the Appellate Court Decision overturning such approval. The Modernization Project would complete construction of these Facility components, which cannot occur at an off-site location. Moreover, the fundamental purpose of the Modernization Project is to improve the reliability, safety and integrity of the existing Facility in manner that allows it to process crude oil blends and externally sourced gas oils containing greater quantities of sulfur than the feedstock currently processed at the Facility. This fundamental purpose would not be achieved by locating the Project on an alternative site. Therefore, this alternative need not be considered in this EIR (In Re Bay-Delta Programmatic Environmental Impact Report Coordinated Proceedings (2008) 43 Cal.4th 1143, 1165 [EIR not required consider alternative that "cannot achieve the project's underlying fundamental purpose."]).

Moreover, CEQA does not require this EIR to consider project alternatives that are infeasible (14 Cal. Code Regs. Section 15126.6(c)). A feasible alternative is one that is "capable of being accomplished in a successful manner within a reasonable period of time, taking into account … technological factors" (Pub. Res. Code Section 21061.1). The Modernization Project's proposed technological improvements would have no practical utility were they located at a different site. The Project can only be successfully accomplished if it is located at the Facility on the Project site. As such, this alternative is infeasible and is dismissed from consideration in this EIR.

It should be noted that, while CEQA requires an EIR to identify project alternatives, it does not require the EIR to identify alternative project locations.

Per the CEQA Guidelines, an EIR must include a reasonable range of "alternatives to the project, or to the location of the Project" (14 Cal. Code of Regs. Section 15126.6(a)(emphasis added)). Applicable case law recognizes that CEQA grants lead agencies flexibility to elect to analyze either on-site or off-site alternatives, or both (Mira Mar Mobile Community v. City of Oceanside (2004) 119 Cal.App.4th 447, 491). There is no requirement that an EIR always explore an off-site alternative (California Native Plant Society v. City of Santa Cruz (2009) 177 Cal.App.4th 957, 933).

6.4.2 Sulfur Cap Alternative

As described in *Appendix 3, Overview of Oil Refining Process*, sulfur occurs naturally in crude oil. The quantity of sulfur in any given crude oil is primarily determined by the region of the world where the crude oil is extracted and the geological formation from which it is extracted. Sulfur is removed from the crude oil during the refining process in order to meet federal and state air quality laws. As described above, the Modernization Project's fundamental purpose is to improve the reliability, safety and integrity of the existing Facility in manner that allows it to process crude oil blends and externally sourced gas oils containing greater quantities of sulfur than the feedstock currently processed at the Facility.

The Sulfur Cap alternative assumes that the applicant would be required to limit the Facility's feedstock to crude and gas oils that do not exceed average 2008-2010 sulfur content levels of 1.58% for crude oil, and 1.5% for gas oil. None of the Modernization Project's proposed Facility improvements are necessary to process crude oil and gas oil with 2008-2010 sulfur content levels. Therefore, this alternative assumes that the Facility would continue to operate as currently configured, with no physical modifications. Instead, this alternative assumes a new Facility permit requirement limiting the maximum sulfur content of the Facility's feedstock to 2008-2010 levels.

Pursuant to CEQA Guideline Section 15126.6(c), to be suitable for consideration in this EIR, a Project alternative must meet most of the Project objectives. The Sulfur Cap alternative would not achieve any of the six Project objectives. It not would maintain the Facility's current throughput processing capacity because it would prohibit sulfur recovery unit utilization up to its current 600 long tons per day permit limit and thus would not achieve this Project objective. Moreover, since this alternative would not replace or upgrade any of the Facility's equipment, this alternative would not meet the Project objective to modernize and increase the equipment reliability and integrity of the Facility. Nor would it meet the Project objective to replace the Facility's hydrogen plant. Without this new equipment, the Facility would be incapable of processing higher sulfur feedstock, and would thus not satisfy this Project objective. Finally, the Sulfur

Cap alternative would not ensure no net increase in Facility emissions of greenhouse gases, CAPs, and public health risks from TACs compared to the 2008-2010 Baseline period. Under this alternative, the Facility would continue to operate in accordance with its existing Title V permit, which authorizes Refinery Operations at utilization levels that exceed the Baseline 89% utilization level. Greater Facility utilization, even with current sulfur quantities, would result in a net increase in greenhouse gas, CAP and TAC emissions. Since the Sulfur Cap alternative would not achieve most of the Project objectives, it has been dismissed from consideration in this EIR.

Since the Sulfur Cap alternative would not construct any of the Project's proposed Facility improvements or Hydrogen Plant Replacement, the Sulfur Cap alternative would avoid all of the Modernization Project's direct, indirect, and cumulative construction and operational impacts related to aesthetics, agricultural resources, biological resources, cultural resources, geology, hydrology, land use, noise, population, employment, housing, parks and recreation, transportation, and utilities. The Modernization Project is committing to no net increase of emissions over 2008-2010, and the Sulfur Cap alternative would have an emission profile consistent with the 2008-2010 Baseline if the Facility is operated at 89% utilization levels. If, however, the Facility operates at a greater than 89% utilization level, as it is currently permitted to do, this alternative would have greater air quality impacts as compared to the Modernization Project, resulting in a net increase of greenhouse gas, CAP, and TAC emissions.

Since the Modernization Project would be expected to consume more energy than the Sulfur Cap alternative, this alternative would have less impact on energy resources, but it would not achieve the Project's public safety and Facility reliability benefits. Moreover, even if the Sulfur Cap alternative would avoid or reduce some Project impacts, all of the Project's potentially significant adverse direct, indirect, and cumulative impacts are less than significant, or would be mitigated to a less-than-significant level, as described in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*.

6.4.3 Rejected Renewable Energy Alternatives

This *Chapter 6, Alternatives Analysis*, evaluates multiple alternatives designed to offset some or all of the Project-related greenhouse gas emissions by generating renewable energy, irrespective of whether such renewable energy is used by the Facility or transferred to the electrical grid. In addition to the feasible Renewable Energy alternative evaluated in *Section 6.6*, below, this *Section 6.5.3* describes those renewable energy alternatives considered but ultimately rejected from consideration.

6.4.3.1 Wind Energy Alternative

Wind energy, or electricity generated from wind-powered turbines, is a proven and available technology. However, power generated by wind turbines is, like solar power, highly variable. Both wind power and solar power are "non-firm" forms of renewable energy and thus are interruptible and not available on a continuous schedule. Furthermore, according to the California Energy Commission (CEC), wind resource potential for the area around the Facility is low (CEC, 2014a), with average wind speeds generally below 15 miles per hour (CEC, 2006), making wind energy less desirable than solar for repowering purposes in the City.

According to the American Wind Energy Association, as a general rule of thumb, it requires 60 acres to produce 1 megawatt (MW) of power capacity for land-based wind farms. Thus, in order to match the approximate 100-MW capacity generated by the Facility's co-generation units (as discussed in *Section 4.6, Energy*), wind turbines would need to be constructed on 6,000 acres of land, or approximately 9 square miles of land, which is more than one-quarter of the City's 33.7 land-based square miles (City of Richmond, 2014). Besides the fact that there is not enough undeveloped land within the City to support a wind farm of this size, the related aesthetic impacts would be significant and unavoidable with conventional wind turbine technology. Communities in which large, utility-scale wind developments have been constructed have also raised concerns about subsonic noise and avian mortality issues (CEC, 2007). Given the scope of the necessary development and the potential significant adverse impacts associated with wind development, further analysis of a wind-based renewable energy alternative was screened out on the basis that it is infeasible.

6.4.3.2 Geothermal Power Alternative

Geothermal energy is produced by the heat of the earth and is often associated with volcanic or seismically active regions. Electricity can be generated from high temperature geothermal resources by using the thermal (heated) water and steam to move turbines that in turn run electrical generators and produce electricity. California has 25 known Geothermal Resource Areas, 14 of which have temperatures of 300 degrees Fahrenheit (ºF) or greater (CEC, 2014b). Since the area in and around the Facility is not identified as a known geothermal resource, this source of renewable energy generation was screened out from further analysis on the basis that it is infeasible.

6.4.3.3 Ocean Energy Alternative

According to the CEC, technologies for generating electrical power from the ocean include tidal power, wave power, ocean thermal energy conversion, ocean

currents, ocean winds and salinity gradients (CEC, 2014c). Of these, the three most well-developed technologies are tidal power, wave power, and ocean thermal energy conversion. Tidal power requires large tidal differences which, in the U.S., occur only in Maine and Alaska. Ocean thermal energy conversion is limited to tropical regions, such as Hawaii, and to a portion of the Atlantic coast. Thus, tidal power and ocean thermal energy conversion are not feasible alternative energy sources for the Facility.

Wave energy has a more general application, with potential along the California coast. The western coastline has the highest wave potential in the United States. In California, the greatest wave energy potential is located along the northern California coast. According to the CEC, California has more than 1,200 kilometers (745 miles) of coastline, and the combined average annual deep water wave power flux is over 37,000 MW of which an upper limit of about 20% could be converted into electricity, an amount sufficient to power about 23% of California's current electricity consumption. However, economics, environmental impacts, land-use and grid interconnection constraints would likely impose further limits to how much of the resource can be extracted. Further, this technology is still at a relatively immature pilot project stage, making any large-scale development of water energy technology infeasible at this time.

6.4.3.4 Solar Photovoltaic Alternatives

As explained in detail in *Section 4.6, Energy*, the Facility produces both electric power and steam for use throughout the Facility's units. Electric power is generated by two gas turbines and one steam turbine generator. Electric power is also produced in small amounts by the fluid catalytic cracker turbine generator. High-pressure steam is produced by two heat recovery steam generators in the Facility co-generation units as well as by five fired boilers in the Facility's Number 1 Power Plant. The Facility currently has the capacity to self-generate approximately 125 MW of electric power and typically purchases a net average of 2 MW from Pacific Gas and Electric Company (PG&E). Although the Facility self-generates a substantial amount of its own electrical power and can at times sell power back to PG&E based on different Facility unit load conditions, on average the Facility only imports approximately 2% (on a net basis) of its electrical energy from the PG&E electric grid.

Due to prevailing meteorological conditions, the City is not an ideal location for installation of a utility-scale solar energy generation. However, solar photovoltaic (PV) electric generation is technologically and commercially available, and therefore this EIR has selected that technology for further analysis to determine the feasibility of using solar power to repower the Facility or offset some or all of the Modernization Project greenhouse gas emissions. As further discussed in *Sections 6.5.3.4.1* and *6.5.3.4.2*, below, it is infeasible to use solar PV

technology to completely repower the Facility, or to offset all of the Project's greenhouse gas emissions, and doing so would result in numerous new significant and unavoidable impacts without attendant benefits when compared to the Modernization Project. However, as discussed in *Section 6.6.4*, below, this EIR does evaluate a Renewable Energy alternative, which considers a feasible 8-MW solar PV configuration that could be installed on Chevron-owned land, though it would not completely repower the Facility, or completely offset the Project's greenhouse emissions.

6.4.3.4.1 *Solar Photovoltaic Alternative 1: The Use of Solar Photovoltaic Technology to Replace 100% of the Electricity Generated by the Facility's Cogeneration Units*

Solar Photovoltaic alternative 1 assumes construction and operation of the Modernization Project along with development of a solar PV energy system with capacity sufficient to replace 100% of the electricity generated by the Facility's cogeneration units. As discussed in *Section 4.6, Energy*, the Facility requires a continuous, reliable supply of power and can self-generate most of this demand with its co-generation units, which have the ability to generate approximately 876,000 MW per hour of power, which equates to the 100 MW of power generated by the Facility's co-generation units. Facility power must be continuous, surge-free and reliable to ensure safe and stable Refinery Operations. An expected surge or drop in available energy can lead to process upsets and the need for units to be unexpectedly shutdown, which can also result in flaring.

Unlike the power generated from the Facility's co-generation units, which is continuous and reliable, solar PV power generation is variable with the potential for sudden changes during daily and seasonal cycles. Moreover, solar PV technology only generates power during daylight hours. Because of variations in insolation (i.e., incoming solar radiation), a solar PV system designed to completely offset the 100-MW generation capacity of Facility's co-generation units would need store energy during peak insolation hours for use during non-peak times. Solar PV systems typically would provide power at design capacity for 5-6 hours per day. Thus, to store sufficient power to provide continuous, uninterrupted power for 24-hours per day consistent with Facility demand, the solar PV facility would have to have a capacity four to five times larger than the Facility demand (i.e., a capacity of approximately 460 MW).[4]

[4] In terms of capacity, a comparable California-based utility-scale solar project is the Ivanpah Solar Electric Generating System (in San Bernardino County), which went on-line in December 2013 and is an approximately 400-MW project (377-MW net) covering 3,400 acres (5.3 square miles) (CEC, 2010). The Ivanpah Solar Electric Generating System uses a solar thermal "power tower" technology that requires significantly higher direct normal

Solar PV technology typically requires approximately 8 acres of solar PV cells to generate 1 MW of capacity, though some recent design improvements have reduced this to 6 acres per MW. Using the 6-acre-per-MW scale, it would require 600 acres (approximately 1 square mile) of land to provide sufficient space to generate 100 MW of capacity during peak insolation periods. Thus, it would require approximately 2,760 acres (4.3 square miles) of flat terrain to produce the 460 MW of power needed to replace the 24-hour production capacity of the Facility's co-generation units. The entire Modernization Project site is approximately 4.5 square miles, much of which is hilly terrain or otherwise occupied by existing refinery process units. Furthermore, 4.3 square miles is approximately one-eighth of the City's entire land-based area. Figure 6-1 depicts the physical scope of solar PV development that would be necessary to completely replace the electricity generated by the Facility's co-generation units.

Construction and operation of a 4.3-square-mile, utility-scale solar PV facility in the City is infeasible as it would displace numerous homes and business, would result in new construction and operational impacts unrelated to the Modernization Project, and would not substantially lessen or avoid any potential impacts of the Project. Moreover, the energy storage technology necessary to make this alternative technically feasible is not presently commercially available. Furthermore, Solar Photovoltaic alternative 1 would not displace the refinery's need to operate the Facility's co-generation units, or steam boilers, because those units generate steam used by the Facility to process feedstock in to end product. For these reasons, Solar Photovoltaic alternative 1 is deemed infeasible and is not further considered in this EIR.

6.4.3.4.2 *Solar Photovoltaic Alternative 2: The Use of Solar Photovoltaic Technology to Completely Offset the Modernization Project's Greenhouse Gas Emissions*

One of the Modernization Project objectives is to ensure no net increase in emissions of greenhouse gases through a combination of: replacing some existing equipment with new Modernization Project components that are more energy-efficient and lower-emitting, and implementing specific, feasible additional Project Design Features and mitigation measures as described in this EIR. Solar Photovoltaic alternative 2 assumes development of a solar PV energy system capable of completely offsetting the Project's greenhouse gas emissions.

Under the 93% Utilization Scenario described in this EIR, and specifically in *Section 4.8, Greenhouse Gases*, the Modernization Project would generate

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irradiance than is available in the City. Consequently, were the system located in the City, it would require much more land to generate an equivalent output of energy. In any case, solar thermal power plants of 50 MW or greater fall under the exclusive permitting jurisdiction of the CEC and are legally infeasible for the City to approve.



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Note: The yellow line represents the approximate boundary of the Project site.
Source: Chevron, 2014

Figure 6-1
Chevron Refinery Modernization Project EIR
Illustrative Example of Solar Photovoltaic Alternative 1

approximately 800,000 metric tons (MT) of greenhouse gas emissions per year (in carbon dioxide equivalent [CO_2e]) above the 2008-2010 Baseline period. It would require approximately 2,477 MW of solar-energy-generating capacity to offset 800,000 MT of CO_2e/year greenhouse gas emissions. Thus, this alternative assumes construction and operation of a 2,477-MW solar facility to completely offset the Modernization Project's anticipated annual greenhouse gas emission total.

To get a conservative estimate of the land area required to accommodate a 2,477-MW solar facility, calculations were performed assuming a greenhouse gas emissions factor of 0.17 MT of CO_2e per megawatt-hour (MWh), a number that takes into account all of the sources of electricity that PG&E expects to deliver to customers in 2016 (PG&E, 2013). The lower the greenhouse gas emission factor assumed, the more acres of land would be need to support solar power. For purposes of reducing the 800,000 MT of CO_2e greenhouse gas emissions from the Modernization Project, the following calculation was done:

- 1,900 MWh/MW[5] x 0.17 MT CO_2e/MWh = 323 MT CO_2e /MW
- 800,000 MT CO_2e/year ÷ 323 MT CO_2e/MW = 2,477 MW

At 6 acres per MW, it would require up to 14,862 acres, or 23.2 square miles of land, which is significantly larger than the Facility itself, and nearly 59% of the entire land-based area of the City. To put that number into perspective, Figure 6-2, below, depicts a solar facility covering just 7.8 square miles of land in the vicinity of the Facility, or about a third of the land area required to accommodate this alternative.

Construction and operation of a 23.2-square-mile, utility-scale solar facility in the City is clearly infeasible as it would displace numerous homes and business, would result in new construction and operational impacts unrelated to the Modernization Project. As such, this alternative is not studied any further in this EIR.

6.4.4 Other Alternatives Eligible for Screening

Section 6.5, below, analyzes in detail six alternatives to the Modernization Project in addition to the required "No Project" alternative. Three such alternatives, however, are eligible to be screened out for further analysis either because they would not achieve the Project's fundamental underlying purpose or because they would not reduce any of the Modernization Project's environmental impacts. These three "screening eligible alternatives" are the American Petroleum

[5] Based on insolation data, a solar power output of 1,900 MWh/MW was assumed for the City of Richmond.



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Note: The yellow line represents the approximate boundary of the Project site.
Source: Chevron, 2014

Figure 6-2
Chevron Refinery Modernization Project EIR
Illustrative Example of 7.8-Square-Mile Solar Photovoltaic Facility

Institute (API) Gravity 35.3 Cap alternative, the API Gravity 29.2 Cap alternative, and the Carbon Intensity Cap alternative. Although these three alternatives are eligible for screening, they are carried forward for analysis for informational purposes in response to prior expressions of public interest.

6.5 ALTERNATIVES TO THE MODERNIZATION PROJECT

The following potentially feasible alternatives are evaluated in this EIR:

- No Project alternative: 89% Utilization
- No Project alternative: 93% Utilization
- No Project alternative: 100% Utilization
- Hydrogen Cap alternative
- Reduced Sulfur Processing alternative
- Renewable Energy alternative
- API Gravity 35.3 Cap alternative
- API Gravity 29.2 Cap alternative
- Carbon Intensity Cap alternative
- Reduced Sulfur Processing/No Increase in Refinery GHG Emissions Alternative
- Reduced Sulfur Processing/No Increase in Refinery GHG Emissions Alternative/No FCC FHT Expansion Alternative

Each alternative has a description and a summary of impacts, as set forth in *Sections 6.5.1* through *6.5.12*, below.

As described in *Chapter 3, Project Description*, this EIR evaluates Modernization Project impacts under two post-Project Facility utilization scenarios: the 93% Utilization Scenario and the 100% Utilization Scenario. Unless otherwise noted, this *Section 6.5* compares the impacts of each Project alternative against the Modernization Project's 93% Utilization Scenario, and conservatively assumes 100% utilization of the proposed Hydrogen Replacement Plant under Project conditions. The Modernization Project's 93% Utilization Scenario represents the upper bound of the average annual utilization rate for refineries in the Western United States. The 93% Utilization Scenario is conservative because it represents a material increase from the Facility's 88.6% utilization that occurred during the 2008-2010 Baseline period and other recent years. As explained in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures*, however, to the extent the Project's direct, indirect, and cumulative impacts under the 100% Utilization Scenario are more significant than corresponding impacts under the 93% Utilization Scenario, all such impacts would nevertheless be mitigated to less-than-significant levels.

To compare the relative emissions as between the Modernization Project and each alternative considered in this *Chapter 6*, it is further assumed that the

Project (but not necessarily the alternative being considered) would process a "project crude blend" with a higher sulfur content than average crude oil blend processed at the Facility during the 2008-2010 Baseline period (2.5% sulfur content versus the Baseline 1.58% sulfur content) and an API Gravity (31.6 degrees) that is representative of the crude oil weight that the Facility anticipates using in the future, as discussed further in *Appendix 4.3-URM* (the project crude blend).[6] The fractional characteristics and sulfur content of the project crude blend are summarized in Table 6-1.

For purposes of this *Section 6.5*, it is also assumed that the Facility would operate in compliance with a number of confirmed regulatory changes that will go into effect before 2016 and thereby reduce Facility emissions, including:

- Changes to legal air pollution limitations based on adopted rules with known compliance deadlines requiring reductions in particulate matter and NO_x emissions from transportation sources, including rail, shipping and trucks.
- Updates by BAAQMD engineering staff to emission estimation factors for various Facility equipment and processing units, consistent with BAAQMD Emission Inventory management practices.
- Scheduled, funded and authorized changes in equipment between the end of the Baseline period (2010) and the commencement of Project operation (2016).

With the exception of the three "No Project" alternative variants and the Reduced Sulfur Processing/No Increase In Refinery GHG Emissions/No FCC FHT Expansion Alternative, for purposes of this alternatives analysis, it is assumed that all Modernization Project alternatives would construct all of the Modernization Project's proposed improvements, including the Hydrogen Plant Replacement. This alternatives analysis also considers the impacts of each alternative with and without implementation of the Project's proposed Reliability Program described in *Section 4.13, Public Safety*. Likewise, this alternatives analysis considers the impacts of each alternative with and without implementation of the Project's commitment to achieve no net increase of greenhouse gas emissions, cap emissions, and health risks associated with toxic air contaminant (TAC) emissions.

[6] For some alternatives (i.e., the "No Project" Alternative, the API Gravity 35.2 Cap Alternative, the API Gravity 29.2 Cap Alternative, and the Carbon Intensity Cap Alternative), it is assumed that the Facility would process a crude blend with fractional characteristics that are different than the project crude blend. Thus, under some alternatives, it is assumed that the Facility would process a crude blend that is different than the crude blend that would be processed under Project conditions, as explained below.

TABLE 6-1 PROJECT CRUDE BLEND CHARACTERISTICS CRUDE OIL FRACTIONS

Fraction (Boiling Point, °F)	Volume of Crude Supply (%)
Butane and Lighter Fractions	1.93
Naphtha and LSR (C5-290)	17.36
Kerosene (290-510)	21.11
Diesel (510-625)	10.62
Gas Oil (625-770)	12.58
Heavy Oil (770-1020)	18.11
Residuum (1020+)	18.30
Feedstock Input Characteristics (% by Weight, Unless Otherwise Specified)	
Crude Oil API Gravity (Degrees)	31.6
Crude Oil Specific Gravity	0.868
Crude Oil Sulfur Content	2.50
Sour Gas Oil Sulfur Content	2.25
Sweet Gas Oil Sulfur Content	0.25
Crude Oil Sulfur in Residuum Fraction Processed in Solvent De-Asphalting Unit (SDA)	55

Note: Percent in each boiling point range from assay data, °F.

A comparison of the impacts of each alternative relative to the Modernization Project (93% Utilization Scenario) is summarized in Table 6-2 and Table 6-2b.

6.5.1 No Project Alternative

Per the Facility's existing federal Clean Air Act Title V permit, the Facility is authorized to process up to 257,200 barrels per day of crude oil. This permit limit would not be modified by the Modernization Project and the Project would maintain the Facility's current crude oil throughput capacity. As explained in *Appendix 4.3-URM*, the Facility's ability to process gas oil is constrained by the throughput limits of the Facility's five gas oil gateway units: the fluid catalytic cracker, the hydrocracker, the light neutral hydrocracker, the heavy neutral hydrocracker, and the fluid catalytic cracker feed hydrotreater (FCC FHT). The Modernization Project would not modify the throughput limits of any of the Facility's five gas oil gateway units, with the exception of the FCC FHT. If implemented, the Project would increase the throughput limit of the FCC FHT by

TABLE 6-2 SUMMARY OF COMPARISON OF ALTERNATIVES IMPACTS

		Summary of Project Alternative Impacts Compared to Modernization Project (93% Utilization Scenario)										
Impact Category	**Summary of Project Impacts**	**No Project: 89% Utilization**	**No Project: 93% Utilization**	**No Project: 100% Utilization**	**Hydrogen Cap Alternative**	**Reduced Sulfur Processing**	**Renewable Energy Alternative**	**API Gravity 35.3 Cap Alternative**	**API Gravity 29.2 Cap Alternative**	**Carbon Intensity Cap Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions Alternative**
Aesthetics	Less than Significant	Less than Project	Less than Project	Less than Project	Same as Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Agricultural Resources	No Impact	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Air Quality	Less than Significant after Mitigation	Same as Project	Greater than Project	Greater than Project	Greater than or Same as Project	Greater than or Same as Project	Greater than Project	Greater than or Same as Project	Greater than or Same as Project	Greater than or Same as Project	Less than Project	Less than Project
Biological Resources	Less than Significant after mitigation	Less than Project	Less than Project	Less than Project	Same as Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as project	Same as Project
Cultural Resources	Less than Significant after Mitigation	Less than Project	Less than Project	Less than Project	Same as Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Energy	Less than Significant	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project

TABLE 6-2 SUMMARY OF COMPARISON OF ALTERNATIVES IMPACTS

		Summary of Project Alternative Impacts Compared to Modernization Project (93% Utilization Scenario)										
Impact Category	**Summary of Project Impacts**	**No Project: 89% Utilization**	**No Project: 93% Utilization**	**No Project: 100% Utilization**	**Hydrogen Cap Alternative**	**Reduced Sulfur Processing**	**Renewable Energy Alternative**	**API Gravity 35.3 Cap Alternative**	**API Gravity 29.2 Cap Alternative**	**Carbon Intensity Cap Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions Alternative**
Geology, Soils, and Seismicity	Less than Significant after Mitigation	Less than Project	Less than Project	Less than Project	Same as Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Greenhouse Gas Emissions	Less than Significant after Mitigation	Same as Project	Greater than Project	Greater than Project	Greater than or Same as Project	Greater than or same as Project	Same as or Less than Project	Greater than or Same as Project	Greater than or Same as Project	Greater than or Same as Project	Less than Project	Less than Project
Hydrology and Water Quality	Less than Significant	Same as Project	Greater than Project	Greater than Project	Less than Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Land Use, Plans, and Policies	Less than Significant	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Noise	Less than Significant after Mitigation	Less than Project	Less than Project	Less than Project	Same as Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Population, Employment & Housing	Less than Significant	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project

TABLE 6-2 SUMMARY OF COMPARISON OF ALTERNATIVES IMPACTS

		Summary of Project Alternative Impacts Compared to Modernization Project (93% Utilization Scenario)										
Impact Category	**Summary of Project Impacts**	**No Project: 89% Utilization**	**No Project: 93% Utilization**	**No Project: 100% Utilization**	**Hydrogen Cap Alternative**	**Reduced Sulfur Processing**	**Renewable Energy Alternative**	**API Gravity 35.3 Cap Alternative**	**API Gravity 29.2 Cap Alternative**	**Carbon Intensity Cap Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions Alternative**
Public Safety	Less than Significant after Mitigation	Greater than Project	Greater than Project	Greater than Project	Greater than Project	Greater than Project	Greater than Project	Greater than Project	Greater than Project	Greater than Project	Same as Project	Same as Project
Parks & Recreation	Less than Significant	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Public Services	Less than Significant	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Transportation	Less than Significant after Mitigation	Less than Project	Less than Project	Less than Project	Same as Project	Less than Project	Greater than Project	Less than Project	Greater than Project	Less than Project	Less than Project	Less than Project
Utilities and Service Systems	Less than Significant	Less than Project	Greater than Project	Greater than Project	Less than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project

Note: This table assumes that the Project's no net increase commitment and Reliability Program are not implemented for each alternative

TABLE 6-2B SUMMARY OF COMPARISON OF ALTERNATIVES IMPACTS – ASSUMING IMPLEMENTATION OF RELIABILITY AND NO NET INCREASE COMMITMENT

		Summary of Project Alternative Impacts Compared to Modernization Project (93% Utilization Scenario)										
Impact Category	**Summary of Project Impacts**	**No Project: 89% Utilization**	**No Project: 93% Utilization**	**No Project: 100% Utilization**	**Hydrogen Cap Alternative**	**Reduced Sulfur Processing**	**Renewable Energy Alternative**	**API Gravity 35.3 Cap Alternative**	**API Gravity 29.2 Cap Alternative**	**Carbon Intensity Cap Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions/ No FCC FHT Expansion Alternative**
Aesthetics	Less than Significant	Less than Project	Less than Project	Less than Project	Same as Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Agricultural Resources	No Impact	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Air Quality	Less than Significant after Mitigation	Same as Project	Greater than Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Less than Project	Less than Project
Biological Resources	Less than Significant after mitigation	Less than Project	Less than Project	Less than Project	Same as Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Cultural Resources	Less than Significant after Mitigation	Less than Project	Less than Project	Less than Project	Same as Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Energy	Less than Significant	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Geology, Soils, and Seismicity	Less than Significant after Mitigation	Less than Project	Less than Project	Less than Project	Same as Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project

TABLE 6-2B SUMMARY OF COMPARISON OF ALTERNATIVES IMPACTS – ASSUMING IMPLEMENTATION OF RELIABILITY AND NO NET INCREASE COMMITMENT

		Summary of Project Alternative Impacts Compared to Modernization Project (93% Utilization Scenario)										
Impact Category	**Summary of Project Impacts**	**No Project: 89% Utilization**	**No Project: 93% Utilization**	**No Project: 100% Utilization**	**Hydrogen Cap Alternative**	**Reduced Sulfur Processing**	**Renewable Energy Alternative**	**API Gravity 35.3 Cap Alternative**	**API Gravity 29.2 Cap Alternative**	**Carbon Intensity Cap Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions/ No FCC FHT Expansion Alternative**
Greenhouse Gas Emissions	Less than Significant after Mitigation	Same as Project	Greater than Project	Greater than Project	Same as Project	Same as Project	Same as or Less than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Hydrology and Water Quality	Less than Significant	Same as Project	Greater than Project	Greater than Project	Less than Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Land Use, Plans, and Policies	Less than Significant	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Noise	Less than Significant after Mitigation	Less than Project	Less than Project	Less than Project	Same as Project	Same as Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Population, Employment & Housing	Less than Significant	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Public Safety	Less than Significant after Mitigation	Greater than Project	Greater than Project	Greater than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Parks & Recreation	Less than Significant	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project

TABLE 6-2B SUMMARY OF COMPARISON OF ALTERNATIVES IMPACTS – ASSUMING IMPLEMENTATION OF RELIABILITY AND NO NET INCREASE COMMITMENT

		Summary of Project Alternative Impacts Compared to Modernization Project (93% Utilization Scenario)										
Impact Category	**Summary of Project Impacts**	**No Project: 89% Utilization**	**No Project: 93% Utilization**	**No Project: 100% Utilization**	**Hydrogen Cap Alternative**	**Reduced Sulfur Processing**	**Renewable Energy Alternative**	**API Gravity 35.3 Cap Alternative**	**API Gravity 29.2 Cap Alternative**	**Carbon Intensity Cap Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions Alternative**	**Reduced Sulfur Processing/ No Increase in Refinery Greenhouse Gas Emissions/ No FCC FHT Expansion Alternative**
Public Services	Less than Significant	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project
Trans-portation	Less than Significant after Mitigation	Less than Project	Less than Project	Less than Project	Same as Project	Less than Project	Greater than Project	Less than Project	Greater than Project	Less than Project	Less than Project	Less than Project
Utilities and Service Systems	Less than Significant	Less than Project	Greater than Project	Greater than Project	Less than Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project	Same as Project

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15,000 barrels per day, which would increase the Facility's total gas oil processing capacity by approximately 1,200 barrels per day. For each variant of the "No Project" alternative described in this *Section 6.5.1*, however, it is assumed that Modernization Project would not be implemented and, therefore, the FCC FHT's existing throughput limit would not be increased. In addition, each "No Project" alternative variant assumes that the Hydrogen Plant Replacement would not be constructed.

6.5.1.1 Summary of the "No Project" Alternative Variants

As explained in more detail below, this *Section 6.5.1* analyzes three variants of the "No Project" alternative, as follows:

- The "**No Project: 89% Utilization**" alternative analyzes Refinery Operations under no-Project future conditions (i.e., no changes to the Facility related to the Project occur) assuming 89% of the crude unit capacity is utilized on an annual average daily rate basis. This alternative represents a level of Refinery Operations that is consistent with those occurring during the 2008-2010 Baseline period and therefore most closely approximates future no-Project conditions.
- The "**No Project: 93% Utilization**" alternative analyzes Refinery Operations under no-Project future conditions (i.e., no changes to the Facility related to the Project occur) assuming 93% of the crude unit and gas oil gateway unit capacities are utilized on an annual average daily rate basis. This alternative represents a level of Refinery Operations that is authorized by the Facility's existing Title V permit, though the Facility rarely operates at this utilization level. Since, however, the Facility has occasionally operated at a 93% utilization rate during the Baseline Period, and could theoretically do so again if the Project is not approved, this alternative is evaluated as a potential, though unlikely, "No Project" scenario.
- The "**No Project: 100% Utilization**" alternative analyzes Refinery Operations under no-Project future conditions (i.e., no changes to the Facility related to the Project occur) assuming 100% of the crude unit and gas oil gateway unit permitted capacities are utilized on an annual average daily rate basis. Though it is unlikely that the Facility would operate at a 100% utilization given its existing crude oil and gas oil throughput limits, this operational level is authorized under the Facility's existing Title V permit. Accordingly, the No Project: 100% Utilization alternative is analyzed for purposes of comparing Project impacts against the Facility's legally permitted operational limits.

For all three of the "No Project" variants analyzed below, it is assumed that under future no-Project conditions the Facility would process: (1) crude oil feedstocks

that have the same fractional characteristics as the average crude blend processed during the 2008-2010 Baseline period; and (2) purchased gas oil with an average sulfur content of 1.5% by weight, which represents the average sulfur content of the purchased gas oil processed at the Facility during the 2008-2010 Baseline period.

6.5.1.2 Impact Determinations Common to All "No Project" Alternative Variants

Since each of the "No Project" variants analyzed below would not construct any of the Modernization Project's proposed improvements, all "No Project" alternative variants would avoid the Project's direct, indirect, and cumulative impacts related to: aesthetics; agricultural resources; biological resources; cultural resources; energy; geology, soils and seismicity; hydrology and water quality; land use, plans and policies; noise; population, employment and housing; parks and recreation; public services; transportation and traffic; and, utilities and public services. Although every variant the "No Project" alternative would avoid these Project impacts, all such Project impacts would be less than significant or less than significant after mitigation, as described in greater detail in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures* of this EIR.

As described in *Section 4.13, Public Safety*, the Modernization Project's direct and indirect and cumulative impacts to public safety are less than significant, or less than significant after mitigation. Compared to the Project, none of the "No Project" alternative variants evaluated in this *Section 6.5.1* would implement the various Project components and Project Design Features that would improve Facility safety and reliability. These include:

1. **New hydrogen sulfide (H_2S) absorber.** The Modernization Project includes the installation of a new H_2S absorber on the recycled hydrogen gas stream of the Facility's FCC FHT process unit. The absorber uses a solvent (or amine solution), which, when it comes in contact with the gas stream, removes the H_2S from the gas. The removal of H_2S from this gas stream provides reliability improvements by eliminating a potential source of corrosion in the system.

2. **New amine regenerator (#6 H_2S Plant).** To complement the additional H_2S absorber described above, the Modernization Project would also install a new amine regenerator, which separates the H_2S from the amine solution. The H_2S gas is then processed by the sulfur recovery units and regenerated amine solution is reused in the H_2S absorber. The Modernization Project is implementing an inherently safer design for these new components by locating the regenerating process near the sulfur recovery units and not at the FCC FHT unit near the H_2S absorber, thereby limiting the length of the piping circuit that contains H_2S gas. Instead, the longer piping circuit

between the FCC FHT and the sulfur recovery units would contain a solvent/H_2S liquid, or "rich amine solution." The potential impact of a loss of containment of rich amine solution, rather than H_2S gas, is significantly lower because the dispersion of the liquid is slower and more easily contained.

3. **New standby H_2S scrubber.** The Modernization Project includes the installation of a new standby scrubber, in addition to an existing scrubber, within the Facility's sulfur removal system. The new scrubber would be used in non-routine operating scenarios to safely absorb and process H_2S gas in the event in cannot be recovered by the sulfur recovery units. The standby scrubbers offer an added layer of protection to the sulfur removal system by providing additional time for the Facility to shutdown/slowdown process units or divert H_2S gas flows.
4. **Replacement hydrogen recovery plant.** The new hydrogen plant would replace the existing hydrogen recovery unit with a new one. Both the existing and new units utilize pressure swing adsorption technology, which uses an adsorbent along with changes in pressure to separate hydrogen from the remaining portion of the Facility's process gas stream. The new hydrogen recovery unit's design would incorporate structural improvements to the pressure swing adsorption vessel internals that have been developed since the existing pressure swing adsorption unit was built. These improvements would increase the reliability of the units by reducing the risk for pressure swing adsorption vessel fatigue.
5. **Replacement hydrogen manufacturing plant.** The Modernization Project's replacement of the Facility's hydrogen manufacturing facility would result in multiple reliability benefits. First, the new hydrogen plant would utilize pressure swing adsorption technology in place of the existing hydrogen plant's methods to convert and purify the manufactured hydrogen stream. This would eliminate the use of monoethanolamine, which is used to separate carbon dioxide from the hydrogen stream, and arsenic, which is used to minimize corrosion in the monoethanolamine system. Second, individual units within the hydrogen manufacturing process, such as the reforming furnaces and their associated internals, would be replaced in their entirety. These completely new units would enhance reliability and maintenance efforts compared to the monitoring and eventual replacement of individual components within the existing operating plant.
6. **New hydrogen plant flare and cooling water tower.** The new hydrogen manufacturing facility would be served by independent flare and cooling water tower systems. The subsequent decommissioning of the existing hydrogen manufacturing plant would result in the elimination of a user of the existing cooling water tower and refinery flare gas system located in that processing area. This change would reduce the operational load on both of

these systems and ensures that the new hydrogen manufacturing plant would not be impacted by any potential operational changes within the existing cooling water or flare systems.

7. **Hydrogen compressor upgrades.** The new hydrogen manufacturing facility would be served by independent flare and cooling water tower systems. The subsequent decommissioning of the existing hydrogen manufacturing plant would result in the elimination of a user of the existing cooling water tower and refinery flare gas system located in that processing area. This change would reduce the operational load on both of these systems and ensures that the new hydrogen manufacturing plant would not be impacted by any potential operational changes within the existing cooling water or flare systems.
8. **Ammonia as a feedstock for hydrogen production.** The Facility produces ammonia as part of the refining process. Currently the ammonia is collected and used in the Facility's air emission control devices, known as selective catalytic reduction units, or sold as a refinery product. As a result of the Revised Project, the number of refinery selective catalytic reduction units would increase by one and the new hydrogen manufacturing plant would include added flexibility to use ammonia, along with refinery process gas and import natural gas, as part of its feedstock. The additional selective catalytic reduction and feedstock flexibility provides additional uses for refinery generated ammonia, likely decreasing the amount of ammonia being stored and loaded onto railcars as product.

In addition, as discussed in more detail in *Section 4.13, Public Safety*, the Modernization Project would implement a Project Reliability Program that would inherently improve Facility safety and reduce hazard-related risks. By way of background, the City retained an expert to conduct a reliability review for the Project, including identification of damage mechanisms that may be implicated by the Modernization Project and an evaluation of their potential consequences under post-Project operating conditions, including higher sulfur content in the crude and gas oils processed at the Facility. Based on the recommendations made in the reliability review report, as well as corrective actions being undertaken as a part of the probation terms, Chevron developed a Modernization Reliability Program to be implemented as a Project Design Feature to reduce potential increases in hazard-related risks. The Facility's Modernization Reliability Program is discussed further in *Section 4.13, Public Safety*, and is included as *Appendix 4.8-REL*.

None of the "No Project" alternatives would implement the Modernization Project's safety and reliability improvements described above, nor would they implement the Modernization Reliability Program. Accordingly, none of the "No

Project" alternative variants would achieve the Modernization Project's safety and reliability benefits. In this respect, all of the "No Project" variants are environmentally inferior to the Project. The Project, however, would increase the Facility's flexibility to process higher sulfur feedstocks which may result in increased corrosion rates under the "No Project" alternative, though any related Public Safety impacts would be reduced to less than significant levels, as explained in *Section 4.13, Public Safety*.

6.5.1.3 Assumptions Common to All "No Project" Alternative Variants Used to Determine Air Quality and Greenhouse Gas Impacts

Each of the "No Project" alternative variants is evaluated below, with a primary focus on air quality and greenhouse gas impacts in comparison to the Modernization Project.

For purposes of evaluating air quality and greenhouse gas impacts, for each variant of the "No Project" alternative, it is assumed that the Facility would process a crude oil blend comparable to the average crude oil blend processed at the Facility during the 2008-2010 baseline period (the Baseline crude blend). The fractional characteristics and sulfur content of the Baseline crude blend are summarized in Table 6-3.

6.5.2 No Project: 89% Utilization Alternative

As explained in *Chapter 3, Project Description*, during the 2008-2010 Baseline period, the Facility operated at an average annual daily utilization rate of approximately 89% of the Facility's permitted capacity. This No Project: 89% Utilization alternative assumes that the Facility would continue to operate at the 89% utilization rate that characterized the 2008-2010 Baseline period. Under this alternative, Chevron would not implement the Modernization Project's proposed Facility modifications, and would not obtain any new discretionary agency approvals for Facility modifications. This alternative further assumes Chevron would not make any Facility improvements or modifications that would increase hydrogen production capacity or sulfur removal capacity over 2008-2010 Baseline levels.

6.5.2.1 Comparative Air Quality and Greenhouse Gas Impacts of the No Project: 89% Utilization Alternative

As shown in Table 6-4, the No Project: 89% Utilization alternative and the Project would have the same quantity of greenhouse gas emissions because the Modernization Project would ensure that there is no net increase in greenhouse gas emissions by replacing some existing equipment with new Modernization Project components that are more energy-efficient and lower-emitting, and

TABLE 6-3 BASELINE CRUDE BLEND CHARACTERISTICS

Fraction (Boiling Point, °F)	Volume of Crude Supply (%)
Crude Oil Fractional Characteristics	
Butane and Lighter Fractions	2.21
Naphtha and LSR (C5-290)	19.29
Kerosene (290-510)	22.12
Diesel (510-625)	11.16
Gas Oil (625-770)	12.99
Heavy Oil (770-1020)	17.25
Residuum (1020+)	14.99
Weight and Sulfur Content	
Crude Oil API Gravity (degrees)	33.7
Crude Oil Specific Gravity	0.857
Crude Oil Sulfur Content (%-wt)	1.58%
Sour Gas Oil Sulfur Content (%-wt)	1.5%
Sweet Gas Oil Sulfur Content (%-wt)	0.3%

TABLE 6-4 NO PROJECT (89% UTILIZATION) ALTERNATIVE EMISSIONS COMPARED TO PROJECT EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOC**	
No Project: 89% Utilization Alternative Emissions	525	1,303	503	502	373	973	4,602,947
Project Emissions (with Project Design Features and mitigated to no net increase over Baseline)	525	1,269	501	499	359	973	4,602,947

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound.

implementing specific, feasible additional Project Design Features and mitigation measures as described in *Section 4.8, Greenhouse Gases*. Furthermore, as shown in Table 6-4, the No Project: 89% Utilization alternative would emit the same or greater quantities of CAPs than would the Modernization Project. Again, this is due to the Project's commitment to ensure there is no net increase in such emissions through a combination of Facility improvements, Project Design Features, and mitigation measures described in *Section 4.3, Air Quality*.

6.5.2.2 Comparative Water Supply Impacts of the No Project: 89% Utilization Alternative

Since the Project would produce more hydrogen than the No Project: 89% Utilization alternative, and thus requires a greater use of water, this alternative would have a slightly lower impact on water supplies than would the Project.

6.5.2.3 No Project: 89% Utilization Alternative's Relationship to the Project Objectives

Although feasible, implementation of the No Project: 89% Utilization alternative would not achieve most of the Project objectives described in *Section 6.3*, above. This alternative would not modernize and increase equipment reliability and integrity of the Facility by replacing older equipment with newer, cleaner, and inherently safer equipment and technologies. It would not allow the Facility to processes higher sulfur crude oil blends and gas oils, and it would not replace the Facility's existing hydrogen plant. This alternative would, however, achieve the Project objective of maintaining the Facility's current throughput processing capacity. Also, since this alternative's emissions are representative of 2008-2010 Baseline conditions, it would satisfy the Project objectives' goal of achieving no net increase of Facility emissions over Baseline levels.

6.5.3 No Project: 93% Utilization Alternative

Under this variant of the "No Project" alternative, it is assumed that the Facility would operate at an average annual daily utilization rate of 93% while processing the Baseline crude blend described in *Section 6.5.1*, above. Under this alternative, Chevron would not implement the Modernization Project's proposed Facility modifications, and Chevron would not obtain any new discretionary agency approvals for Facility modifications. This alternative further assumes Chevron would not make any Facility improvements or modifications that would increase the Facility's hydrogen production capacity or sulfur removal capacity over 2008-2010 Baseline levels.

6.5.3.1 Comparative Air Quality and Greenhouse Gas Impacts of the No Project: 93% Utilization Alternative

As shown in Table 6-5, the No Project: 93% Utilization alternative would emit a greater quantity of greenhouse gas and CAP emissions compared to the Project. In this respect, this alternative is environmentally inferior to the Modernization Project. This alternative would not implement the Modernization Project's commitment to achieve no net increase of greenhouse gas emissions, CAPs, and health risks associated with TACs. Indeed, this alternative would result in a net increase in greenhouse gas emissions, CAPs and health risks associated with TACs as compared to the 2008-2010 Baseline period because it does not include the Modernization Project's proposed energy-efficient and lower-emitting Facility improvement and would not implement the Project Design Features, as described in *Sections 4.3, Air Quality*, and *4.8, Greenhouse Gases*.

TABLE 6-5 NO PROJECT (93% UTILIZATION) ALTERNATIVE EMISSIONS COMPARED TO PROJECT EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOC**	
No Project: 93% Utilization Alternative Emissions	555	1,334	530	528	394	1,001	4,792,397
Project Emissions	525	1,269	501	499	359	973	4,602,947

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound

6.5.3.2 Comparative Water Supply and Wastewater Treatment Impacts of the No Project: 93% Utilization Alternative

Since this alternative assumes that the Facility would be operated at a higher utilization rate over baseline conditions, and since it would not implement the Project's proposed Project Design Features that would reduce the Facility's overall water consumption, as explained in *Section 4.17, Utility and Service Systems*, this alternative would have a slightly greater impact on water supplies than would the Project. This alternative would also generate slightly greater amounts of wastewater discharge than would the Modernization Project and would thus have a slightly greater impact on the Facility's wastewater treatment capacity than would the Project.

6.5.3.3 No Project: 93% Utilization Alternative's Relationship to the Project Objectives

Although feasible, implementation of the No Project: 93% Utilization alternative would not achieve five of the six Project objectives. Under this alternative, operation of the Facility would cause greenhouse gas and CAP emissions that exceed Baseline levels. It would also likely result in a net increase in health risks associated with TACs. Moreover, this alternative would not improve Facility reliability and safety by replacing older equipment with newer, cleaner, and inherently safer equipment and technologies, nor would it enhance the Facility's ability to process higher sulfur crude oil blends and gas oils. Finally, this alternative would not replace the Facility's existing hydrogen plant. This alternative would, however, achieve the Project objective of maintaining the Facility's current throughput processing capacity.

6.5.4 No Project: 100% Utilization Alternative

Under this variant of the "No Project" alternative, it is assumed that the Facility would legally operate at up to 100% of its permitted production capacity using the Baseline crude blend if the Modernization Project is not approved. Under this alternative, Chevron would not implement the Modernization Project's proposed Facility modifications, and would not obtain any new discretionary agency approvals for Facility modifications. This alternative further assumes Chevron would not make any Facility improvements or modifications that would increase hydrogen production capacity or sulfur removal capacity over Baseline levels.

As explained in *Appendix 4.3-URM*, the Facility did not operate at full capacity during the entire 2008-2010 Baseline period and, for a variety of reasons, refineries typically do not, or are not able to, continuously operate at full capacity for sustained periods. However, this alternative is appropriately evaluated in this *Section 6.6.1* because it represents the Refinery Operations in accordance with its maximum legally authorized permit capacity.

6.5.4.1 Comparative Air Quality and Greenhouse Gas Impacts of the No Project: 100% Utilization Alternative

As shown by Table 6-6, implementation of the No Project: 100% Utilization alternative would generate greenhouse gas and CAP emissions in quantities that far surpass the Modernization Project and, in this respect, is environmentally inferior to the Project. This alternative would not implement the Modernization Project's commitment to achieve no net increase of greenhouse gas emissions, CAPs, and health risks associated with TACs. Indeed, this alternative would result in a net increase in greenhouse gas emissions, CAPs and health risks associated with TACs as compared to the 2008-2010 Baseline period because it does not include the Modernization Project's proposed energy-efficient and lower-emitting

TABLE 6-6 NO PROJECT (100% UTILIZATION) ALTERNATIVE EMISSIONS COMPARED TO PROJECT (93% UTILIZATION) EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOC**	
No Project: 100% Utilization Alternative Emissions	576	1,388	560	558	416	1,022	4,915,594
Project (93% Utilization) Emissions	525	1,269	501	499	359	973	4,602,947

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound.

Facility improvement and would not implement the Project Design Features and mitigation measures designed to reduce Facility Emissions, as described in *Sections 4.3, Air Quality*, and *4.8, Greenhouse Gases*. Although the Modernization Project is not expected to operate at 100% utilization, Table 6-7 compares the emissions of this No Project: 100% Utilization alternative to the Project 100% Utilization Scenario.

TABLE 6-7 NO PROJECT (100% UTILIZATION) EMISSIONS COMPARED TO PROJECT (100% UTILIZATION) EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOC**	
No Project: 100% Utilization Emissions	576	1,388	560	558	416	1,022	4,915,594
Project (100% Utilization) Emissions	525	1,303	503	502	373	973	4,602,947

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound.

As demonstrated by Table 6-7, even if the Modernization Project operates up to the 100% Utilization Scenario, Facility emissions would be well below those caused by the No Project: 100% Utilization Alternative.

6.5.4.2 Comparative Water Supply and Wastewater Treatment Impacts of the No Project: 100% Utilization Alternative

Since this alternative assumes that the Facility would be operated at a higher utilization rate over baseline conditions, and since it would not implement the Project's proposed Project Design Features that would reduce the Facility's overall water consumption, as explained in *Section 4.17, Utility and Service Systems*, this alternative would have a greater impact on water supplies than would the Project. This alternative would also generate greater amounts of wastewater discharge than would the Modernization Project and would thus have a greater impact on the Facility's wastewater treatment capacity than would the Project.

6.5.4.3 Relationship of the No Project: 100% Utilization Alternative to the Project Objectives

Although feasible, implementation of the No Project: 100% Utilization alternative would not achieve five of the six Project objectives described in *Section 6.3*, above. Under this alternative, operation of the Facility would cause greenhouse gas and CAP emissions that exceed 2008-2010 Baseline levels. This alternative would also likely result in a net increase in health risks associated with TACs. Moreover, this alternative would not modernize and increase equipment reliability and integrity of the Facility by replacing older equipment with newer, cleaner, and inherently safer equipment and technologies. This alternative would also fail to achieve the Project objective of enhancing the Facility's ability to processes higher sulfur crude oil blends and gas oils. Finally, this alternative would not replace the Facility's existing hydrogen plant. This alternative would, however, achieve the Project objective of maintaining the Facility's current throughput processing capacity.

6.5.5 Reduced Sulfur Processing Alternative

The crude oil and gas oil processed at the Facility contain sulfur that must be removed during the refining process. As explained in *Chapter 3, Project Description*, the Facility's overall capacity to remove sulfur from Facility feedstock is constrained by the capacity of the Facility's sulfur recovery units. The sulfur recovery units convert H_2S to elemental sulfur, a product sold for various agricultural and industrial uses. The Facility's existing sulfur recovery units consist of three parallel process units with a combined sulfur removal capacity of 600 long tons per day.[7] The Modernization Project would add oxygen enrichment facilities and other improvements to the sulfur recovery units that

[7] 1 long ton (the standard unit for measuring sulfur exports) equals 2,240 pounds or 1.12 standard tons.

would enable the combined sulfur recovery capacity to be increased to 900 long tons per day, as described in *Chapter 3, Project Description*.

The primary features of the sulfur recovery unit modifications are the addition of oxygen storage tanks, and modifications to burners to handle the oxygen-enriched combustion air. These modifications would allow for higher levels of oxygen in the air feeding into the sulfur recovery units, which would allow the sulfur recovery units to process more H_2S than current levels without increasing the physical size of the sulfur recovery units. As described in Table 3-1 in *Chapter 3, Project Description*, the Modernization Project would also include numerous improvements to offset or reduce emission increases related to the increase in the sulfur recovery units' overall capacity.

This Reduced Sulfur Processing alternative assumes that Modernization Project would be implemented as proposed, except that the sulfur recovery unit's sulfur removal capacity would only be increased to 750 long tons per day, whereas the Project proposes to increase such capacity to 900 long tons per day. Thus, under this alternative, Chevron would implement all of the Modernization Project's proposed Facility modifications, but the sulfur recovery unit's utilization rate would be limited to approximately 83.3% of the capacity proposed by the Modernization Project. Moreover, as with the Project, this alternative assumes that the Facility would be operated consistent with the 93% Utilization Scenario, processing the project crude blend, with the Hydrogen Plant Replacement operating at 100% of capacity.

A project alternative that restricts the Modernization Project's requested increase in sulfur production to 750 long tons per day is an appropriate alternative under CEQA because: (1) a sulfur production limit of 750 long tons per day represents a 50% decrease of the requested Modernization Project increase (the Project requests a 300 long tons per day permit limit increase from 600 long tons per day to 900 long tons per day), which would restrict the ability of the Facility to process higher sulfur feedstocks at the magnitude proposed by the Project; and (2) the reduction still represents an increase over existing sulfur production limits (600 long tons per day), which would allow the Facility to achieve the Project objective of having the flexibility to process higher sulfur feedstock, compared to the 2008-2010 Baseline period, albeit at a reduced capability of what the Modernization Project requests.

6.5.5.1 Comparative Impacts of the Reduced Sulfur Processing Alternative

6.5.5.1.1 *Impacts Similar to Project*

Since this alternative assumes construction of all Modernization Project components, as compared to the Project, the Reduced Sulfur Processing

alternative would have similar direct, indirect, and cumulative construction and operational impacts related to: aesthetics; agricultural resources; biological resources; cultural resources; energy; geology, soils and seismicity; hydrology and water quality; land use, plans and policies; noise; population, employment and housing; parks and recreation; public services; and, utilities and public services. As with the Modernization Project, all such impacts would either be less than significant, or mitigated to a less-than-significant level. This alternative would also have construction-related transportation impacts similar to the Modernization Project, but such impact would be mitigated to a less-than-significant level for both the Project and this alternative.

6.5.5.1.2 *Comparative Reliability and Public Safety Risks*

Unlike this alternative, the Project proposes, as a Project Design Feature, the Modernization Reliability Program designed to further enhance safety and reliability of Facility equipment and Refinery Operations. The Reliability Program includes replacements of several piping circuits in the crude unit and other safety upgrades, and also requires implementation of recommendations made by the City's independent safety expert to address corrosion risks and other potential damage risks that could occur as a result of the Modernization Project. This alternative does not assume implementation of this Project Design Feature and, therefore, would not achieve the same reliability and public safety benefits that would occur if the Project were approved. But if the Reliability Program were implemented, then the public safety risk of this alternative would generally be equivalent to Modernization Project public safety risks. However, because this alternative would bring less sulfur from crude oil into the Facility, its risk of corrosion would be slightly reduced compared to the Project.

6.5.5.1.3 *Comparative Transporation Impacts*

This alternative would have reduced operational transportation impacts than the Modernization Project. This alternative would produce a lower quantity of elemental sulfur compared to the Modernization Project and, therefore, it would require fewer truck trips to transport elemental sulfur off site following its production. Although this alternative would have reduced operational transportation impacts compared to the Modernization Project, these impacts are less than significant for both the Project and this alternative.

6.5.5.1.4 *Comparative Air Quaility Impacts*

As explained in *Section 4.3, Air Quality,* the EIR evaluates the Modernization Project air emissions against two Refinery Operation scenarios: the 93%

Utilization Scenario and the 100% Utilization Scenario.[8] The 93% Utilization Scenario assumes both that the 239,200 barrels per day of crude oil (93% of the permitted crude unit limit of 257,200 barrels per day) is used by the Facility and that the gas oil gateway units operate at 93% of permitted capacity. The 100% Utilization Scenario assumes both that 257,200 barrels per day of crude oil is used by the Facility, and that the gas oil gate units operate at 100% of permitted capacity.

As explained in *Section 4.3, Air Quality*, the Modernization Project's total emissions and change from Baseline levels for each utilization scenario are, in general, calculated by scaling the level of activity associated with associated with Baseline emissions to the level of activity calculated by Unit Rate Model (URM).[9] As shown in Tables A4.3-URM-18 and A4.3-URM-27 of *Appendix 4.3-URM*, under the 93% Utilization Scenario, the crude unit and gas oil gateway unit utilization would operate at the same rate for both this alternative and the Project. Under those 93% Utilization conditions, therefore, this alternative's unmitigated emissions are the same as the Modernization Project's unmitigated emissions, as shown in Table 6-8.

As shown in Table 6-8, without mitigation, the Reduced Sulfur Processing alternative and the Project would generate greenhouse gas emissions, VOC emissions, and NO_x emissions that exceed applicable thresholds of significance. Were this alternative implemented, however, its significant emission impacts would be mitigated to less than significant levels in the same manner as the Project. And emission reductions would occur if approval of this alternative were

[8] As used in this EIR and in the Unit Rate Model (URM) included as *Appendix 4.3-URM*, the Facility utilization rate refers to the percentage of (1) the maximum crude unit permitted capacity (257,200 barrels per day); and (2) the maximum daily throughput limits of the five processing units through which all purchased gas oil must initially be fed (the "gas oil gateway units"). The gas oil gateway units are discussed in *Appendix 4.3-URM* and include the Fluid Catalytic Cracker, the FCC FHT, the Hydrocracker, the Light Neutral Hydrocracker, and the Heavy Neutral Hydrocracker. The Facility's total purchased gas oil processing capacity is less than the sum of the unit' throughput limits because certain of the gas oil gateway units are fed by other gas oil gateway units and by gas oil distilled from the crude unit and deasphalted gas oil from the SDA unit.

[9] As explained in *Appendix 4.3-URM*, the URM calculates the volume of each fraction that would be produced from the crude oil used in each utilization scenario, and assumes that the applicable fractions will be fed to other refinery processing units in accordance with allocation and operational parameters developed by the City's oil industry experts. All of the naphtha fraction, for example is fed to the Naphtha Hydrotreater; all of the residuum is fed to the SDA. Once the amount of each crude oil fraction has been calculated, the URM estimates how much additional gas oil must be purchased to operate the gas oil gateway units at the specified utilization level (e.g., 93% or 100%). The total volume of crude oil and purchased gas oil and the total throughput of each Facility processing unit (in barrels per day) is calculated by the model. As discussed in *Section 4.3, Air Quality* and *Appendix 4.3-URM*, in certain instances, crude oil throughput will be limited below the maximum capacity of the crude unit by one or more processing throughput constraints.

TABLE 6-8 UNMITIGATED REDUCED SULFUR PROCESSING ALTERNATIVE (93% UTILIZATION) EMISSIONS COMPARED TO UNMITIGATED PROJECT (93% UTILIZATION) EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOC**	
Reduced Sulfur Processing Alternative (93% Utilization) Unmitigated Emissions	575	1,320	501	500	358	1,002	5,328,526
Project (93% Utilization) Unmitigated Emissions	575	1,320	501	500	358	1,002	5,328,526

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound.

predicated on implementation of the emissions-reducing Project Design Features. For example, if approval of the Reduced Sulfur Processing alternative was predicated on implementation of the Project Design Features, but not predicated on Chevron's commitment to achieve no net increase, this alternative's greenhouse gas emissions would be reduced by approximately 6,128 CO_2e per year. If the no net increase commitment were implemented, then this alternative would result in no net increase over baseline emissions, like the Project, as shown in Table 6-9.

If it is assumed that this alternative operates in accordance with the 100% Utilization Scenario, this alternative would generate greater unmitigated greenhouse gas, SO_x, PM10, and PM2.5 emissions than would the unmitigated Project operating in accordance with the 93% Utilization Scenario, as shown in Table 6-10. Under the 100% Utilization Scenario, however, this alternative's Facility crude oil throughput would be restricted to 205,000 barrels per day, compared to 239,200 barrels per day under the 93% Utilization Scenario (and 257,200 barrels per day under the Project's 100% Utilization Scenario), as shown in *Tables A4.3-URM-18 and A4.3-URM-27 of Appendix 4.3-URM*.

As demonstrated by Table 6-10, if operating at 100% utilization, this alternative would have greater unmitigated greenhouse gas, SOx, and PM2.5 emissions than would the project. However, even at 100% Utilization, if the no net increase commitment were implemented, then this alternative could achieve that commitment in the same manner as the Modernization Project.

TABLE 6-9 REDUCED SULFUR PROCESSING ALTERNATIVE (93% UTILIZATION) EMISSIONS (MITIGATED TO NNI) COMPARED TO PROJECT EMISSIONS (MITIGATED TO NNI)

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOC**	
Reduced Sulfur Processing Alternative (93% Utilization) Emissions (Mitigated to NNI)	525	1,269	501	499	359	973	4,602,947
Project Emissions (Mitigated to NNI)	525	1,269	501	499	359	973	4,602,947

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound; NNI = no net increase.

TABLE 6-10 REDUCED SULFUR PROCESSING ALTERNATIVE (100% UTILIZATION) UNMITIGATED EMISSIONS COMPARED TO PROJECT (93% UTILIZATION) UNMITIGATED EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOC**	
Reduced Sulfur Processing Alternative (100% Utilization) Unmitigated Emissions	564	1,292	522	520	371	994	5,336,031
Project (93% Utilization) Unmitigated Emissions	575	1,320	501	500	358	1,002	5,328,526

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound.

Although the Modernization Project is not expected to operate at 100% utilization, for informational purposes, Table 6-11 compares the unmitigated emissions of the Project operating in accordance with the 100% Utilization Scenario to the unmitigated emissions of the Reduced Sulfur Processing alternative operating in accordance with the 100% Utilization Scenario.

6.5.5.2 Relationship of the Reduced Sulfur Processing Alternative to the Project Objectives

The Reduced Sulfur Processing alternative is feasible and, if the no net increase commitment were implemented, could achieve most of the Project Objectives described in *Section 6.3*, above. This alternative would, modernize and increase

TABLE 6-11 UNMITIGATED REDUCED SULFUR PROCESSING ALTERNATIVE (100% UTILIZATION) EMISSIONS COMPARED TO UNMITIGATED PROJECT (100% UTILIZATION) EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	
Reduced Sulfur Processing Alternative (100% Utilization) Unmitigated Emissions	564	1,292	522	520	371	994	5,336,031
Project (100% Utilization) Unmitigated Emissions	600	1,399	535	533	374	1,030	5,501,709

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound

equipment reliability and integrity of the Facility by replacing older equipment with newer, cleaner, and inherently safer equipment and technologies and it would replace the Facility's existing hydrogen plant. This alternative would also facilitate the Facility's flexibility to processes higher sulfur crude oil blends and gas oils, though not to the same extent as the proposed Modernization Project. Moreover, this alternative would achieve the Project objective of maintaining the Facility's current throughput processing capacity.

The Reduced Sulfur Processing alternative would not implement the Project's Project Design Features to ensure that there is no net increase in emissions of greenhouse gases and CAPs compared to the 2008-2010 Baseline period and would fail this Project Objective. For the same reason, this alternative would not achieve the Project Objective of assuring no net increase of health risks related to TAC emissions. However, if the no net increase commitment were implemented, then the CAP and GHG emissions, and risks from TAC emissions, from this alternative would also be at or below Baseline and these Project Objective's would be achieved.

6.5.6 Hydrogen Cap Alternative

The Hydrogen Cap alternative assumes that the Hydrogen Plant Replacement would be built but only permitted to produce 197 million metric square cubic feet of hydrogen per day (MMSCFD), exclusive of the Facility's hydrogen recovery capability. This Hydrogen Cap alternative further assumes that the Modernization Project would be implemented as proposed and that the Facility would be operated consistent with the 93% Utilization Scenario, processing the project crude blend. Setting the limit at 197 MMSCFD is an appropriate alternative because it represents a reduction in the Project's requested permitted hydrogen

production limit and a reduction in the URM's maximum calculated use of hydrogen for Refinery Operations.

6.5.6.1 Comparative Impacts of the Hydrogen Cap Alternative

6.5.6.1.1 *Impacts Similar to the Project*

Since this alternative assumes construction of all Modernization Project components, as compared to the Project, the Hydrogen Cap alternative would have similar direct, indirect, and cumulative construction and operational impacts related to: aesthetics; agricultural and forestry resources; biological resources; cultural resources; energy; geology, soils and seismicity; hydrology and water quality; land use, plans and policies; noise; population, employment and housing; parks and recreation; public services; transportation and traffic; and, utilities and public services. As with the Project, all such impacts would either be less than significant, or mitigated to a less-than-significant level.

6.5.6.1.2 *Comparative Reliability and Public Safety Impacts*

Unlike this alternative, the Project proposes, as a Project Design Feature, the Modernization Reliability Program designed to further enhance safety and reliability of Facility equipment and Refinery Operations. The Reliability Program includes replacements of several piping circuits in the crude unit and other safety upgrades, and also requires implementation of recommendations made by the City's independent safety expert to address corrosion risks and other potential damage risks that could occur as a result of the Modernization Project. This alternative does not assume implementation of this Project Design Feature and, therefore, would not achieve the same reliability and public safety benefits that would occur if the Project were approved. However, if the Reliability Program were implemented, then the public safety risk of this alternative would generally be equivalent to Modernization Project public safety risks.

6.5.6.1.3 *Comparative Water Supply and Wastewater Treatment Impacts*

It requires less water to produce hydrogen. Under this alternative, the Hydrogen Replacement Plan would produce less hydrogen compared to the Project and would therefore require less water than the Project. This alternative would also generate less wastewater than the Project and thus would have a reduced impact on the Facility's wastewater treatment capacity.

6.5.6.1.4 *Comparative Air Quality Impacts*

Table 6-12 compares this alternative's unmitigated emissions to the Project's unmitigated emissions.

As shown in Table 6-12, without mitigation, the Hydrogen Cap alternative would generate fewer overall unmitigated emissions than would the Project, and both

TABLE 6-12 UNMITIGATED HYDROGEN CAP ALTERNATIVE EMISSIONS COMPARED TO UNMITIGATED PROJECT EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**	**VOC**	
Unmitigated Hydrogen Cap Alternative Emissions	563	1,310	497	495	358	997	4,949,268
Unmitigated Project Emissions	575	1,320	501	500	358	1,002	5,328,526

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound.

would generate greenhouse gas emissions and VOC emissions that exceed applicable thresholds of significance. Were this alternative implemented, however, its significant emission impacts would be mitigated to less than significant levels in the same manner as the Project. And emission reductions would occur if approval of this alternative were predicated on implementation of the emissions-reducing Project Design Features. For example, if approval of the Hydrogen Cap alternative was predicated on implementation of the Project Design Features, but not predicated on Chevron's commitment to achieve no net increase, this alternative's greenhouse gas emissions would be reduced by approximately 6,128 CO_2e per year. If the no net increase commitment were implemented, then this alternative would result in no net increase over baseline emissions, like the Project, as shown in Table 6-13.

6.5.6.2 Relationship of the Hydrogen Cap Alternative to the Project Objectives

The Hydrogen Cap alternative is feasible and, if the no net increase commitment were implemented, then it could achieve most of the Project Objectives described in *Section 6.3*, above. This alternative would, modernize and increase equipment reliability and integrity of the Facility by replacing older equipment with newer, cleaner, and inherently safer equipment and technologies and it would replace the Facility's existing hydrogen plant. This alternative would also enhance the Facility's flexibility to processes higher sulfur crude oil blends and gas oils, but at a reduced capacity when compared to the Modernization Project. Moreover, this alternative would achieve the Project objective of maintaining the Facility's current throughput processing capacity.

The Hydrogen Cap alternative would not implement the Project's Project Design Features to ensure that there is no net increase in emissions of greenhouse

TABLE 6-13 HYDROGEN CAP ALTERNATIVE EMISSIONS (MITIGATED TO NNI) COMPARED TO PROJECT EMISSIONS (MITIGATED TO NNI)

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	
Hydrogen Cap Alternative Emissions (Mitigated to NNI)	525	1,259	497	495	359	973	4,602,947
Project Emissions (Mitigated to NNI)	525	1,269	501	499	359	973	4,602,947

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound; NNI = no net increase

gases and CAPs compared to the 2008-2010 Baseline period and would fail this Project Objective. For the same reason, this alternative would not achieve the Project Objective of assuring no net increase of health risks related to TAC emissions. However, if the no net increase commitment were implemented, then the CAP and GHG emissions, and risks from TAC emissions, from this alternative would also be at or below Baseline and these Project Objective's would be achieved.

6.5.7 Renewable Energy Alternative

This Renewable Energy alternative assumes that the Modernization Project would be implemented as proposed, but it would also include construction of an 8-MW ground-mounted solar PV facility on approximately 40 acres of Chevron-owned property adjacent to the Project site and generally encompassing a commonly known as Landfill 15 (the 8-MW solar facility). The 8-MW solar facility would be comprised of approximately 31,200 PV solar panels, each rated at 295 watts.[10] For purposes of this Renewable Energy alternative, it is assumed that the energy produced by the 8-MW solar facility would be used at the Facility or put back into the electrical grid.

6.5.7.1 Location of the 8-MW Solar Facility

In August 2012, Chevron Technology Ventures conducted an assessment of clear, level Chevron-owned property in and around the Facility capable of

[10] The 8-WM solar facility is distinct from, but would be constructed adjacent to, the 2-MW solar facility included in the list of potential Community Greenhouse Gas Reduction Programs described in *Section 4.8, Greenhouse Gases*. If the 2-MW solar facility is implemented, it would be constructed in addition to the 8-MW solar facility assumed by this Rewnewable Energy Alternative.

supporting solar development. This assessment initially identified 90 acres of land potentially available for solar development, but 30 acres were later deemed unsuitable for solar use due to various reasons, including concerns with the structural integrity of an existing landfill cap that must be maintained consistent with existing environmental regulations and agreements. The remaining 60 acres present various levels of suitability for solar development.

Of the 60 acres identified as potentially suitable for solar development, a 20-acre portion has minimal need for grading and no existing cap or other regulatory restrictions. Of this 20-acre portion, 13 acres could be used for development the 2-MW solar facility included in the Community Greenhouse Gas Reduction Program described in *Section 4.8, Greenhouse Gases*. The 47-acre balance could be used for construction of the 8-MW solar facility contemplated by this Renewable Energy alternative (the solar facility site).

The solar facility site includes 40 acres generally encompassing an area referred to as Landfill 15. Landfill 15 was used as an evaporation pond and landfill from the early 1960's through 1987. From 1995 to 1997, Landfill 15 was capped and today contains oily and acid sludge, sulfur wastes, hydrocarbon contaminated soil, and other non-hazardous waste from within the Facility. The landfill is currently regulated by Regional Water Quality Control Board Order #2011-0036 and surrounded by a groundwater protection system, as well as a methane gas venting and storm water containment systems. To accommodate the 8-MW solar facility, the Landfill 14 area would need to be regraded, and clean fill added, so that the existing cap would not be disturbed or damaged. This would require approval from the Regional Water Quality Control Board. Nevertheless, assuming engineering and permitting issues can be overcome, this 40-acre area could be used for solar development.

The location of and conceptual layout of the 8-MW solar facility is depicted in Figure 6-3.

6.5.7.2 Comparative Impacts of the Renewable Energy Alternative

The Renewable Energy alternative assumes the Modernization Project would be constructed and operated as proposed, with the addition of the 8-MW solar facility. Accordingly, this alternative would not reduce or avoid any of the Project's direct, indirect or cumulative impacts related to: aesthetics, visual quality, light, and glare; agricultural resources; air quality; biological resources; cultural resources; energy; geology, soils, seismicity, and mineral resources; greenhouse gases; hydrology and water quality; land use, plans and policies; noise; employment, population, and housing; public safety; public services; parks and recreation; transportation; or utilities and services. Moreover, since this alternative assumes construction and operation of both the Project and the



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Note: The yellow line represents the approximate boundary of the Project site.
Source: Chevron, 2014

Figure 6-3
Chevron Refinery Modernization Project EIR
Renewable Energy Alternative

8-MW solar facility, compared to the Modernization Project, this alternative would result in additional potentially significant adverse environmental impacts.

The potential impacts of constructing and operating this alternative's proposed 8-MW solar facility are discussed below.

6.5.7.2.1 *Aesthetics, Visual Quality, Light, and Glare*

The site for the 8-MW solar facility would be located adjacent to Castro Street, in an area only viewable to drivers traveling along that street or from surrounding industrialized parcels. The solar facility site is an open area, lined on the southeast side with shrubs that limit views of the solar facility site from public vantage points (though there are few breaks in the vegetation that would allow drivers to see some portion of the site). As discussed in *Section 4.1, Aesthetics, Visual Quality, Light, and Glare*, there are no scenic vistas or scenic highways in the vicinity of the Project site. The solar facility would not be visible in a designated scenic vista and would not be visible from a scenic highway. Therefore, there is no impact on scenic vistas or scenic resources within a scenic highway. The area is generally industrial in character. The solar facility would result in an incremental change to the visual character but, because of the industrial nature of the area, this would be less-than-significant impact. The impacts related to light and glare would be less-than-significant because there are many existing sources of both light and glare in the area and the solar facility would not be easily visible from the road.

6.5.7.2.2 *Agricultural Resources*

There is no prime farmland, unique farmland, or farmland of statewide importance at the solar facility site; therefore there is no potential to convert prime farmland, unique farmland, or farmland of statewide importance to non-agricultural use. The site is currently zoned M-3, an industrial zoning category. The 8-MW solar facility would have no impacts on any CEQA Guidelines Appendix G criterion regarding agriculture and agricultural resources.

6.5.7.2.3 *Air Quality*

The 8-MW solar facility would not create air emissions during its operation since there is no combustion taking place, no chemical processes occurring that directly emit air pollutants, or fugitive sources of air pollutants. Construction activities associated with the 8-MW solar facility would generate air emissions in amounts proportionally greater than those associated with construction of the 2-MW solar facility evaluated in *Section 4.8, Greenhouse Gases*. Similarly, the excess lifetime cancer risk, chronic health index, and emissions of $PM_{2.5}$ generated by construction of the 8-MW solar facility are also minimal, though

proportionally greater than those associated with construction of the 2-MW solar facility evaluated in *Section 4.8, Greenhouse Gases*.

Since this alternative is not assumed to implement the no net increase commitment, it would have overall greater air quality impacts than the Modernization Project. However, if the no net increase commitment were implemented, then this alternative's greenhouse gas and CAP emissions, and health risks associated with TAC emissions, would also be at or below Baseline, like the Project.

6.5.7.2.4 *Biological Resources*

The solar facility site is located entirely on disturbed upland habitats dominated by non-native and/or invasive grass and forb species. However, the site is situated within close proximity to Herman's Slough, an open water brackish channel bordered by degraded coastal brackish marsh habitat that supports a moderate cover of invasive plant species such as ice plant and Scotch broom. Despite their low habitat quality, adjacent marsh habitats have the potential to support special-status plant species, although none were observed during site assessments. In addition, upland buffer habitats adjacent to the Herman Slough including coyote brush scrub and non-native annual grassland have a low potential to support special-status plants. As with the 2-MW solar facility evaluated in *Section 4.8, Greenhouse Gases*, there is a potential for a significant adverse impact to special-status plant species.

These surrounding vegetation types have potential to provide suitable foraging and nesting habitat for raptors and songbirds protected under the State Fish and Game code and/or the federal Migratory Bird Treaty Act. Construction activities including vegetation removal, noise and vibration have a potential to result in direct (i.e., death or physical harm) and indirect (i.e., nest abandonment) adverse impacts to nesting birds. Implementing Mitigation Measure 4.4-1a required by this EIR would reduce impacts to special-status bird species to less than significant.

Although Herman's Slough contains marginally suitable habitat for mammal species, there is some potential for migration onto the site from nearby degraded marsh habitat.

No sensitive plant communities are present within the footprint of the solar facility site; however, the site is bisected by an open water channel and associated brackish marsh habitat that would be regulated as Waters of the U.S. under Section 404/401 of the Clean Water Act. Although placement of solar arrays and solar energy infrastructure could be restricted to upland/brownfield

areas, there is potential to adversely impact nearby jurisdictional wetland and water resources.

Potential impacts to special-status fisheries could occur if runoff from the solar facility site, either during construction or operation, was substantially degraded and discharged to receiving waters. As described in the Hydrology and Water Quality discussion below, the 8-MW solar facility would be required to comply with existing National Pollutant Discharge Elimination System (NPDES) regulations that, when implemented properly, would reduce this potential impact to a less-than-significant level.

The 8-MW solar facility would not conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

The solar facility site is located in the Bay Area-Delta Bioregion, which is covered by the State's Natural Community Conservation Planning Act. The solar facility would not impact sensitive natural communities comprising the Bay Area-Delta Bioregion. The site is not located within any other Habitat Conservation Plan or other local, regional, or State habitat conservation plan areas.

In order to avoid adverse impacts to sensitive biological resources in the vicinity of the solar facility, if this alternative were adopted, it would be required to implement the same mitigation measures for coastal brackish marsh habitat and special-status mammal species applicable to the 2-MW solar facility described in *Section 4.8, Greenhouse Gases*.

6.5.7.2.5 *Cultural Resources*

There are no historic resources as defined in Section 15064.5 within or near the solar facility site; therefore there would be no impacts to historic resources.

As described in *Section 4.5, Cultural Resources*, there are no known unique or significant archeological resources, unique geologic structures or paleontological resources located within the area of the solar facility site. There are no known human remains or burial sites within or near the solar facility site. There is a remote possibility that an unexpected archeological or paleontological resource, or human remains, could be discovered during construction of the solar facility. Since this alternative assumes that the 8-MW solar facility would occur in addition to the Modernization Project, this potentially significant adverse impact would adequately mitigated through implementation of Mitigation Measure 4.5-1, Mitigation Measure 4.5-2, and Mitigation Measure 4.5-3 in this EIR.

6.5.7.2.6 *Energy*

The construction of the 8-MW solar facility would require consumption of fuel and electricity for equipment and transportation fuel for construction vehicles. The scope of the construction of the solar facility would be much less than the construction of the Modernization Project. Since impacts on energy from construction of the Project were less than significant, the impacts from construction of the solar facility would also be less than significant.

The operation of the 8-MW solar facility would result in generation of electrical energy from a renewable source (i.e., sunlight) that would either be used by the Facility or put back into the electrical grid. This would result in less energy overall being used to generate electricity from the utility provider.

6.5.7.2.7 *Geology, Soils, Seismicity, and Mineral Resources*

The 8-MW solar facility site is underlain by a capped landfill. The potential for the construction of the solar facility to breach the cap and encounter landfill wastes is described in the Public Safety discussion below. Since the solar facility site is relatively flat, landslide hazards would not be expected. The potential for erosion and the regulatory requirements that address erosion control are discussed below in the Hydrology and Water Quality discussion.

The 8-MW solar facility is located in an area likely to experience at least one major earthquake within the next 30 years. Ground shaking could potentially expose persons and property to seismic-related hazards, including localized liquefaction and seismically induced settlement, and expansive soils. This impact would be less than significant because the solar facility would be constructed in accordance with the current California Building Code.

The 8-MW solar facility site is not delineated by the Richmond General Plan 2030 as a locally important mineral resource area. Similarly, the California Geological Survey has not identified any mineral resources at the 8-MW solar facility site (USDA, 1996). Thus, construction and operation of the Modernization Project would not result in the loss of a locally important mineral resource recovery site.

There would be no on-site septic systems installed, and therefore no impact related to placement of septic tanks.

6.5.7.2.8 *Greenhouse Gases*

As discussed for Air Quality, the 8-MW solar facility would not create greenhouse gas emissions during its operation since there is no combustion taking place, no chemical processes occurring that directly emit air pollutants, or fugitive sources of air pollutants. Construction activities would be a source of greenhouse gas emissions. The construction of the 8-MW solar facility would be expected to take

a proportionally longer period than 5 months estimated for construction of the 2-MW solar facility described in *Section 4.8, Greenhouse Gases* and would cause proportionally greater construction-related greenhouse gas emissions.

To the extent power generated by the 8-MW solar facility is used by the Facility, it would reduce the Facility's overall greenhouse gas emissions. Any such power is put back into the grid, would offset Facility greenhouse gas emissions by selling clean energy back to the grid. Assuming a greenhouse gas emissions factor of 0.17 MT CO_2e/MWh, the 8-MW solar facility would offset approximately 2,548 MT CO_2e/year of Facility greenhouse gas emissions if all such power was put back into the grid.

6.5.7.2.9 *Hydrology and Water Quality*

Construction of the 8-MW solar facility would require excavation and grading. This soil disturbance could expose soils to erosion and off-site sedimentation. Since the area of disturbance would exceed 1 acre, it would be required to comply with the NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit) (Order No. 2009-0009-DWQ, NPDES No. CAR000002). In addition, the Modernization Project would be required to treat stormwater runoff in accordance with the San Francisco Bay Region Municipal Regional Stormwater NPDES Permit, Order No. R2-2009-0074, NPDES Permit No. CAS612008. Compliance with existing regulatory programs would ensure that water quality impacts related to Project development would be less than significant and no additional mitigation measures are required.

No use of groundwater resources would occur at the 8-MW solar facility, and therefore the 8-MW solar facility project would not substantially deplete groundwater supplies by pumping groundwater. The solar facility site is capped and minimal infiltration is expected to occur under existing conditions. Therefore, the 8-MW solar facility would have a less-than-significant impact on groundwater recharge.

The 8-MW solar facility would not substantially alter the existing drainage pattern of the site or result in a substantial increase in runoff because the site is relatively flat and impervious under existing conditions and would remain flat and impervious after construction.

Portions of the solar facility site are located within 100-year flood hazard area as designated by the Federal Emergency Management Agency (FEMA, 2009). Any development within the 100-year flood hazard area would be required to comply with the City of Richmond Municipal Code (Chapter 12.56 Flood Damage Prevention) Flood Ordinance, which requires physical improvements that are

susceptible to flooding to be elevated above the 100-year inundation level and anchored to prevent floatation. Therefore, this is a less-than-significant impact.

6.5.7.2.10 *Land Use, Plans, and Policies*

The solar facility site is located completely on Chevron property and would not divide an existing community. There is no impact. The site is designated for industrial use and the solar facility would be a compatible use under the existing land use and zoning designations. There would be no conflicts with any applicable plans or regulations. No mitigation would be needed.

6.5.7.2.11 *Noise*

Construction of the 8-MW solar facility would require the use of heavy equipment for several months. The highest level of construction activity is expected to occur in the first quarter of construction when a belly dump, grader, compactor, two forklifts, and two power generators are expected to operate. Using sound levels identified in the Federal Highway Administration's Roadway Construction Noise Model (FHWA, 2008), construction-related sound levels at the nearest residential receivers were predicted using the CadnaA noise model.

Modeled sound levels of construction noise ranged from 40 to 53 A-weighted decibels (dBA) at the nearest residential locations south, east, and northeast of the solar facility site. These modeled levels would comply with the noise standard of 60 dBA identified in the Richmond Noise Ordinance for weekday (7 a.m. to 7 p.m.) construction activities greater than 15 days. They would also comply with the stricter noise limit of 55 dBA applicable on weekends between 9 a.m. and 8 p.m. Furthermore, construction of the solar facility is expected to increase ambient daytime sound levels by only 0 to 2 dBA. Because noise from construction of the facility would comply with the Richmond noise limits and would increase the ambient levels by 2 dBA or less, no significant adverse noise impacts are anticipated during construction of the facility.

Noise from operation of the solar facility is expected to be minimal and result in no significant adverse noise impacts.

6.5.7.2.12 *Employment, Population, and Housing*

Similar to what was described in *Section 4.12, Employment, Population, and Housing*, the 8-MW solar facility would have no impact on displacing housing or people because there is no existing housing or population at the location. There could be a short-term increase in construction work-force; however, this would be a less-than-significant impact because any increase in population would be temporary and minimal in comparison to the current local population.

6.5.7.2.13 *Public Safety*

The CEQA significance criteria for public safety are listed in Appendix G of the CEQA Guidelines. Each criterion is addressed as follows:

(A) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

The operation of the 8-MW solar facility would not result in the routine transport, use or disposal of hazardous materials as hazardous materials are not required for its operation. The construction of the solar facility may require the transport, use or disposal of hazardous materials. However, the duration of the construction period would not be long enough to be considered routine.

(B) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

The operation of the 8-MW solar facility would not require the use or storage of hazardous materials. Therefore there would be no risk of release of hazardous materials.

(C) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within ¼ mile of an existing or proposed school?

The 8-MW solar facility would not be located within ¼ mile of an existing or proposed school. The closest school to the facility boundary is 0.32-mile southeast of the facility boundary.

(D) Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

The potential for this impact is considered in *Section 4.13, Public Safety* where it is evaluated as less than significant after mitigation. The mitigation under that impact would also apply to the construction activities for the solar facility.

(E) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?

The 8-MW solar facility is not located on an airport land use plan. The closest public airport is approximately 14 miles to the north-northwest of the facility in Marin County.

(F) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?

The 8-MW solar facility is not located within 2 miles of a private airstrip.

(G) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

The 8-MW solar facility would be located within the facility boundary and does not introduce hazardous materials and therefore does not increase the current maximum on-site storage quantities. Thus, the 8-MW solar facility would not interfere with existing emergency plans for areas outside the refinery. The 8-MW solar facility would be integrated into the facility's emergency plan as needed.

(H) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

The operation of the 8-MW solar facility would not increase the risk of wildland fires.

The construction and operation of the 8-MW solar facility does not meet or exceed any of the significance thresholds for public safety.

Because this alternative would not implement the Project's Reliability Program, it would not achieve the same degree of reliability and public safety benefits as would the Project. However, if the Reliability Program were implemented, the public safety risks associated with this alternative would generally be equivalent to the Project.

6.5.7.2.14 *Public Services*

The 8-MW solar facility project would not require additional government facilities or services related to fire protection, police protection, schools, or parks. The 8-MW solar facility would be fenced and not expected to be particularly targeted for crime. Similarly, solar facilities are not particularly prone to fire. No new schools or parks would be needed to support the solar facility project.

6.5.7.2.15 *Parks and Recreation*

As described above under "Employment, Population, and Housing"; there could be a short-term increase in construction work-force. These workers could, during lunch times, temporarily increase the usage of local parks or the proposed segments of the Bay Trail along Western Drive. However, such a temporary impact would not be considered significant. The 8-MW solar facility would not include any additional park or recreation facilities. There is no impact.

6.5.7.2.16 *Transportation and Traffic*

Similar to what was discussed in *Section 4.16, Transportation and Traffic*, the 8-MW solar facility would have no impact on air traffic and would not increase transportation-related hazards. There would be no impact on emergency access and no conflict with adopted plans or policies related to public transit, bicycle, or pedestrian facilities.

The construction of the 8-MW solar facility would generate proportionally more daily worker trips and daily delivery truck trips than estimated for the 2-MW solar facility evaluated in *Section 4.8, Greenhouse Gases*. Although most of the workers would travel to and from the site during the peak congestion periods, most of the truck trips would be during off-peak hours. As a result, the peak-hour traffic generated during the construction of the 8-MW solar facility is expected to be small compared to the total Facility trip generation and within the typical day-to-day fluctuation at the Facility. Thus, the level of additional vehicles on the streets adjacent to the Project site would not be noticeable to most motorists and the increase in delay would be negligible and not considered significant.

6.5.7.2.17 *Utilities and Service Systems*

Operation of the 8-MW solar facility would not result in new demand for wastewater treatment because the facility would not generate substantial new wastewater load. The only source of wastewater expected would be sanitary sewage related to a new restroom facility. Similarly, the solar facility project would require minimal new water supply. The site is relatively flat and impervious (due to the existing landfill cap). Any new drainage facilities would be designed to convey a post-construction surface runoff (in a similar volume to existing conditions) to existing conveyance facilities. The 8-MW solar facility project would not generate a significant amount of solid waste during construction or operation. Therefore, impacts related to utilities and service systems would be less than significant.

6.5.7.3 Relationship to Project Objectives

The Renewable Energy alternative assumes construction and operation of the Modernization Project and implementation of the 8-MW solar facility. This does not, however, include the Modernization Project's commitment to achieve no net increase over 2008-2010 Baseline greenhouse gas emissions, CAP emissions, and risks related to TAC emissions. Accordingly, the Renewable Energy alternative would not achieve all of the Project objectives, unless the no net increase commitment were implemented. However, the Renewable Energy alternative would help reduce greenhouse gas emissions by offsetting up to 2,584 MT CO_2e/year of greenhouse gas emissions, as discussed above.

6.5.8 API Gravity 35.3 Cap Alternative

As explained in *Appendix 3, Overview of Oil Refining Process*, the API gravity is a metric, expressed in degrees, used to measure how heavy or light petroleum is compared to water. The lower the API gravity number, the heavier the petroleum. API gravity can be used to generally categorize crude oil as heavy, medium, or light. Heavy crude oil is denser than light crude oil because the hydrocarbon molecules in heavy crude oil are larger, with more carbon atoms, than those in light crude oil.

As explained in *Chapter 3, Project Description*, the Facility's design and configuration, which the Modernization Project would not fundamentally alter, constrains the range of feedstock that the Facility can process. During the 2008-2010 Baseline period, the Facility processed crude oil blends at the light end of the intermediate API gravity range (i.e., crude oil blends in the low-to-mid 30s). As explained in *Appendix 4.3-URM*, the Facility's ability to process crude oil that is much heavier or lighter than the crude blend used during the Baseline period is subject to two existing constraints: (1) the physical and permitted through limit of the Facility's SDA unit for heavier crudes; and (2) the physical and permitted throughput limit of the Facility's naptha hydrotreater for lighter crudes. Neither throughput limit would be increased by Modernization Project. Therefore, the Project would not enable a significant change in the API gravity of the crude oil processed at the Facility. Indeed, any such significant change would adversely affect the Facility's ability to effectively manufacture its full-range of products required to meet customer demand.[11]

As explained in *Section 4.3, Air Quality*, this EIR evaluated representative crude blends that could be processed under reasonably foreseeable post-Project operating conditions under the 93% and 100% Utilization Scenarios, including the

[11] The Chevron Richmond Refinery is the only manufacturer of lubricant base oils on the West Coast.

so-called "lightest crude blend." The lightest crude blend case assumes a crude blend with the highest API that can achieve the 93% Utilization Scenario and 100% Utilization Scenario without exceeding the processing capacity of the Facility's naptha hydrotreater (API gravity 35.3).

The fractional characteristics and sulfur content of the lightest crude blend are summarized in Table 6-14.

The API Gravity 35.3 Cap alternative assumes that the Modernization Project would be implemented as proposed, except that the Facility would be required to limit its crude oil feedstock to crude oil that does not exceed an API gravity of 35.3 degrees, a number that corresponds to the API gravity of the crude oil component of the lightest crude blend. The alternative further assumes that the Facility would be operated consistent with the reasonably foreseeable 93% Utilization Scenario, and with the Hydrogen Plant Replacement operating at 100% of capacity. As explained below, this alternative would not achieve the Project's most basic and fundamental objective and is thus eligible to be screened from consideration in this *Chapter 6*, *Alternatives*. Nevertheless, it is evaluated in this *Section 6.5* in response to prior expressions of public interest.

6.5.8.1 Comparative Impacts of the API Gravity 35.3 Cap Alternative

6.5.8.1.1 *Impacts Similar to the Project*

Since this alternative assumes construction of all Modernization Project components, as compared to the Project, the API Gravity 35.3 Cap alternative would have similar direct, indirect, and cumulative construction and operational impacts related to: aesthetics; agricultural and forestry resources; biological resources; cultural resources; energy; geology, soils and seismicity; hydrology and water quality; land use, plans and policies; noise; population, employment and housing; parks and recreation; public services; construction transportation; and, utilities and public services. As with the Modernization Project, all such impacts would either be less than significant, or mitigated to a less-than-significant level. This alternative would also have construction-related transportation impacts similar to the Modernization Project, but such impact would be mitigated to a less-than-significant level for both the Project and this alternative.

6.5.8.1.2 *Comparative Reliability and Public Safety Impacts*

Unlike this alternative, the Project proposes, as a Project Design Feature, the Modernization Reliability Program designed to further enhance safety and reliability of Facility equipment and Refinery Operations. The Reliability Program includes replacements of several piping circuits in the crude unit and other safety upgrades, and also requires implementation of recommendations made by

TABLE 6-14 LIGHTEST CRUDE BLEND CHARACTERISTICS

Fraction (Boiling Point, °F)	Volume of Crude Supply (%)
Crude Oil Fractions (% in Each Boiling Point Range from Assay Data, °F)	
Butane and Lighter Fractions	2.53
Naphtha and LSR (C5-290)	21.01
Kerosene (290-510)	23.17
Diesel (510-625)	10.85
Gas Oil (625-770)	11.93
Heavy Oil (770-1020)	16.65
Residuum (1020+)	13.87
Feedstock Input Characteristics (% by Weight, Unless Otherwise Specified)	
Crude Oil API Gravity (degrees)	35.3
Crude Oil Specific Gravity	0.848
Crude Oil Sulfur Content	1.68
Sour Gas Oil Sulfur Content	2.25
Sweet Gas Oil Sulfur Content	0.25
Crude Oil Sulfur in Residuum Fraction Processed in SDA Unit	55

the City's independent safety expert to address corrosion risks and other potential damage risks that could occur as a result of the Modernization Project. This alternative does not assume implementation of this Project Design Feature and, therefore, would not achieve the same reliability and public safety benefits that would occur if the Project were approved. However, if the Reliability Program were implemented, then the public safety risk of this alternative would generally be equivalent to Modernization Project public safety risks.

6.5.8.1.3 *Comparative Transporation Impacts*

This alternative would have reduced operational transportation impacts compared to the Modernization Project with respect to truck trips. This alternative would produce a lower quantity of elemental sulfur compared to the Project and, therefore, it would require fewer truck trips to transport elemental sulfur off site following its production.

6.5.8.1.4 *Comparative Air Quality Impacts*

Table 6-15 compares the API Gravity 35.2 Cap's unmitigated emissions to the Project's unmitigated emissions.

As shown in Table 6-15, without mitigation, the API Gravity 35.3 Cap alternative would generate greater overall unmitigated emissions than would the Project, and both would generate greenhouse gas emissions, NO_x, and VOC emissions that exceed applicable thresholds of significance. Were this alternative implemented, however, its significant emission impacts would be mitigated to less than significant levels in the same manner as the Project. And emission reductions would occur if approval of this alternative were predicated on implementation of the emissions-reducing Project Design Features. For example, if approval of the API Gravity 35.3 Cap alternative was predicated on implementation of the Project Design Features, but not predicated on Chevron's commitment to achieve no net increase, this alternative's greenhouse gas emissions would be reduced by approximately 6,099 CO_2e per year. If, however, the no net increase commitment were implemented, then this alternative would result in no net increase over baseline emissions, like the Project, as shown in Table 6-16.

6.5.8.2 API Gravity 35.3 Cap Alternative's Relationship to the Project Objectives

The API Gravity 35.3 Cap alternative is feasible, and, if the no net increase commitment were implemented, it could achieve some Project Objectives, but it would not achieve the Project's most basic Project objective.

This alternative would, modernize and increase equipment reliability and integrity of the Facility by replacing older equipment with newer, cleaner, and inherently safer equipment and technologies and it would replace the Facility's existing hydrogen plant. This alternative would also achieve the Project objective of maintaining the Facility's current throughput processing capacity.

The API Gravity 35.3 Cap alternative would not implement the Project's Project Design Features to ensure that there is no net increase in emissions of greenhouse gases and CAPs compared to the 2008-2010 Baseline period and would fail this Project Objective. For the same reason, this alternative would not achieve the Project Objective of assuring no net increase of health risks related to TAC emissions. However, if the no net increase commitment were implemented, then the CAP and GHG emissions, and risks from TAC emissions, from this alternative would also be at or below Baseline and these Project Objective's would be achieved.

TABLE 6-15 UNMITIGATED API GRAVITY 35.3 CAP EMISSIONS COMPARED TO UNMITIGATED PROJECT EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes
Emissions Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	CO2e/Year)
Unmitigated API Gravity 35.3 Cap Alternative Emissions	578	1,376	503	501	358	1,017	5,341,400
Unmitigated Project Emissions	575	1,320	501	500	358	1,002	5,328,526

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound.

TABLE 6-16 API GRAVITY 35.3 CAP ALTERNATIVE EMISSIONS (MITIGATED TO NNI) COMPARED TO PROJECT EMISSIONS (MITIGATED TO NNI)

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes
Emissions Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	CO2e/Year)
API Gravity 35.3 Cap Alternative Emissions (Mitigated to NNI)	525	1,303	503	501	359	973	4,602,947
Project Emissions (Mitigated to NNI)	525	1,269	501	499	359	973	4,602,947

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound; NNI = no net increase.

The API 35.3 Cap alternative would not, however, achieve the Modernization Project's fundamental underlying purpose of improving the Facility's flexibility to processes crude oil blends with higher sulfur content than Baseline conditions. Though the lightest crude blend has a slightly higher sulfur content than the baseline crude blend, the Facility's ability to remove sulfur remains subject to the capacity of the Facility's naphtha hydrotreater. The naptha hydrotreater has a throughput capacity of 57,600 barrels per day, which capacity would not be increased by the Modernization Project.[12] Under 2008-2010 Baseline conditions, when the naphtha hydrotreater's capacity is reached, the Facility's sulfur recovery units can remove 593 long tons per day of sulfur.[13] Were this alternative implemented, under the assumed 93% Utilization Scenario, the naphtha

[12] *Appendix 4.3-URM,* Table A4.3-URM-3.
[13] *Appendix 4.3-URM,* Table A4.3-URM-3.

hydrotreater would reach capacity and the sulfur recovery units would be able to remove just 587 long tons per day of sulfur, an amount slightly less than Baseline conditions.[14] Under the unlikely 100% Utilization Scenario, were this alternative implemented, the sulfur recovery units would be able to remove 600 long tons per day, barely exceeding Baseline conditions.[15] Thus, were the Facility restricted to processing the lightest crude blend as assumed by this alternative, the naphtha hydrotreater would reach capacity well before the sulfur recovery units could remove sulfur at levels measurably greater than Baseline conditions, thus substantially frustrating the Project's fundamental underlying purpose.

6.5.9 API Gravity 29.2 Cap Alternative

As discussed in *Section 6.5.8*, above, this EIR evaluated Project operation using various types of crude blends that could be efficiently processed at the Facility under the 93% and 100% Utilization Scenarios, including the so-called "heaviest crude blend." The heaviest crude blend case assumes a crude blend with the lowest API that can achieve the 93% Utilization Scenario and 100% Utilization Scenario without exceeding the processing capacity of the Facility's SDA unit (API gravity 29.2).

The fractional characteristics and sulfur content of the heaviest crude blend are summarized in Table 6-17.

The API Gravity 29.2 Cap alternative assumes that the Modernization Project would be implemented as proposed, except that the Facility would be required to limit its crude oil feedstock to crude oil that does not exceed an API gravity of 29.2 degrees, a number that corresponds to the API gravity of the crude oil component of the heaviest crude blend. The alternative further assumes that the Facility would be operated consistent with the reasonably foreseeable 93% Utilization Scenario, and with the Hydrogen Plant Replacement operating at 100% of capacity.

As explained below, the API Gravity 29.2 Cap alternative would not reduce any of the Modernization Project's environmental impacts and, in some cases, would increase them. Accordingly, it is eligible to be screened from consideration in this Chapter 6, Alternatives. However, this alternative describes Refinery Operations processing the heaviest crude blend the Facility can theoretically accommodate16 and, therefore, it is evaluated for informational purposes in response to prior expressions of public interest.

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[14] *Appendix 4.3-URM,* Table A4.3-URM-3.
[15] *Appendix 4.3-URM,* Table A4.3-URM-6.
[16] As explained in *Appendix 4.3-URM.*

TABLE 6-17 HEAVIEST CRUDE BLEND CHARACTERISTICS

Fraction (Boiling Point, °F)	Volume of Crude Supply (%)
Crude Oil Fractions (% in Each Boiling Point Range from Assay Data, °F)	
Butane and Lighter Fractions	1.29
Naphtha and LSR (C5-290)	14.87
Kerosene (290-510)	20.04
Diesel (510-625)	10.76
Gas Oil (625-770)	13.13
Heavy Oil (770-1020)	19.01
Residuum (1020+)	20.90
Feedstock Input Characteristics (Percentage by Weight, Unless Otherwise Specified)	
Crude Oil API Gravity (Degrees)	29.2
Crude Oil Specific Gravity	0.881
Crude Oil Sulfur Content	2.61
Sour Gas Oil Sulfur Content	2.25
Sweet Gas Oil Sulfur Content	0.25
Crude Oil Sulfur in Residuum Fraction Processed in Solvent De-Asphalting Unit	55

6.5.9.1 Comparative Impacts of the API Gravity 29.2 Cap Alternative

6.5.9.1.1 *Impacts Similar to the Project*

Since this alternative assumes construction of all Modernization Project components, as compared to the Project, the API Gravity 29.2 Cap alternative would have similar direct, indirect, and cumulative construction and operational impacts related to: aesthetics; agricultural and forestry resources; biological resources; cultural resources; energy; geology, soils and seismicity; hydrology and water quality; land use, plans and policies; noise; population, employment and housing; parks and recreation; public services; and, utilities and public services. As with the Modernization Project, all such impacts would either be less than significant, or mitigated to a less-than-significant level. This alternative would also have construction-related transportation impacts similar to the

Project, but such impact would be mitigated to a less-than-significant level for both the Project and this alternative.

6.5.9.1.2 *Comparative Reliability and Public Safety Impacts*

Unlike this alternative, the Project proposes, as a Project Design Feature, the Modernization Reliability Program designed to further enhance safety and reliability of Facility equipment and Refinery Operations. The Reliability Program includes replacements of several piping circuits in the crude unit and other safety upgrades, and also requires implementation of recommendations made by the City's independent safety expert to address corrosion risks and other potential damage risks that could occur as a result of the Modernization Project. This alternative does not assume implementation of this Project Design Feature and, therefore, would not achieve the same reliability and public safety benefits that would occur if the Project were approved. However, if the Reliability Program were implemented, then the public safety risk of this alternative would generally be equivalent to Modernization Project public safety risks.

6.5.9.1.3 *Comparative Transporation Impacts*

This alternative would have greater operational transportation impacts compared to the Modernization Project with respect to truck trips. This alternative would produce a greater quantity of elemental sulfur compared to the Project and, therefore, it would require more truck trips to transport elemental sulfur off site following its production.

6.5.9.1.4 *Comparative Air Quality Imapcts*

Table 6-18, compares the unmitigated emissions of the API Gravity 29.2 Cap alternative to the unmitigated emissions of the Project.

As shown in Table 6-18, without mitigation, the API Gravity 29.2 Cap alternative would generate similar overall unmitigated emissions compared to the Project, and both would generate greenhouse gas emissions and VOC emissions that exceed applicable thresholds of significance. Were this alternative implemented, however, its significant emission impacts would be mitigated to less than significant levels in the same manner as the Project. And emission reductions would occur if approval of this alternative were predicated on implementation of the emissions-reducing Project Design Features. For example, if approval of the API 29.2 Gravity Cap alternative was predicated on implementation of the Project Design Features, but not predicated on Chevron's commitment to achieve no net increase, this alternative's greenhouse gas emissions would be reduced by approximately 10,523 CO_2e per year. If the no net increase commitment were implemented, then this alternative would result in no net increase over baseline emissions, like the Project, as shown in Table 6-19.

TABLE 6-18 UNMITIGATED API 29.2 CAP ALTERNATIVE EMISSIONS COMPARED TO UNMITIGATED PROJECT EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	
Unmitigated API Gravity 29.2 Cap Alternative Emissions	573	1,300	501	499	358	992	5,321,436
Unmitigated Project Emissions	575	1,320	501	500	358	1,002	5,328,526

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound.

TABLE 6-19 API 29.2 CAP ALTERNATIVE EMISSIONS (MITIGATED TO NNI) COMPARED TO PROJECT EMISSIONS (MITIGATED TO NNI)

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	
API Gravity 29.2 Cap Alternative Emissions (Mitigated to NNI)	525	1,250	500	498	358	973	4,602,947
Project Emissions (Mitigated to NNI)	525	1,269	501	499	359	973	4,602,947

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound; NNI = no net increase.

6.5.9.2 API Gravity 29.2 Cap Alternative's Relationship to the Project Objectives

The API Gravity 29.2 Cap alternative is feasible and, if the no net increase commitment were implemented, it could achieve most of the Project Objectives described in *Section 6.3*, above. This alternative would, modernize and increase equipment reliability and integrity of the Facility by replacing older equipment with newer, cleaner, and inherently safer equipment and technologies and it would replace the Facility's existing hydrogen plant. This alternative would also enhance the Facility's flexibility to processes crude oil blends and gas oils with higher sulfur contents compared to Baseline. This alternative would not achieve the Project objective of maintaining the Facility's current throughput processing capacity because it would restrict the Facility's existing capacity to process crude blends with API gravity greater than 29.2. Moreover, as proposed, the API Gravity 29.2 Cap alternative would not implement the Project's Project Design Features

to ensure that there is no net increase in emissions of greenhouse gases and CAPs compared to the 2008-2010 Baseline period and would fail this Project Objective. For the same reason, this alternative would not achieve the Project Objective of assuring no net increase of health risks related to TAC emissions. However, if the no net increase commitment were implemented, then the CAP and GHG emissions, and risks from TAC emissions, from this alternative would also be at or below Baseline and these Project Objectives would be achieved.

6.5.10 Carbon Intensity Cap Alternative

The California Air Resources Board defines "carbon intensity" as the amount of "lifecycle" greenhouse gas emissions, per unit of energy of fuel delivered, expressed in grams of CO_2e per megajoule (17 Cal. Code of Regs. Section 95481(a)(16)). In the context of hydrocarbon fuel production, carbon intensity is a metric that describes to total greenhouse gas emissions associated with the extraction, transportation, processing, distribution and ultimate consumption of a hydrocarbon fuel product.

Under this alternative, the applicant would be required to limit Refinery Operations such that the Facility would not process feedstocks that exceed the "carbon intensity" of the feedstock processed at the Facility during the 2008-2010 Baseline period. Accordingly, this alternative assumes that all of the Modernization Project's proposed Facility modifications would be implemented and that the Facility would be operated consistent with the 93% Utilization Scenario, with the Hydrogen Plant Replacement operating at 100% of capacity. Under this alternative, however, the Facility would be restricted to processing the Baseline crude blend, a crude blend that represents the average carbon intensity of the feedstock processed at the Facility during the 2008-2010 Baseline period.

As explained below, this alternative would not achieve the Modernization Project most basic Project objective, to provide the Facility flexibility to process crude blends with higher sulfur content than 2008-2010 Baseline conditions. Though it is eligible to be screened from consideration in this *Section 6.5*, this alternative is evaluated for informational purposes in response to prior expressions of public interest.

6.5.10.1 Comparative Impacts of the Carbon Intensity Cap Alternative

6.5.10.1.1 *Impacts Similar to the Project*

Because this alternative assumes construction of all Modernization Project components, as compared to the Project, the Carbon Intensity Cap alternative would have similar direct, indirect, and cumulative construction and operational impacts related to: aesthetics; agricultural and forestry resources; biological resources; cultural resources; energy; geology, soils and seismicity; hydrology

and water quality; land use, plans and policies; noise; population, employment and housing; parks and recreation; public services; and, utilities and public services. As with the Modernization Project, all such impacts would either be less than significant, or mitigated to a less-than-significant level. This alternative would also have construction-related transportation impacts similar to the Project, but such impacts would be mitigated to a less-than-significant level for both the Modernization Project and this alternative.

6.5.10.1.2 *Comparative Reliability and Public Safety Impacts*

Unlike this alternative, the Project proposes, as a Project Design Feature, the Modernization Reliability Program designed to further enhance safety and reliability of Facility equipment and Refinery Operations. The Reliability Program includes replacements of several piping circuits in the crude unit and other safety upgrades, and also requires implementation of recommendations made by the City's independent safety expert to address corrosion risks and other potential damage risks that could occur as a result of the Modernization Project. This alternative does not assume implementation of this Project Design Feature and, therefore, would not achieve the same reliability and public safety benefits that would occur if the Project were approved. But if the Reliability Program were implemented, then the public safety risk of this alternative would generally be equivalent to Modernization Project public safety risks.

6.5.10.1.3 *Comparative Transportation Impacts*

This alternative would have reduced operational transportation impacts compared to the Modernization Project. This alternative would produce a lower quantity of elemental sulfur compared to the Project and, therefore, it would require fewer truck trips to transport elemental sulfur off-site following its production. Although this alternative would have reduced operational transportation impacts compared to the Project, these impacts are less than significant for both the Project and this alternative.

6.5.10.1.4 *Comparative Air Quaility Impacts*

Table 6-20 compares the unmitigated emissions of Carbon Intensity Cap alternative to the unmitigated emissions of the Project.

As shown in Table 6-20, without mitigation, the Carbon Intensity Cap alternative would generate fewer overall unmitigated emissions than would the Project, and both would generate greenhouse gas emissions, NO_x, and VOC emissions that exceed applicable thresholds of significance. Were this alternative implemented, however, its significant emission impacts would be mitigated to less than significant levels in the same manner as the Project. And emission reductions would occur if approval of this alternative were predicated on implementation of

TABLE 6-20 UNMITIGATED CARBON INTENSITY CAP ALTERNATIVE EMISSIONS COMPARED TO UNMITIGATED PROJECT EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	
Unmitigated Carbon Intensity Cap Alternative Emissions	554	1,320	501	499	345	1,008	5,323,841
Unmitigated Project Emissions	575	1,320	501	500	358	1,002	5,328,526

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound.

the emissions-reducing Project Design Features. For example, if approval of the Carbon Intensity Cap alternative was predicated on implementation of the Project Design Features, but not predicated on Chevron's commitment to achieve no net increase, this alternative's greenhouse gas emissions would be reduced by approximately 10,715 CO_2e per year. If the no net increase commitment were implemented, however, then this alternative would result in no net increase over baseline emissions, like the Project, as shown in Table 6-21.

This alternative would, modernize and increase equipment reliability and integrity of the Facility by replacing older equipment with newer, cleaner, and inherently safer equipment and technologies and it would replace the Facility's existing hydrogen plant. Moreover, this alternative would achieve the Project objective of maintaining the Facility's current throughput processing capacity.

The Carbon Intensity Cap alternative would not implement the Project's Project Design Features to ensure that there is no net increase in emissions of greenhouse gases and CAPs compared to the 2008-2010 Baseline period and would fail this Project Objective. For the same reason, this alternative would not achieve the Project Objective of assuring no net increase of health risks related to TAC emissions. However, if the no net increase commitment were implemented, then the CAP and GHG emissions, and risks from TAC emissions, from this alternative would also be at or below Baseline and these Project Objective's would be achieved. Since, however, this alternative would restrict the Facility to processing the same crude blend processed during the 2008-2010 Baseline period, it would substantially frustrate the Project's fundamental underlying purpose of improving the Facility's flexibility to processes crude oil blends and gas oils with higher sulfur content than Baseline conditions and is therefore eligible to be screened from analysis in this *Chapter 6, Alternatives*.

TABLE 6-21 CARBON INTENSITY CAP ALTERNATIVE EMISSIONS (MITIGATED TO NNI) COMPARED TO PROJECT EMISSIONS (MITIGATED TO NNI)

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	
Unmitigated Carbon Intensity Cap Alternative Emissions (Mitigated to NNI)	525	1,268	500	498	345	973	4,602,947
Project Emissions (Mitigated to NNI)	525	1,269	501	499	359	973	4,602,947

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound; NNI = no net increase.

6.5.11 Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions Alternative

Section 6.5.5 of the Draft EIR evaluated a Reduced Sulfur Processing Alternative that would limit Chevron to only half of the sulfur treatment expansion capacity included in the Modernization Project (750 long tons per day instead of the requested 900 long tons per day, or 150 long tons per day over the existing 600 long tons per day of sulfur removal capacity). Section 6.5.6 of the Draft EIR also evaluated a Hydrogen Cap Alternative that would limit the hydrogen production of the Hydrogen Plant to 197 million square cubic feet of hydrogen per day (MMSCFD), or approximately 19% less than proposed in the Modernization Project.

In response to comments, the Final EIR includes a new Alternative that is combines the Reduced Sulfur Processing Alternative with a modified form of a Hydrogen Cap Alternative which focuses on total Refinery greenhouse gas emissions (inclusive of Refinery-related transportation greenhouse gas emissions), instead of the Hydrogen Plant's production. Under this Alternative, the Facility:

- Would limit sulfur removal to 750 long tons per day, which is 150 long tons higher than what is currently permitted, but only half of the 300 long tons capacity increase requested by Chevron and included in the Modernization Project.
- Would limit greenhouse gas emissions from Refinery operations (including Refinery-related transportation greenhouse gas emissions) to Baseline levels of 4,602,947 metric tons (MT) per year, and thus allow no physical increase in greenhouse gas emissions from the Refinery over Baseline. Because the

vast majority of greenhouse gas emission increases associated with the Modernization Project are from the increased production capacity of the Replacement Hydrogen Plant and increased utilization of the Facility, this Alternative would, under the operational scenarios considered in the Unit Rate Model included as *Appendix AQ-URM* in the Draft EIR and discussed further below, result in a Facility utilization (i.e., both crude unit and gas oil gateway unit) level for the Project Crude blend of approximately 84.7%.

- The Modernization Project assumed that the Hydrogen Plant Replacement would operate at 100% utilization levels to accommodate a combination of Facility needs and the potential future export of hydrogen through a separate pipeline and related Hydrogen Export project proposed by Praxair. The Hydrogen Cap Alternative evaluated in the Draft EIR assumed that the Hydrogen Plant Replacement would be capped at a reduced level of 197 MMSCFD, producing an unmitigated total of 4,949,268 MT of CO2e/year (greenhouse gas) relative to the unmitigated total of 5,328,526 MT of greenhouse gas for the Project under the 93% Utilization, Max Hydrogen production scenario. (Under No Net Increase, greenhouse gas emissions would be mitigated to Baseline levels for the Modernization Project and the Hydrogen Cap Alternative). Under this new Alternative, greenhouse gas emissions would be capped for the Refinery at the Baseline level of 4,602,947 MT of greenhouse gas. Actual Hydrogen Plant Replacement production levels would vary based on operational conditions; for example, because other parts of the Facility, such as the Rheniformers, also produce hydrogen that is used to remove sulfur, actual Hydrogen Plant operations could increase to offset a reduction in hydrogen production if, for example, a Rheniformer was out of operation (e.g., for a maintenance turnaround). Capping Refinery greenhouse gas emissions rather than Hydrogen Plant Replacement operational levels is responsive to comments objecting to physical increase in greenhouse gas emissions from Refinery operations, notwithstanding the no net increase project objective and mitigation measures requiring compliance with no net increase through a mitigation program that includes a combination of internal Facility greenhouse gas reductions, community-based greenhouse gas emission reductions, and AB 32 Cap and Trade allowances, greenhouse gas offset credits, and curtailment, as discussed in *Section 4.8, Greenhouse Gases,* of the Draft EIR and Master Response 1: Greenhouse Gases of this Final EIR.
- Under this Alternative, the separate, potential future Hydrogen Export project would still be required to mitigate to no net increase for any greenhouse gas emissions attributable to hydrogen export; however, a physical increase in greenhouse gas over Baseline would occur and would be reduced to no net increase through mitigation measures that include AB 32 Compliant Cap and Trade compliance instruments, and CAPCOA-approved greenhouse gas

credits. For example, if the Chevron Refinery used 80% of the production from the Hydrogen Plant Replacement, the physical greenhouse gas emissions associated with that 80% production level of Hydrogen Plant Replacement—along with all other Refinery greenhouse gas emissions—could not exceed the Refinery's physical greenhouse gas Baseline emission levels, and could not "net out" through the use of AB 32 Cap and Trade Allowances or CAPCOA greenhouse gas exchange credits. If the remaining 20% of the production from Hydrogen Plant Replacement is exported as part of a potential future hydrogen pipeline project, then the greenhouse gas emissions attributable to that future Export Project may result in physical greenhouse gas emissions over Baseline, which must then be separately mitigated to less than significant levels under CEQA (and to no net increase under this EIR) through the use of authorized mitigation measures that would include AB 32 Cap and Trade compliance instruments, and greenhouse gas offset credits.

6.5.11.1 Comparative Impacts of the Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions Alternative

6.5.11.1.1 *Impacts Similar to Project*

Since this alternative assumes construction of all Modernization Project components, as compared to the Project, this alternative would have similar direct, indirect, and cumulative construction and operational impacts related to: aesthetics; agricultural resources; biological resources; cultural resources; energy; geology, soils and seismicity; hydrology and water quality; land use, plans and policies; noise; population, employment and housing; parks and recreation; public services; and, utilities and public services. As with the Modernization Project, all such impacts would either be less than significant, or mitigated to a less-than-significant level. This alternative would also have construction-related transportation impacts similar to the Modernization Project, but such impacts would be mitigated to a less-than-significant level for both the Project and this alternative.

6.5.11.1.2 *Comparative Reliability and Public Safety Risks*

Unlike this alternative, the Project proposes, as a Project Design Feature, the Modernization Reliability Program designed to further enhance safety and reliability of Facility equipment and Refinery Operations. The Reliability Program includes replacements of seventeen (17) piping circuits in the crude unit and other safety upgrades, and also requires implementation of recommendations made by the City's independent safety expert to address corrosion risks and other potential damage risks that could occur as a result of the Modernization Project. This alternative does not assume implementation of this Project Design Feature and, therefore, would not achieve the same reliability and public safety

benefits that would occur if the Project were approved. But if the Reliability Program were implemented, then the public safety risk of this alternative would generally be equivalent to Modernization Project public safety risks. However, because this alternative would bring less sulfur from crude and purchased gas oils into the Facility, its risk of corrosion would be slightly reduced compared to the Project. This Alternative's limitation on greenhouse gas emissions to Baseline levels has no effect on Public Safety and would thus be similar to the Modernization Project.

6.5.11.1.3 *Comparative Transporation Impacts*

This alternative would have reduced operational transportation impacts than the Modernization Project. This alternative would produce a lower quantity of elemental sulfur compared to the Modernization Project and, therefore, it would require fewer truck trips to transport elemental sulfur off site following its production. Although this alternative would have reduced operational transportation impacts compared to the Modernization Project, these impacts are less than significant for both the Project and this alternative. This Alternative's limitation on greenhouse gas emissions to Baseline levels would, under reasonably foreseeable circumstances, result in lower Facility utilization levels, with corresponding decreases in shipping and other transportation activity levels.

6.5.11.1.4 *Comparative Air Quaility Impacts*

As explained in *Section 4.3, Air Quality,* the EIR evaluates the Modernization Project air emissions against two Refinery Operation scenarios: the 93% Utilization Scenario and the 100% Utilization Scenario. The 93% Utilization Scenario assumes both that the 239,200 barrels per day of crude oil (93% of the permitted crude unit limit of 257,200 barrels per day) is used by the Facility and that the gas oil gateway units operate at 93% of permitted capacity. The 100% Utilization Scenario assumes both that 257,200 barrels per day of crude oil is used by the Facility, and that the gas oil gate units operate at 100% of permitted capacity.

As explained in *Section 4.3, Air Quality*, the Modernization Project's total emissions and change from Baseline levels for each utilization scenario are, in general, calculated by scaling Baseline emissions with Baseline emissions with the level of activity associated with associated with Baseline emissions to the level of activity calculated by Unit Rate Model (URM).[17] The Unit Rate Model was

[17] As used in this EIR and in the Unit Rate Model (URM) included as *Appendix 4.3-URM*, the Facility utilization rate refers to the percentage of (1) the maximum crude unit permitted capacity (257,200 barrels per day); and (2) the average annual daily throughput limits of the five processing units through which all purchased gas oil must initially be fed

used to estimate Facility utilization levels assuming normal operating conditions if greenhouse gas emissions were capped to Baseline levels.[18]

As shown in Table 6-22, without mitigation, the Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions Alternative would have substantially lower unmitigated greenhouse gas emissions than the Project, would result in decreases in emissions for all CAPs compared to Baseline with the exception of a one (1) ton increase in CO, and would not exceed any BAAQMD CEQA threshold in any event. Further emission reductions would occur if approval of this alternative were predicated on implementation of the emissions-reducing Project Design Features. If the no net increase commitment were implemented, then this alternative would reduce NO_x, PM_{10}, $PM_{2.5}$, SO_x, and VOC emissions below Baseline levels, and would reduce CO emissions to Baseline levels, and emissions would be lower than the Project, as shown in Table 6-23.

Unlike the Modernization Project, this alternative would not allow the Facility to operate at 100% capacity due to the new greenhouse gas emission constraint precluding Refinery greenhouse gas emissions to exceed Baseline levels, without regard to imposition of off-site mitigation measures including AB 32 Cap and Trade compliance instruments, and CAPCOA greenhouse gas Rx or similar greenhouse gas reduction credits.

This alternative would continue to allow for the potential future export of hydrogen if Praxair obtains permits for and builds its export pipeline. This alternative would thus also include the potential that the Replacement Hydrogen Plant would operate up to its maximum 100% permitted capacity, and require

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(the "gas oil gateway units"). The gas oil gateway units are discussed in *Appendix 4.3-URM* and include the Fluid Catalytic Cracker, the FCC FHT, the Hydrocracker, the Light Neutral Hydrocracker, and the Heavy Neutral Hydrocracker. The Facility's total purchased gas oil processing capacity is less than the sum of the unit throughput limits because certain of the gas oil gateway units are fed by other gas oil gateway units and by gas oil distilled from the crude unit and deasphalted gas oil from the SDA unit.

[18] As explained in *Appendix 4.3-URM*, the URM calculates the volume of each fraction that would be produced from the crude oil used in each utilization scenario, and assumes that the applicable fractions will be fed to other refinery processing units in accordance with allocation and operational parameters developed by the City's oil industry experts. All of the naphtha fraction, for example is fed to the Naphtha Hydrotreater; all of the residuum is fed to the SDA. Once the amount of each crude oil fraction has been calculated, the URM estimates how much additional gas oil must be purchased to operate the gas oil gateway units at the specified utilization level (e.g., 93% or 100%). The total volume of crude oil and purchased gas oil and the total throughput of each Facility processing unit (in barrels per day) is calculated by the model. As discussed in *Section 4.3, Air Quality* and *Appendix 4.3-URM*, in certain instances, crude oil throughput will be limited below the maximum capacity of the crude unit by one or more processing throughput constraints.

TABLE 6-22 UNMITIGATED REDUCED SULFUR PROCESSING/NO INCREASED GREENHOUSE GAS REFINERY EMISSIONS ALTERNATIVE EMISSIONS COMPARED TO UNMITIGATED PROJECT (93% UTILIZATION) EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	
Baseline	525	1,303	503	502	373	973	4,602,947
Reduced Sulfur Processing/ No Increased Greenhouse Gas Refinery Emissions Alternative (84.7% Utilization) Unmitigated Emissions	526	1,172	456	454	340	959	4,599,848
Project (93% Utilization) Unmitigated Emissions	575	1,320	501	500	358	1,002	5,328,526

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound.

TABLE 6-23 REDUCED SULFUR PROCESSING ALTERNATIVE/NO INCREASED GREENHOUSE GAS REFINERY EMISSIONS ALTERNATIVE EMISSIONS (MITIGATED TO NNI) COMPARED TO PROJECT EMISSIONS (MITIGATED TO NNI)

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	
Baseline	525	1,303	503	502	373	973	4,602,947
Reduced Sulfur Processing/No Increased Greenhouse Gas Refinery Emissions Alternative (84.7% Utilization) Emissions (Mitigated to NNI)	525	1,172	456	454	340	959	4,599,848
Project Emissions (Mitigated to NNI)	525	1,269	501	499	359	973	4,602,947

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound; NNI = no net increase.

mitigation (inclusive of AB 32 Cap and Trade Allowances and Credits, and the CAPCOA greenhouse gas exchange credits) to have less than significant greenhouse gas emissions and achieve no net increase consistent with the project objectives. With the Project crude blend, the URM calculated that under normal operating conditions approximately 70 MMSCF/day would be available for potential export. Table 6-24 identifies the unmitigated emissions associated with this additional hydrogen production. These emissions would be mitigated per the no net increase project objective, but would result in physical emissions

TABLE 6-24 ADDITIONAL CAP AND GREENHOUSE GAS EMISSIONS FROM MAXIMUM HYDROGEN PRODUCTION FOR THE REDUCED SULFUR PRODUCTION/NO INCREASE IN REFINERY GREENHOUSE GAS EMISSIONS ALTERNATIVE

Additional Hydrogen (mmscf/day)	Additional CAP Emissions (tons/year)					Additional Greenhouse Gas Emissions (tonnes CO_2e/year)
	CO	NO_x	PM_{10}	SO_x[a]	ROG/VOC	
66.9	18	15	6	--	6	555,199

Notes: Hydrogen export would not result in increased SO_x emissions, as both cases already require fuel gas treatment to limit SO_x emissions from fuel gas to 49.09 tons/year.

over Baseline. Because this alternative results in a lower level of Facility utilization relative to the Project, and thus lower levels of refinery activity and transportation, even with the Hydrogen Plant Replacement operating at 100% capacity this alternative results in lower CAP, TAC, and greenhouse gas emissions relative to the Project.

6.5.11.2 Relationship of the Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions Alternative to the Project Objectives

In addition to a comparative evaluation of the environmental impacts of a reasonable range of alternatives, CEQA requires an assessment of a reasonable range of alternatives that "can attain most of the basic objectives of the project" (CEQA Guidelines Section 15126.6(f)). CEQA also requires that alternatives must be "feasible," and "feasibility" is defined, as noted in *Chapter 6, Alternatives Analysis*, of the Draft EIR, as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors" (CEQA Guidelines Section 15364). The EIR preparers have confirmed that the Reduced Sulfur Processing/No Net Increase in Refinery Greenhouse Gas Emissions Alternative is technically feasible. Because the Facility could not operate to 100% of the utilization levels authorized in its existing air quality permits, and because the Project has been mitigated to a less-than-significant level and this alternative does not avoid or minimize a significant unmitigated Project impact, CEQA does not provide an independent legal basis requiring selection of this alternative instead of the Project. Feasibility is also defined relative to economic feasibility, and the EIR preparers have no information regarding the economic feasibility of this alternative for the applicant relative to the Project.

This alternative could achieve some portion of all of the Project Objectives described in Section 6.3, above. This alternative would modernize and increase equipment reliability and integrity of the Facility by replacing older equipment

with newer, cleaner, and inherently safer equipment and technologies (even more so if the Project's Reliability Program were implemented) and it would replace the Facility's existing hydrogen plant. This alternative would also facilitate the Facility's flexibility to processes higher sulfur crude oil blends and gas oils, though not to the same extent as the proposed Modernization Project. This alternative would also ensure no net increase in greenhouse gas emissions, CAP emissions, and health risks related to TAC emissions, if the Project's no net increase commitment were implemented. This alternative would not achieve the Project objective of maintaining the Facility's current throughput processing capacity since throughput would necessarily decrease in order to achieve no physical increase in greenhouse gas emissions from refinery operations.

6.5.12 Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions/No FCC FHT Expansion Alternative

In response to comments, the Final EIR includes two new alternatives. Section 6.5.11, above, combines the Reduced Sulfur Processing Alternative with a variant of the Hydrogen Cap Alternative and evaluates a new Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions Alternative.

The second new alternative considered in this Final EIR is another "smaller project" variant, which includes all features in the Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions as well as elimination of the proposed FCC FHT expansion. As explained in the *Chapter 3, Project Description* (page. 3-25), the Modernization Project would increase the throughput capacity of the FCC FHT from 65,000 to 80,000 barrels per day, which would enable the Facility to import and process higher sulfur gas oils in lieu of importing low sulfur gas oils that are fed directly to the Facility's FCC unit. Under this alternative, this FCC FHT modification would not be completed.

This alternative, like the Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions Alternative, would reduce Facility utilization levels to below Baseline levels. The URM was used to identify probable utilization levels assuming no physical increase in Refinery greenhouse gas emissions (inclusive of Refinery-related transportation greenhouse gas emissions), and it was determined that, under this alternative, Facility utilization would decrease to approximately 86% (inclusive of all Crude and Gas Oil Gateway units).

6.5.12.1 Comparative Impacts of the Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions/No FCC FHT Expansion Alternative

6.5.12.1.1 *Impacts Similar to Project*

Since this alternative assumes construction of almost all Modernization Project components except for the FCC FHT, as compared to the Project, this alternative

would have similar direct, indirect, and cumulative construction and operational impacts related to: aesthetics; agricultural resources; biological resources; cultural resources; energy; geology, soils and seismicity; hydrology and water quality; land use, plans and policies; noise; population, employment and housing; parks and recreation; public services; and, utilities and public services. As with the Modernization Project, all such impacts would either be less than significant, or mitigated to a less-than-significant level. This alternative would also have construction-related transportation impacts similar to the Modernization Project, but such impacts would be mitigated to a less-than-significant level for both the Project and this alternative.

6.5.12.1.2 *Comparative Reliability and Public Safety Risks*

Unlike this alternative, the Project proposes, as a Project Design Feature, the Modernization Reliability Program designed to further enhance safety and reliability of Facility equipment and Refinery Operations. The Reliability Program includes replacements of several piping circuits in the crude unit and other safety upgrades, and also requires implementation of recommendations made by the City's independent safety expert to address corrosion risks and other potential damage risks that could occur as a result of the Modernization Project. This alternative does not assume implementation of this Project Design Feature and, therefore, would not achieve the same reliability and public safety benefits that would occur if the Project were approved. But if the Reliability Program were implemented, then the public safety risk of this alternative would generally be equivalent to Modernization Project public safety risks. However, because this alternative would bring less sulfur from crude and purchased gas oils into the Facility, its risk of corrosion would be slightly reduced compared to the Project. Also, because this alternative would not include an FCC FHT modification that would allow the Facility to import and process higher sulfur gas oils, corrosion risks from increased sulfur in gas oils would also be lower relative to the Project. This alternative's limitation on greenhouse gas emissions to Baseline levels would be similar to the Modernization Project with respect to Public Safety.

6.5.12.1.3 *Comparative Transportation Impacts*

This alternative would have reduced operational transportation impacts than the Modernization Project. This alternative would produce a lower quantity of elemental sulfur compared to the Modernization Project and, therefore, it would require fewer truck trips to transport elemental sulfur off site following its production. Although this alternative would have reduced operational transportation impacts compared to the Modernization Project, these impacts are less than significant for both the Project and this alternative. This alternative's limitation on greenhouse gas emissions to Baseline levels would, under reasonably foreseeable circumstances, result in lower Facility utilization levels,

with corresponding decreases in shipping and other transportation activity levels.

6.5.12.1.4 *Comparative Air Quaility Impacts*

As explained in *Section 4.3, Air Quality,* the EIR evaluates the Modernization Project air emissions against two Refinery Operation scenarios: the 93% Utilization Scenario and the 100% Utilization Scenario. The 93% Utilization Scenario assumes both that the 239,200 barrels per day of crude oil (93% of the permitted crude unit limit of 257,200 barrels per day) is used by the Facility and that the gas oil gateway units operate at 93% of permitted capacity. The 100% Utilization Scenario assumes both that 257,200 barrels per day of crude oil is used by the Facility, and that the gas oil gate units operate at 100% of permitted capacity.

As explained in *Section 4.3, Air Quality*, the Modernization Project's total emissions and change from Baseline levels for each utilization scenario are, in general, calculated by scaling Baseline emissions with the level of activity associated with associated with Baseline emissions to the level of activity calculated by Unit Rate Model (URM).[19] The Unit Rate Model was used to estimate Facility utilization levels assuming normal operating conditions if greenhouse gas emissions were capped to Baseline levels.[20]

As shown in Table 6-25, without mitigation, the Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions/No FCC FHT Expansion

[19] As used in this EIR and in the Unit Rate Model (URM) included as *Appendix 4.3-URM*, the Facility utilization rate refers to the percentage of (1) the maximum crude unit permitted capacity (257,200 barrels per day); and (2) the maximum daily throughput limits of the five processing units through which all purchased gas oil must initially be fed (the "gas oil gateway units"). The gas oil gateway units are discussed in *Appendix 4.3-URM* and include the Fluid Catalytic Cracker, the FCC FHT, the Hydrocracker, the Light Neutral Hydrocracker, and the Heavy Neutral Hydrocracker. The Facility's total purchased gas oil processing capacity is less than the sum of the unit throughput limits because certain of the gas oil gateway units are fed by other gas oil gateway units and by gas oil distilled from the crude unit and deasphalted gas oil from the SDA unit.

[20] As explained in *Appendix 4.3-URM*, the URM calculates the volume of each fraction that would be produced from the crude oil used in each utilization scenario, and assumes that the applicable fractions will be fed to other refinery processing units in accordance with allocation and operational parameters developed by the City's oil industry experts. All of the naphtha fraction, for example is fed to the Naphtha Hydrotreater; all of the residuum is fed to the SDA. Once the amount of each crude oil fraction has been calculated, the URM estimates how much additional gas oil must be purchased to operate the gas oil gateway units at the specified utilization level (e.g., 93% or 100%). The total volume of crude oil and purchased gas oil and the total throughput of each Facility processing unit (in barrels per day) is calculated by the model. As discussed in *Section 4.3, Air Quality* and *Appendix 4.3-URM*, in certain instances, crude oil throughput will be limited below the maximum capacity of the crude unit by one or more processing throughput constraints.

TABLE 6-25 UNMITIGATED REDUCED SULFUR PROCESSING/NO INCREASED GREENHOUSE GAS REFINERY EMISSIONS/NO FCC FHT EXPANSION ALTERNATIVE EMISSIONS COMPARED TO UNMITIGATED PROJECT (93% UTILIZATION) EMISSIONS

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	
Baseline	525	1,303	503	502	373	973	4,602,947
Reduced Sulfur Processing/No Increased Greenhouse Gas Refinery Emissions/No FCC FHT Alternative (86% Utilization) Unmitigated Emissions	529	1,181	461	460	343	964	4,601,592
Project (93% Utilization) Unmitigated Emissions	575	1,320	501	500	358	1,002	5,328,526

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound.

Alternative would result emissions below Baseline levels for all CAPS except CO, would have substantially lower unmitigated greenhouse gs emissions than the Project, and would not exceed the BAAQMD CEQA thresholds for any pollutant. Further emissions reductions would occur if approval of this alternative were predicated on implementation of the emissions-reducing Project Design Features. If the no net increase commitment were implemented, then this alternative would result in no increase in Refinery-related greenhouse gas physical emissions over Baseline, and would thus have physical emission levels that are lower than the Project, as shown in Table 6-26.

Unlike the Modernization Project, using the operating parameters used in the URM, this alternative would not allow the Facility to operate at even 93% of its capacity using the Project crude blend due to the new greenhouse gas emission constraint of limiting physical greenhouse gas emissions for Refinery-related activities to Baseline levels. This lower utilization level would result in lower emissions for CAPs and TACs, since these pollutants generally scale up with increased utilization as described further in *Section 4.3, Air Quality*, of the Draft EIR. Lower utilization would also result in less transportation activity, and thus reduced levels of CAPs and TACs relative to the Project. Assuming no net increase was implemented for this alternative, ***net*** emissions would continue to be equivalent to the Project which must implement the No Net Increase mitigation requirements for CAPs, and for risks from TACs, as set forth in the Draft EIR.

TABLE 6-26 REDUCED SULFUR PROCESSING/NO INCREASED GREENHOUSE GAS REFINERY EMISSIONS/NO FCC FHT ALTERNATIVE EMISSIONS (TO BE MITIGATED TO NNI) COMPARED TO PROJECT EMISSIONS (TO BE MITIGATED TO NNI)

	Emissions (Tons/Year)						Greenhouse Gases (Tonnes CO_2e/Year)
Emissions Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC	
Baseline	525	1,303	503	502	373	973	4,602,947
Reduced Sulfur Processing/No Increased Greenhouse Gas Refinery Emissions/No FCC FHT Alternative (86% Utilization) Emissions (Mitigated to NNI)	525	1,181	461	460	343	964	4,601,592
Project Emissions (Mitigated to NNI)	525	1,269	501	499	359	973	4,602,947

Notes: CO = carbon monoxide; PM_{10} = respirable particulates; SO_x = sulfur oxides; VOC = volatile organic compound; NNI = no net increase.

As with the Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions Alternative discussed above, this alternative would continue to allow for full utilization of the Hydrogen Plant Replacement production capacity if the separate potential future hydrogen export project is approved. The air emissions associated with this alternative are noted in Table 6-27, below. Because this alternative results in a lower level of Facility utilization relative to the Project, and thus lower levels of refinery activity and transportation, even with the Hydrogen Plant Replacement operating at 100% capacity this alternative results in lower CAP, TAC, and greenhouse gas emissions relative to the Project.

6.5.12.2 Relationship of the Reduced Sulfur Processing/No Increase in Refinery Greenhouse Gas Emissions/No FCC FHT Alternative to the Project Objectives

As discussed above in Section 4.6.11 and Chapter 4.6 of the Draft EIR, an alternative must also be "feasible" and capable of timely achieving most of the basic project objectives. The EIR preparers have confirmed that the Reduced Sulfur Processing/No Net Increase in Refinery Greenhouse Gas Emissions/No FCC FHT Alternative is technically feasible. Because the Facility could not operate to 100% of the utilization levels authorized in its existing air quality permits, and because the Project has been mitigated to a less than significant level and this alternative does not avoid or minimize a significant unmitigated Project impact, CEQA does not provide an independent legal basis requiring selection of this alternative instead of the Project. Feasibility is also defined relative to economic

TABLE 6-27 ADDITIONAL CAP AND GREENHOUSE GAS EMISSIONS FROM MAXIMUM HYDROGEN PRODUCTION FOR THE REDUCED SULFUR PROCESSING/NO INCREASE IN REFINERY GREENHOUSE GAS EMISSIONS/NO FCC FHT EXPANSION ALTERNATIVE

Additional Hydrogen (mmscf/day)	Additional CAP Emissions (tons/year)					Additional Greenhouse Gas Emissions (tonnes CO_2e/year)
	CO	NO_x	PM_{10}	SO_x[a]	ROG/VOC	
63.6	17	14	5	--	6	527,219

Notes: Hydrogen export would not result in increased SO_x emissions, as this case already require fuel gas treatment to limit SO_x emissions from fuel gas to 49.09 tons/year.

feasibility, and the EIR preparers have no information regarding the economic feasibility of this alternative for the applicant relative to the Project.

This alternative could achieve some portion of all of the Project Objectives described in Section 6.3, above. This alternative would modernize and increase equipment reliability and integrity of the Facility by replacing older equipment with newer, cleaner, and inherently safer equipment and technologies (even more so if the Project Reliability Program were implemented) and it would replace the Facility's existing hydrogen plant. This alternative would also facilitate the Facility's flexibility to processes higher sulfur crude oil blends and gas oils, although the Facility's capacity to accept more higher sulfur gas oils in lieu of low-sulfur gas oils would be reduced in relation to the Project. This alternative would also ensure no net increase in greenhouse gas emissions, CAP emissions, and health risks related to TAC emissions, if the Project's no net increase commitment were implemented. This alternative would not achieve the Project objective of maintaining the Facility's current throughput processing capacity.

6.6 ENVIRONMENTALLY SUPERIOR ALTERNATIVE

Identification of an environmentally superior alternative is required under CEQA (Cal. Code Regs. Section 15126.6(e)(2)).

Were it static, the No Project: 89% Utilization variant of the "no project" alternative would be the environmentally superior alternative because, compared to the Project, it would have less overall impact than the Project in the areas of biological resources, cultural resources, geology, noise, transportation, and utilities (although, after mitigation, the Project would also not have any significant impacts within these impact categories). However, this variant of the "no project" alternative is not static. It merely represents Refinery Operations

during the 2008-2010 baseline period. It may not be representative of future "no project" conditions because the Facility is currently permitted to operate at a utilization rate greater than 89%, hence this chapter's consideration of multiple "no project" variants. In any case, even if the No Project: 89% Utilization alternative were the environmentally superior alternative, this EIR must also identify an environmentally superior alternative from among the other alternatives (14 Cal. Code Regs. Section 15126.6(e)(2)).

The API Gravity 29.2 Cap alternative is clearly not environmentally superior to the Modernization Project because it would not reduce any Project impacts and, in some cases, would slightly exacerbate Project impacts, as described in *Section 6.6.6*, above.

As for the remaining Modernization Project alternatives described in this *Chapter 6*, none would implement the Project's commitment to no net increase of greenhouse gas emissions, CAP emissions, and health risks related to TAC emissions. As a result, all of the alternatives evaluated above would result in overall greater emissions than the Modernization Project, except for the Reduced Sulfur Processing/No Increase In Refinery GHG Emissions Alternative and the Reduced Sulfur Processing/No Increase In Refinery GHG Emissions/No FCC FHT Expansion Alternative. Similarly, none of the alternatives would implement the Reliability Program and thus would not achieve the Project's reliability and public safety benefits. In this respect, the Project is environmentally superior to all of the alternatives discussed in this Chapter 6.

All things being equal, however, when compared to the Project, the Reduced Sulfur Processing alternative would have reduced transportation impacts and slightly reduced reliability and public safety impacts, as explained in *Section 6.5.5.1*. And, all things being equal, the Hydrogen Cap alternative, would have reduced water supply and wastewater treatment impacts compared to the Project. Since none of alternatives (or the Project) would have a significant impact on water supplies or wastewater treatment capacity, and since Facility reliability and safety is an important goal of the Project, as between the two alternatives, the Reduced Sulfur Processing alternative is, on balance, environmentally superior to the Hydrogen Cap alternative. Thus, if the Reduced Sulfur Processing alternative were approved, and if the no net increase commitment and Reliability Program were implemented, then the Reduced Sulfur Processing alternative would be environmentally superior to the Modernization Project.

All things being equal, the Reduced Sulfur Processing alternative is not, however, environmentally superior to either the Reduced Sulfur/No Increase In Refinery GHG Emissions Alternative or the Reduced Sulfur/No Increase In Refinery GHG Emissions/No FCC FHT Expansion Alternative. The later two alternatives would

both result in lower greenhouse gas, CAP and TAC emissions than would the Reduced Sulfur Processing alternative. And, of the two, the Reduced Sulfur/No Increase in Refinery GHG Emissions Alternative is environmentally superior to the Reduced Sulfur/No Increase in GHG Emissions/No FCC FHT Expansion Alternative. Moreover, the Reduced Sulfur/No Increase in Refinery GHG Emissions Alternative is environmentally superior to the Project because it would result in lower greenhouse gas, CAP and TAC emissions. As noted above, however, while the EIR preparers have confirmed that both the Reduced Sulfur/No Increase in Refinery GHG Emissions/No FCC FHT Expansion Alternative and the Reduced Sulfur/No Increase in Refinery GHG Emissions Alternative are technically feasible, they have no information regarding the economic feasibility of these two new alternatives for the applicant relative to the Project.

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CHAPTER 7.
REPORT PREPARATION

7.1 REPORT AUTHORS

7.1.1 Lead Agency

City of Richmond
Lina Velasco, Senior Planner, Project Manager
Bruce Reed Goodmiller, City Attorney
Rachel Sommovilla, Assistant City Attorney
Hector Rojas, Senior Planner

7.1.2 EIR Management - Consultant and Legal Team

ENVIRON, Prime Consultant
Air Quality, Biological Resources, Energy, Greenhouse Gas Analysis, Noise, Public Safety,

Shari Libicki, PhD, Global Air Quality Practice Area Leader, Project Director
Doug Daugherty, PhD, PE, CIH| Managing Principal, Deputy Project Director
Gavin Hoch, Air Quality, Public Safety
David Kim, PhD, Greenhouse Gas & Energy
John Grant, Shipping Emissions
Michael Howley, Air Quality
Min Hou, Air Quality
David Phong, Air Quality
Kai Zhao, Air Quality
Megan Klevze, Public Safety
Amy Parravano, Biological Resources
Laura Moran, Biological Resources
Heather Esper, Biological Resources
Kristen Wallace, Noise
Andrew Sheaffer, Energy
Carolyn Nobel, Building Materials
Michael DiCostanzo, RMP/Hazards
Ruben So, GIS Technician

Urban Planning Partners, EIR Project Management and Public Outreach and Education

Aesthetics, Visual Quality, Light and Glare; Agricultural Resources; Geology; Land Use, Plans, and Policies; Employment, Population, and Housing; Public Services; Parks and Recreation; Utilities and Service Systems

Lynette Dias, AICP, Principal, Project Manager
Elizabeth Boyd, AICP, EIR Deputy Project Manager
Dana Turrey, Associate Planner
Carla Violet, Planner
Susan Smith, Document Production and Word Processing
Natalie Macris, Technical Editor
Bo Dash, Technical Editor
Bart Wright, GIS and Graphics

Holland & Knight, Assistance with Preparation of EIR

Jennifer Hernandez, Partner
Nicholas Targ, Partner
Kristina Kelchner, Of Counsel
Andrea Sumits, Of Counsel
David Friedman, Of Counsel
Bradley Brownlow, Partner

7.1.2.1 Technical and Support

BASELINE

Hydrology and Water Quality and assistance with other sections

Bruce Abelli-Amen, Principal
Yane Nordhav, Principal

Fehr & Peers

Transportation and Traffic

Sam Tabibnia, P.E., Associate

LSA Associates

Cultural Resources

Andrew Pulcheon, AICP, CEP, Principal/Cultural Resources Manager
Neal Kaptain, Archaeologist & Architectural Historian

7.1.2.2 Assistance to City Staff and assistance with final report production

Analytical Environmental Services

Ryan Lee Sawyer, AICP, Vice President (Project Director)

Bibiana Alvarez, Environmental Specialist (Project Manager)
Pete Bontadelli, Director of Biological Resources and Permitting
John Fox, COO
Kurtis Steinert, AICP, Project Manager
Annalee Sanborn, Analyst II (Environmental Specialist)
David Sawyer, Analyst III (Environmental Specialist)
Jacqueline McCrory, Analyst II (Habitat Restoration Specialist)
Erin Quinn, Analyst III (Air Quality, Greenhouse Gas Specialist)
Alison Middlekauff, Analyst II (Environmental Specialist)

CHAPTER 8.
GLOSSARY

8.1 GLOSSARY

8.1.1 Project-Specific Terms

A number of technical terms are used in the refining industry and at the Chevron Richmond Refinery (Refinery) to describe the materials, products, operations and equipment that are in use there. This section of the glossary includes selected definitions and in some cases expanded descriptions of these terms that allow the reader of this document to follow the discussions. In addition, these expanded descriptions also present how these processes specifically take place at the Refinery.

Term	Description
acid gas scrubber	Equipment in which a gas is blown by a fan through a liquid chemical mist. The liquid chemical has an affinity for the acid components in the gas and absorbs the acid components in the liquid.
Alkanes	Commonly known *hydrocarbons* such as methane (CH_4.), ethane (C_2H_6), propane (C_3H_8), and butane (C_4H_{10}), are all members of the *alkane* series—a family of *hydrocarbons* having the general molecular formula C_nH_{2n+2}. In this formula, "n" stands for the number of carbon atoms. The formula states that the number of hydrogen atoms in any *alkane* is two times the number of carbon atoms, plus two. For example, propane has three carbon atoms. Therefore, propane contains (2 x 3) + 2 = 8 hydrogen atoms. Hence, its molecular formula is C_3H_8. In organic chemistry terms, an *alkane* is a saturated *hydrocarbon* without carbon rings, that is, primarily an acyclic, or aliphatic (straight-chain) *hydrocarbon* in which the molecule has the maximum possible number of hydrogen atoms and so has no double bonds. *Alkanes* are also often known as *paraffins*, especially the high molecular weight *alkanes* for which n is greater than about 20,Alkanes, or paraffins, are one of the four classes or types of hydrocarbon molecules found in refined petroleum products

Term	Description
	and crude oil mixtures. These four —*paraffins, olefins, naphthenes*, and *aromatics*— have different chemical properties.
alkylate	A high *octane* component that is blended with other gasoline component streams to make finished gasoline.
alkylation	A process that chemically combines LPGs (light olefin hydrocarbons produced at the FCC Plant and isobutane), using low temperature and sulfuric acid as a catalyst, to make a gasoline blending component known as alkylate.
amine	Amines are chemicals with nitrogen and hydrogen molecules that are similar to ammonia with hydrocarbons substituted for one, two, or three of the hydrogen atoms. Amines are colorless gases or liquids, usually flammable, with strong odors.
Amine Contactor	Equipment in which an amine or amine solution is used as the liquid chemical in a stripper. The liquid amine has an affinity for the acid components in the gas, especially hydrogen sulfide and absorbs them in the liquid.
ammonia	The molecular formula for ammonia is NH_3.
API gravity	API gravity is a measure of how heavy or light a petroleum liquid is compared to water.
aromatic	Aromatics are cyclical hydrocarbon molecules. The base of aromatics molecules is usually benzene.
asphalt	In the refining industry, asphalt is primarily composed of long hydrocarbon chains found in crude oil. Asphalt is a binder used in road construction.
atmospheric pressure	14.7 pounds of force per square inch at sea level. One atmosphere pressure is used as the standard pressure for gases and gas mixtures.
aviation gasoline	Aviation gasoline is a special blend of high octane gasoline blending components that provides a stable fuel for gasoline powered airplane engines.
barrel	In the petroleum industry, a barrel is a volume of 42 gallons. See also BBL.
benzene	A special hydrocarbon with a formula of C_6H_6, with a stable, resonating carbon to carbon bond.

Term	Description
biomass	Biomass refers to solid organic material that is amenable to reaction with biologic agents such as bacteria or enzymes, or is produced by them.
boiler	Equipment in which water is heated to create steam, a pressurized water vapor that is used to transport energy to other equipment in which the vapor is condensed, releasing some of the energy used to create the steam.
boiling point	The boiling point of a pure chemical is that temperature, for a specified pressure, at which the chemical undergoes a physical transformation from the liquid phase to the gaseous phase. For a mixture of chemicals, the boiling point becomes a range of temperatures where each of the components in the mixture undergo the liquid to vapor transition.
British thermal unit	One British thermal unit (Btu) is the quantity of heat required to raise the temperature of one pound of water from 60° to 61°F at a constant pressure of one atmosphere, or the quantity of heat equal to 1/180 of the heat required to raise the temperature of one pound of water from 32° to 212°F at a constant pressure of one atmosphere.
butane	Butane is a saturated (only single chemical bonds) hydrocarbon with a formula of C_4H_{10}. See also *Alkanes*, above.
C3 or C_3	Hydrocarbons with 3 carbon atoms. Refers to mixed *propane* streams or fractions.
C4 or C_4	Hydrocarbons with 4 carbons. Refers to mixed *butane* streams or fractions.
C5 or C_5	Hydrocarbons with 5 carbons. Refers to mixed *pentane* streams or fractions.
C6 or C_6	Hydrocarbon compounds with 6 carbon atoms. Refers to mixed *hexane* streams or fractions.
California specifications	Specifications on gasoline or diesel formulations for fuels to be used in vehicles in California that reduce the amount of airborne air emissions from automobiles. Refineries are required to produce these special formulations approved by the California Air Resources Board.

Term	Description
catalyst	In classical chemistry terms, a catalyst promotes a chemical reaction without itself being consumed in the reaction. A catalyst accelerates a chemical reaction so it will proceed at a reasonable rate at lower temperatures and pressures than the reaction would without a catalyst. Typically, refinery catalysts are round or cylindrical in shape and are materials called zealots, or alumna, or are silica. These catalysts deteriorate over time and require replacement or regeneration when their activity drops below a specified level.
caustic	The *caustic* used in most proposed processes is sodium hydroxide (NaOH).
caustic scrubber	Equipment in which a sodium hydroxide or a sodium hydroxide solution is used as the liquid chemical in a stripper.
Claus Process (sulfur removal)	The Claus Process converts hydrogen sulfide to elemental sulfur in a two-stage process. In the first stage, hydrogen sulfide is combusted with oxygen to form sulfur dioxide. In the second stage, the sulfur dioxide is reacted with hydrogen sulfide in the presence of a catalyst to form molten sulfur which is then stored in a tank at the refinery.
CO	Carbon monoxide, a toxic gas generated by incomplete combustion. CO is a *criteria air pollutant*.
cogeneration	An energy-producing process in which fuel is burned and the combustion gases are first used to generate electricity (as in a turbine) and then afterward usually to generate steam from the heat remaining in the gases.
cooling water tower	Equipment in chemical plants requires cooling that is usually provided by water in a heat exchanger. Water that picks up heat in the process is sent to a cooling tower where the water is dispersed into thin streams over which air is passed. The air evaporates a small amount of the water and the evaporation cools down the water, which is then pumped back to the heat exchanger again for reuse.
cracking	*Cracking* uses heat and *catalyst* to break large hydrocarbons into smaller ones. Cracking is used to produce more gasoline from each barrel of crude oil than naturally exists in the crude. The heavier cuts or *fractions* from the crude

Term	Description
	unit and the *gas oils* that are purchased as *feedstocks* consist of large, heavy *hydrocarbon* molecules, which are too large to have the desired properties. However, when hydrocarbons are heated to about 900°F they begin to break, or crack, into smaller molecules. *Cracking* converts some of the larger molecules of heavy oils into shorter-chained molecules, such as *naphthenes*, and ring-shaped molecules, such as *aromatics*. Both *naphthenes* and *aromatics* are components of gasoline and diesel.
criteria air pollutant	An air pollutant for which acceptable levels of exposure can be determined and for which an ambient air quality standard has been set. Examples include ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, and PM_{10} and $PM_{2.5}$.
crude oil	*Crude oil* is the term used for the naturally occurring petroleum mixtures that are pumped from wells and then delivered to the refinery by tank ship, pipeline, or rail car. Crude oil is the basic petroleum feedstock that is processed at the refinery. Crude oil contains many different hydrocarbon molecules, usually with a wide range of boiling points, representing many potential products such as propane, butane, gasoline, jet fuel, diesel oil, fuel oil, wax, and asphalt. Because crude oil is a natural product, there is a wide variation in the characteristics of a crude depending mostly on the wells from which it is obtained. Crude oils usually contain some sulfur; crudes that contain low percentages of sulfur, 0.5 percent or less, are called "sweet" crudes, while crudes that contain high percentages of sulfur, 1.5percent or more, are called "sour" crudes. Crudes with sulfur percentages in between are called "intermediate." Crude oils also may contain other organic compounds that include nitrogen and metals, along with inorganic salts and water, again, depending on the origin of the crude oil. Crude oil consists mainly of hydrocarbons, chemical compounds made up of hydrogen and carbon atoms that are combined into molecules of different sizes, shapes, and configurations. The smallest hydrocarbon molecules, with only a few atoms of hydrogen and carbon, such as methane, ethane, propane, and butane, are gases under normal conditions, while somewhat larger hydrocarbon molecules,

Term	Description
	such as gasoline and diesel, are liquids and very large hydrocarbon molecules, such as asphalt and tar, are solids. These basic physical properties result mainly from the number of carbon atoms in each compound and give the crude the name "light" or "heavy," depending on the fractions of lighter and heavier hydrocarbons in the crude oil. Four classes or types of hydrocarbon molecules are found in crude oil mixtures. These four —*paraffins, olefins, naphthenes*, and *aromatics*—have different chemical properties. Paraffin is a saturated carbon chain. Olefin is an unsaturated carbon chain containing double or triple bonds. Olefins are not normally found in crudes. Aromatic is an unsaturated but stable carbon ring. Naphthene is a saturated carbon ring. The proportions of these four hydrocarbon classes in a crude oil are important indicators of the amounts of commercial products that can be made from that crude oil.
cutter	Cutter stock is a refined product that is usually about the weight of kerosene/diesel fuel. Cutter stock (cutter) is blended with heavier products to assist with pumping those heavier products.
Deasphalted Oil	Typically, heavy gas oils, from which the asphalt has been removed.
Diethanolamine	A chemical compound (DEA) used to remove H2S from hydrogen, dry gas and LPG streams.
distillation	The process of separating each of the chemical *hydrocarbon* compounds (fractions) in the *crude oil* mixture by heating the mixture.
duct burner	Secondary burner installed in the discharge duct of the cogen system after the turbine to increase the amount of steam that can be generated.

Term	Description
FCC Feed Hydrotreater	A furnace and reactor vessel containing hydro-desulfurization catalyst to remove hydrogen sulfide gas and ammonia in the feed stream of the fluid catalytic cracker (FCC) unit.
feedstock	The term "feedstock" (also called a "feed") is commonly used to denote the fluid material that is fed into a refinery process unit. For example, *crude oil* is a *feedstock* for the crude unit. In a similar vein, the term "stream" refers to the *feedstock* and also can refer to the output of the process.
fixed roof tank	One of two methods of construction of fabricating petroleum storage tanks, the other being floating roof. In the fixed roof design the top of the tank is rigid and fixed. Tanks with fixed roofs can have internal floating roofs.
flammable	A gas or solid chemical whose flash point is below 100°F at atmospheric pressure.
flare system	Upsets can occur in refinery processes. When such upsets occur, they can create excess pressure in a pipe, vessel, or process unit. To make the refinery operationally safe, such over-pressurization is released into a system of pipes that collect the material and direct it to the refinery flares, tall stacks where these excess gases are burned prior to release into the atmosphere. Flares have been developed so that the light created when hydrocarbons burn is only slightly visible or not visible; however, some larger upsets can result in flaring that is quite visible.
floating roof tank	One of two methods of construction of fabricating petroleum storage tanks, the other being fixed roof. In the floating roof design the top of the tank rises and falls with the level of material stored in the tank. A floating roof design eliminates a vapor space above the level of the material stored in the tank and thereby greatly reduces vaporization of the stored liquid.
fraction	In the refining industry, a generic name for the groups of hydrocarbon compounds that boil between any two temperatures. Examples of crude oil fractions, in order of the increasing number of carbon atoms, are light ends, butanes, gasoline, naphtha, kerosene, gas oil, and residue.

Term	Description
fractionation	*Fractionation* is a special form of distillation in which several output streams of similar boiling point ranges are separated from hydrocarbon mixtures. In the fractionation process, the feedstock is introduced into the fractionation column and vaporized by heating. As the hydrocarbon vapors rise, they reach progressively cooler regions of the column and they eventually condense to liquids on horizontal trays inside the column. Each hydrocarbon fraction, or "cut," is collected from a tray positioned at the height (and temperature) in the column where that particular vapor condenses into a liquid. Each cut condenses within a specific temperature range, and therefore at a specific height in the column. Each of the cuts from the column is then sent to storage tanks or is sent to other units for further processing. At the refinery, fractionation towers are parts of many of the refinery process units, and are used to separate the output streams for further processing or handling.
furnaces	Furnaces provide the heat sources needed in the refinery to carry out the distillation or fractionation processes and to provide the energy for cracking large hydrocarbon molecules, driving catalytic reactions to form desirable hydrocarbons, or eliminating undesirable compounds from feed streams. At the refinery, furnaces are integral parts of most refinery processes. *Reforming* and *cracking* depend on heat supplied by the furnaces, and *fractionation* processes rely on furnaces for direct heating of the feedstocks. Furnaces burn refinery process gas, a byproduct of the refining process, or natural gas purchased from outside sources.
gas oil	*Gas oil* is a material that has been processed in a refinery and is one of the heavier fractions resulting from the initial distillation and separation of crude oil.
gas turbine	A *gas turbine* is the first part of a CoGen unit. Hot combustion gases expand and are directed to turbine or fan blades which turn to generate electricity.

Term	Description
heavy gasoline	Motor gasoline blendstock produced from refinery processing units.
hydrocarbons	Molecules made up primarily of hydrogen and carbon atoms. Methane is the simplest of the hydrocarbons, with one carbon atom and four hydrogen atoms. When one of methane's hydrogen atoms is replaced by a second carbon atom and three more hydrogen atoms, the new compound is called ethane. The molecular formula for ethane is C_2H_6. If another hydrogen atom is replaced by a third carbon atom and three more hydrogen atoms, the chemical compound formed is propane. Adding a fourth carbon atom and three more hydrogen atoms to the chain forms butane.
hydrocracking	Hydrocracking adds hydrogen at high temperature and pressure to the *cracking* process. The added hydrogen is needed to produce more of the smaller hydrocarbon molecules. The presence of the hydrogen also helps remove impurities from the hydrocarbons.
hydrofining	*Hydrofining*, also called *hydrotreating*, is a process used primarily to control the sulfur content of a feedstock or stream. In hydrofining, hydrogen is added to the petroleum stream with heat in the presence of a desulfurizing *catalyst* either to create a separable sulfur compound or to capture the sulfur on the surface of the *catalyst*. *Hydrofining* also removes some of the nitrogen compounds in the hydrocarbon feeds by converting them to ammonia. At the refinery, each of the hydrofiner units is named for the petroleum stream that is treated in that unit. For example, the Naphtha Hydrofiner primarily removes sulfur from the Naphtha stream and the Jet Fuel Hydrofiner primarily removes sulfur from jet fuel.
hydrogen production and use	Hydrogen gas is generated in several ways in a refinery. Hydrogen is produced primarily in a *Catalytic Steam Reformer*, where natural gas is reacted with steam to release hydrogen gas. Hydrogen gas also is released from liquid hydrocarbons as a part of the processes that occur in the process *reformers* (see *reforming*, below). Hydrogen also can be recovered from streams of hydrogen-rich gas that occur in other process units, such as the *Hydrofining* Units.

Term	Description
	Large amounts of hydrogen are consumed in the refinery for changing the configuration of the chemical bonds in some molecules or in processes that convert sulfur-containing and nitrogen-containing compounds to gases that can be separated easily from the hydrocarbon molecules. These processes include *hydrocracking* and *hydrofining*.
hydrogen sulfide	Hydrogen sulfide, H_2S, is a gas that smells like rotten eggs. H_2S is dangerous to human health at concentrations greater than 100 parts per million in air.
hydrotreater	Removes sulfur and nitrogen from gasoline through gas oil fractions. Also reduces the olefin content of the various fractions.
Isomax	A process where gas oils are cracked into naphtha feedstocks for the reformer and into gasoline and diesel blendstock streams.
iso-octane	A branched-chain saturated hydrocarbon with 8 carbons in each molecule. The fuel *octane* of iso-octane is defined as 100
jet fuel	A product of the refinery suitable for combustion in a jet aircraft engine.
mercaptan	An odorous hydrocarbon compound that contains sulfur.
methane	A hydrocarbon molecule with one carbon atom. Methane is an *alkane*.
naphtha	*Naphtha* is an intermediate distillation stream that boils in the same boiling range as gasoline. Coal tar naphtha is a colorless or reddish to brown colored, mobile liquid with an aromatic odor. It is a mixture comprised of varying percentages of aromatic hydrocarbons including toluene, xylene, benzene, and cumene. The benzene content is higher in coal tar naphthas with low boiling points.
nitrogen	An element that is a gas at normal temperatures and pressures. It is one of the most abundant elements in the universe and comprises 78% of the volume of air.
nitrogen oxides, NO_x	A general term pertaining to compounds of *nitric oxide* (NO), nitrogen dioxide (NO_2), and other oxides of nitrogen. Nitrogen oxides are typically created during combustion processes and are major contributors to smog formation

Term	Description
	and acid deposition. NO_2 is a *criteria air pollutant* and may result in numerous adverse health effects.
octane (motor fuel rating)	A measure of fuel performance in an internal combustion engine resulting from the tendency of that fuel to ignite spontaneously under compression. *Heptane*, a hydrocarbon with seven carbon atoms, ignites spontaneously at low compression ratios, while *octane*, a hydrocarbon with eight carbon atoms, can be compressed to high ratios without igniting spontaneously. As the percentage of *octane* in a mixture with *heptane* is increased, the compression ratio that the fuel mixture will reach before igniting spontaneously also is increased. An 89-octane fuel would have the same spontaneous ignition under compression as a mixture of 89 percent octane and 11 percent heptane. That mixture spontaneously ignites at a specific compression ratio, and so can only be used in engines that operate at or below that compression ratio. In practice, motor gasoline is made of many combinations of hydrocarbons, but its tendency to ignite spontaneously under compression is referenced to the octane-to-heptane mixture standard.
oil water separators	Equipment that uses the physical property differences between oil and water, such as density and/or surface tension, for example, to separate oil from water.
olefin	The group of unsaturated *hydrocarbon* compounds (alkene vs an alkane) that has one or more double or triple bonds between carbon atoms in the linear chain. Olefins have the general formula C_nH_{2n}. Ethylene, with the chemical formula C_2H_4, is the smallest olefin molecule.
oxygen enrichment	In the first step of Claus reaction, using a combustion oxygen source in which the concentration of oxygen exceeds that of the typical 21 percent oxygen ratio found in air. To enrich the combustion oxygen, pressure swing adsorption is used to separate oxygen from air. This high concentration oxygen is blended into the combustion air for the first step in the Claus Process sequence.
paraffins	Paraffins are *alkanes* or saturated hydrocarbons. High molecular weight *paraffins with* n greater than about 20 are typically solids at room temperatures.

Term	Description
pentane	A hydrocarbon molecule with five carbon atoms and 12 hydrogen atoms. Pentane is one of the *paraffins* or *alkanes.*
perchloroethylene	A chlorinated hydrocarbon that is used to provide chloride atoms to reforming catalyst which prepares the catalyst surface to promote the preferred reaction sequences.
pilot	In a flare, a pilot is a small burner that provides an ignition source for the combustion of hydrocarbons vapors sent to the flare from refinery equipment due to pressure exceeding the set pressure of a relief valve. The combustion transforms the hydrocarbon vapor primarily into carbon dioxide and water.
pressure relief devices	In the refinery, the pressure relief system is a system of piping and equipment connecting the discharge side of the pressure relief valves on equipment. When the pressure in the gas or liquid piping exceeds the relief valve setting, the valve opens and gases or liquids are vented into the relief valve system until sufficient material has been removed and the pressure drops below the relief valve setpoint, and subsequently the relief valve closes. The *safety relief valves* protect refinery equipment from dangerous, damaging overpressurization. The fluids in the pressure relief system are directed to a vessel where as much as possible of the fluids is recovered and recycled back to the refinery. The remaining material is directed to a flare where the hydrocarbons are combusted into carbon dioxide and air.
pressure swing adsorption	*Pressure swing adsorption* applies to a material that will adsorb a specific molecule, like hydrogen, more at one pressure than at another pressure. This differential adsorption is used to purify gases. In the refinery, a continuous hydrogen purification process is created with two vessels of adsorbent, one of which is adsorbing hydrogen from a hydrogen-rich gas while the other vessel is desorbing purified hydrogen. When the first vessel has adsorbed hydrogen to its capacity, the flows are switched and the second vessel adsorbs hydrogen while the first vessel is desorbing purified hydrogen.

Term	Description
propane	A hydrocarbon molecule with three carbon atoms and eight hydrogen atoms. Propane is an *alkane.*
Propylene or Propene	A hydrocarbon molecule with three carbon atoms and six hydrogen atoms. In contrast to propane, propylene has one carbon-carbon bond where two electrons are shared resulting in a molecule with fewer hydrogen atoms than propane. Propylene is an *olefin.*
reforming	*Reforming* modifies the chemical structure of the feedstock hydrocarbons into more valuable hydrocarbon compounds. Reformers use a special catalyst to create *aromatics* and other cyclical *hydrocarbon* molecules from *naphthenes* in the streams fed into the reformer. The *aromatics* and other cyclical hydrocarbons perform better in cars and have higher economic value than the straight-chain molecules from which they are made. As a by-product, *reformers* also are a net producer of *hydrogen* gas.
regenerate	Term used to describe the process that regains the initial activity to a catalyst. In use in the refinery, catalysts are slowly deactivated in chemical processing, usually due to the physical blocking of the catalyst surface by carbon. In regeneration, this carbon is removed by oxidization in a controlled burning of the carbon, converting it to carbon dioxide. The catalyst surface is usually reconditioned with sulfur and chloride and then the catalyst has regained most of its initial activity. Regeneration in a reformer can take place in the reforming reactor, but then the refinery cannot use the process or a continuous regenerating process where a small amount of catalyst is removed continuously from the reformer and is regenerated and reconditioned and then is returned to the reactor.
residuum	The higher boiling point material in crude oil that remains when other hydrocarbons are removed in the initial distillation and vacuum distillations of crude oil at the refinery.
safety relief valve	A *safety relief valve* is the same as a pressure relief valve. It is a valve that is held closed by a spring until the pressure of the fluid exceeds the spring force. When the pressure exceeds the force, the safety relief valve opens and enough fluid is released to drop the fluid pressure to a level below

Term	Description
	the spring force and the spring resets the valve. Safety relief valves protect against overpressure and may be required by regulations on some vessels and pipelines.
scrubber	Scrubbing is a term used for a chemical process in which a component of a gas stream is removed from the gas and is transferred into a liquid. Scrubbing undesirable compounds from gases is a primary pollution control technology. The process is used to separate non-hazardous compounds as well.
selective catalytic reduction	A NO_x emission control system.
selective hydrogenation	*Selective hydrogenation* removes di-olefins and converts light *mercaptans* into heavier sulfides.
sour water	Sour water is water in which ammonia and sulfur-bearing compounds are dissolved. It has a very sour strong aroma.
sulfur dioxide	A gas consisting of one sulfur and two oxygen atoms. The chemical formula is SO_2. *Sulfur dioxide* is a criteria pollutant whose emissions are regulated by the Bay Area Air Quality Management District.
sulfur recovery unit	In a *sulfur recovery unit*, *hydrogen sulfide* is absorbed from refinery gases to reduce their sulfur content so that the refinery gases can be burned for heating refinery intermediate streams. The hydrogen sulfide is desorbed by steam heating the solution and the hydrogen sulfide is burned to form sulfur oxides which are absorbed and converted to molten sulfur using the Claus Process. The sulfur recovery unit and the processes taking place inside its equipment are very common and are found in almost all refineries.
tanks	In a refinery, large tanks are used to store incoming petroleum raw materials such as crude oil, intermediate refinery products such as gas oil, and final products that can be blended for consumer products such as gasoline. All raw materials and products are pumped through pipelines that connect the tanks, refinery process units, and refinery shipping terminals. The tanks typically are equipped with a special floating roof to reduce the evaporation of raw

Term	Description
	hydrocarbons into the air.
tar	In the refinery industry, tar is another term used for a mixture of high boiling point hydrocarbons that are a solid state at normal temperatures and pressures.
tetramer	A polymer with four substructure units.
turnaround	Refers to the period of time when a refinery equipment is down for maintenance and inspections and not available to process feedstocks, as opposed to a refinery equipment's typical 24-hour-a-day, 365-day-a-year operation.
vapor pressure	The pressure, often expressed in millimeters of mercury (mm Hg) or in pounds per square inch (psi) that is characteristic at any given temperatures of a vapor in equilibrium with its liquid or solid form.
volatile organic compounds	Carbon-containing compounds that evaporate into the air (with a few exceptions). Volatile organic compounds (VOCs) contribute to the formation of smog and/or may themselves be toxic. VOCs often have an odor. Examples include gasoline, alcohol, and the solvents used in paints.
wastewater treatment	Equipment in which the water wastes from the refining process are treated and monitored to insure that the refinery discharge meets the regulations of the San Francisco Regional Water Quality Control Board (SFRWQCB), the responsible state agency. The wastewater treatment plant also treats runoff from process areas.

8.1.1.1 Measurement Units Used in this EIR

This section of the glossary lists definitions of key measurement units used in this EIR.

Unit	Description
BBL	Barrel, in the petroleum industry, a volume of 42 gallons.
BBLD	Barrels per day
Btu	British thermal unit, the total energy needed to raise the temperature of 1 pound of water by 1 degree, F.
CFS	Cubic feet per second, a rate of flow or use.
dB	Decibel, one-tenth of a Bel, a measure of noise intensity.

Unit	Description
dBA	A-weighted decibels, a measure of noise intensity.
DNL	The energy average of the A-weighted sound levels occurring during a 24-hour period, and which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night ("penalizing" nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.
°F	Temperature in degrees Fahrenheit.
gpm	gallons per minute
Hz	Hertz – cycles per second.
k	The "k" or kilo is a prefix multiplier applied to many measurement units. The prefix "kilo" multiplies the unit by 1,000. For example, a kilowatt (kW) is one thousand watts. See *watts*, below.
LTD	Long tons per day
MGD	Million gallons per day, a rate of liquid use or flow.
micron	A micron is a linear measure of one-millionth of a meter, or less than one-25,000th of an inch. For comparison, human hair is 50 or more microns in diameter. A micron also can be represented by the Greek letter Mu (μ).
μ	The Greek letter Mu (μ), "micro," a prefix multiplier applied to many measurement units to multiply the unit by one-millionth. For example, a microgram (μg) is one millionth of a gram. See also *μg/m³*, below.
μg/L	Micrograms per liter, one millionth of a gram per liter.
μg/m³	Micrograms per cubic meter, one millionth of a gram per cubic meter.
m	The "m" or "mega" is a prefix multiplier applied to many measurement units to multiply the basic unit by 1,000,000. For example, a megawatt (MW) is one million watts. See *watts*, below.
mph	Miles per hour, a measure of velocity.
MW	Megawatt, one million watts. See *watts*, below.
MWh	Megawatt-hours, one million watt-hours, a measure of total energy. See *watt-hour*, below.
psi	Pounds per square inch, a measure of pressure.

Unit	Description
ppb	Parts per billion, a measure of concentration.
ppm	Parts per million, by weight, a measure of concentration.
ppmv	Parts per million by volume, a measure of concentration.
SCF/hr	Standard cubic feet per hour
SCF	Standard cubic feet, a measure of gas volume under standard conditions of pressure and temperature.
SCFD	Standard cubic feet per day. A gas flow rate.
Therm	A measure of the energy value of natural gas. One Therm is equal to 100,000 Btu, which is roughly the energy value contained in 100 cubic feet of natural gas.
VA	Volt-Amperes, product of voltage and amperage in a conductor. (1 VA is equal to 1 watt in a direct current circuit or if the voltage is in phase with the amperage in an alternating current circuit.)
watt	A measure of the rate of energy consumed or passing through an electric conductor or device. In a direct current circuit, 1 watt = volts x amps. See *VA*, above.
watt-hour	A measure of total energy. The product of watts (the rate of energy use) times the number of hours. A 100-watt light burning for 1 hour uses 100 watt-hours of total energy.

8.2 ACRONYM LIST

A

AAQS	Ambient Air Quality Standards
AB	Assembly Bill
ABAG	Association of Bay Area Governments
ANS	Alaskan North Slope
API	American Petroleum Institute
AWSC	all-way stop-controlled intersection

B

BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technologies
BCDC	Bay Conservation and Development Commission

BMPs	Best Management Practices
BTA	Bicycle Transportation Account
BTU	British thermal unit
BTU/day	British thermal unit per day

C

CAAQS	California Ambient Air Quality Standards
CalARP	California Accidental Release Prevention
Cal/EPA	California Environmental Protection Agency
CAP	criteria air pollutant
CARB	California Air Resources Board
CBC	California Building Code
CCR	California Code of Regulations
CCR	Continuous Catalytic Regeneration
CCTA	Contra Costa Transportation Authority
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CEMA	California Emergency Management Agency
CEMS	Continuous Emissions Monitoring Systems
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGRP	community-based greenhouse gas reduction programs
CGS	California Geological Survey
CH_4	methane
CIWMB	California Integrated Waste Management Board
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society's
CNRA	California Natural Resources Agency
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
CO	carbon monoxide

CoGen	cogeneration
CPF	cancer potency factor
CRAF	cancer risk adjustment factor
CUP	Conditional Use Permit
CTR	California Toxics Rule
CWT	Carbon Weighted Tonne
CZMA	Coastal Zone Management Act

D

DEA	diethanolamine
DHT	diesel hydrotreater
DNL	day-night noise level
DOT	United States Department of Transportation

E

EBMUD	East Bay Municipal Utility District
EBRPD	East Bay Regional Park District
EI	Emissions Inventory
EIA	U.S. Energy Information Administration
EII	Energy Intensity Index
EIR	Environmental Impact Report
EnviroScreen	California Communities Environmental Health Screening
EPA	United States Environmental Protection Agency
ESP	Electrostatic precipitators

F

F	Fahrenheit
FCAA	Federal Clean Air Act
FCC FHT	Fluidized Catalytic Cracker Feed Hydrotreater
FEMA	Federal Emergency Management Agency
FGR	Flare Gas Recovery
FMMP	Farmland Mapping and Monitoring Program
FMP	Flare Management Plan

G

gpm	gallons per minute
g/s	grams per second
GHT	gasoline hydrotreater

H

H_2S	Hydrogen Sulfide
HAPs	hazardous air pollutants
HARP	Hotspots Analysis and Reporting Program
HI	hazard index
HQH	hazard quotient
HRA	health risk assessment
HRSG	Heat Recovery Steam Generator
Hz	hertz

I

I-	Interstate Highway
I-580	Interstate 580
I-80	Interstate 80
ICR	Information Collection Request
IMO	Internal Maritime Organization
IRRF	Integrated Resource Recovery Facility
ISTEA	Intermodal Surface Transportation Efficiency Act

J

K

kWh	kilowatt hours

L

lbs/year	pounds per year
LED	light-emitting diode
L_{eq}	equivalent sound level
L_{dn}	day-to-night equivalent level

LOS	Level of Service
LPGs	liquefied petroleum gases
LTS	Less than Significant

M

MAF	model adjustment factor
MBTA	Federal Migratory Bird Treaty Act
MCE	Marin Clean Energy
MEA	monoethanolamine
MEI	maximum exposed individual
MEISR	maximum exposed individual sensitive receptor
MGD	million gallons per day
MGY	million gallons per year
MMI	Modified Mercalli intensity
MMRP	Mitigation Monitoring and Reporting Program
mmscf	million standard cubic feet
MMT	million metric tons
mpg	miles per gallon
mph	miles per hour
MRZs	Mineral Resource Zones
MT	metric tons
MTC	Metropolitan Transportation Commission
MW	megawatts
MWh	megawatt-hours
MWh/yr	megawatt hours per year

N

NAAQS	National Ambient Air Quality Standards
NCCP	Natural Community Conservation Planning
NCDC	National Climate Data Center
NED	national elevation data
NEPA	National Environmental Protection Act
NH_3	ammonia

NHT	naphtha hydrotreater
NHTSA	National Highway Traffic Safety Administration
NNI	no net increase
NO_2	nitrogen dioxide
NOVs	Notices of Violation
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NTR	National Toxics Rule
NRCS	Natural Resources Conservation Service

O

OGV	ocean-going vessel
OEHHA	Office of Health Hazard Assessment
OPEC	Organization of the Petroleum Exporting Countries

P

PADD	Petroleum Administration Defense District
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PG&E	Pacific Gas & Electric
pH	acid:alkaline balance
$PM_{2.5}$	particulate matter <2.5 microns
PM_{10}	particulate matter <10 microns
POC	Precursors Organic Compound
ppb	parts per billion
ppm	parts per million
ppmvd	parts per million volumetric dry
PSA	pressure swing adsorption
psig	pounds per square inch gauge
PV	photovoltaic

Q

R

RCRA	Resource Conservation and Recovery Act
REL	reference exposure level
RFG	Refinery Fuel Gas
RO	Reverse osmosis
RRWEW	Refinery Water Enhancement Wetland
RWQCB	Regional Water Quality Control Board

S

SCS	Sustainable Communities Strategy
SB	Senate Bill
scf	standard cubic feet
SCFD	standard cubic feet per day
SDA	Solvent De-Asphalting
SEAs	Significant Ecological Areas
SFBAAB	San Francisco Bay Area Air Basin
SFEI	San Francisco Estuary Institute
SIPs	State Implementation Plans
SLM	sound level measurement
SO_2	sulfur dioxide
SRU	sulfur recovery unit
SVP	Society of Vertebrate Paleontology
SWPPP	Storm Water Pollution Prevention Plan

T

TAC	toxic air contaminant
TKN	Taylor Katalytic DeNitrification
TMDL	Total Maximum Daily Loads
TOG	total organic gas
TPY	tons per year

U

UCMP	University of California, Berkeley, Museum of Paleontology
URM	Unit Rate Model
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
UWMP	Urban Water Management Plan

V

VGO	vacuum gas oil
VOC	volatile organic compound

W

W	watts
WCCTAC	West Contra Costa County Transportation Advisory Committee
WCWD	West County Wastewater District
Writ	writ of mandamus
WSA	Water Supply Assessment

X

Y

Z

CHAPTER 9.
MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

A Mitigation Measure Monitoring and Reporting Program (MMRP) is a required step in the CEQA compliance process. The purpose of an MMRP is to ensure the implementation of mitigation measures and project approval conditions that avoid or reduce project impacts that could otherwise be significant adverse environmental impacts. Final mitigation measures as well as project approval conditions that avoid or reduce significant adverse impacts are included in this MMRP. The Chevron Modernization Project Environmental Impact Report (SCH # 2011062042) ("EIR") also includes improvement measures to further minimize less-than-significant Project impacts; improvement measures are also included in this MMRP. The EIR consists of a Draft Environmental Impact Report, Volumes 1 and 2A/2B ("Draft EIR") and a Final Environmental Impact Report (Responses to Comments and text revisions), Volumes 3A/3B and 4 ("Final EIR").

The MMRP for the Modernization Project includes the following required information:

- A list of mitigation and improvement measures, including mitigation measures mandating implementation of Project Design Features;
- The party responsible for implementing the measures;
- The agency/city department responsible for monitoring the implementation;
- The timing for implementation of the measure; and
- The monitoring action and frequency.

The MMRP approach for each of these required components is addressed below and the MMRP is included as Table 9-1 herein.

9.1 *List of Measures*
The list of measures included in this EIR is presented in Table 9-1.

9.2 *Measure Implementation*
Chevron is responsible for implementing all measures, and for funding the Community Greenhouse Gas Reduction Program and Air Quality Improvement Fund. The City is responsible for using such funding for eligible measures.

9.3 *Agency Responsible for Mitigation Monitoring*

The City is responsible for monitoring and reporting the implementation of Mitigation Measures and Improvement Measures. The City will collaborate with the Bay Area Air Quality Management District (BAAQMD) for Mitigation Measures relating to Air Quality and Greenhouse Gas emissions and emission reduction measures (as further described in Section *4.3, Air Quality*, and *Section 4.11, Greenhouse Gases* of the Draft EIR, and with Contra Costa Health Services (CCHS) for Mitigation Measures relating to Facility safety and related issues (as further described in *Section 4.13, Public Safety* of the Draft EIR).

9.4 *Timing of Measure Implementation*

Mitigation Measures included in this Draft EIR generally prescribe Mitigation Measure timing requirements relative to Project-related milestones (e.g., prior to commencing construction, or prior to commencing operation).

A number of improvement measures are also recommended in *Chapter 4, Environmental Setting, Impacts, and Mitigation Measures* of the Draft EIR. Although not required by CEQA, they have been imposed as conditions of approval and will further minimize already less-than-significant impacts. These measures are listed in Table 9-2 Mitigation measures from the Richmond Long Wharf EIR that are incorporated into the Modernization Project Draft EIR are detailed in Table 9-3.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
4.1 AESTHETICS				
Construction or operation of the Modernization Project would result in no significant impacts to Aesthetics. No mitigation is required or recommended.				
4.2 AGRICULTURAL RESOURCES				
Construction or operation of the Modernization Project would result in no impacts to agricultural or forestry resources. No mitigation is required.				
4.3 AIR QUALITY				
4.3-1: All remaining construction activities for the Modernization Project shall comply with the following Bay Area Air Quality Management District (BAAQMD) construction mitigation measures: 1a: All exposed surfaces shall be watered at a frequency adequate to maintain minimum soil moisture of 12%. Moisture content can be verified by lab samples or moisture probe. 1b: All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 miles per hour. 1c: Wind breaks (e.g., trees, fences) shall be installed on the windward side(s) of actively disturbed areas of construction. Wind breaks should have at maximum 50% air porosity. 1d: Vegetative ground cover (e.g., fast-germinating native grass seed) shall be planted in disturbed areas as soon as possible and watered appropriately until vegetation is established. 1e: The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities on the same area at any one time shall be limited. Activities shall be phased to reduce the amount of disturbed surfaces at any one time.	Chevron/Project Contractor	During construction activities	Chevron, BAAQMD and, City of Richmond Planning and Building Services Department	BMPs shall be listed on Plans submitted for building permits, Review and verification by building inspectors, regularly during construction.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
1f: All trucks and equipment, including their tires, shall be washed off prior to leaving the site.				
1g: Site accesses to a distance of 100 feet from the paved road shall be treated with a 6- to 12-inch compacted layer of wood chips, mulch, or gravel.				
1h: Sandbags or other erosion control measures shall be installed to prevent silt runoff to public roadways from sites with a slope greater than 1%.				
1i: All haul trucks transporting soil, sand, or other loose material off-site shall be covered.				
1j: All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping shall be prohibited.				
1k: All vehicle speeds on unpaved roads shall be limited to 15 miles per hour.				
1l: All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.				
1m: Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure, Title 13, Section 2485 of California Code of Regulations). Clear signage shall be provided for construction workers at all access points.				
1n: All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.				

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
1o: A publicly visible sign shall be posted providing the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The BAAQMD's phone number shall also be visible to ensure compliance with applicable regulations.				
4.3-2a: Chevron shall reduce construction-related NO_x emissions to less-than-significant levels by implementing one or more of the following feasible mitigation measures, all of which have been found to result in emissions reduction for construction projects: ▪ Using lower emitting construction equipment, increasing carpooling or otherwise reducing construction-worker automobile use in daily commutes, extending the duration of construction by 1 year by delaying the modifications required to increase the throughput capacity of the FCC FHT until after construction of the hydrogen plant and amine contactor, or reducing the hours of use of construction equipment; ▪ Reducing operations and/or emissions from portable generators at the Facility during the construction period, and thereby reducing NO_x emissions; ▪ Installing the low-NO_x burners included in the Modernization Project in the first 6 months of the construction period, thereby reducing net NO_x emissions from the Facility while construction of the Modernization Project continues; ▪ Retiring permanent NO_x emission reduction credits to offset this temporary NO_x construction increase, in an amount sufficient to offset construction period NO_x emissions; or	Chevron/Project Contractor	During construction activities	Chevron, BAAQMD, and City of Richmond Building Division and Engineering Services Department	Review and verification, continuous during construction. Chevron shall submit for City review and verification quarterly mitigation measure compliance reports reasonably demonstrating compliance with this mitigation measure. Such reports shall be submitted to Building and reviewed and verified in consultation with BAAQMD.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
▪ Implementing a combination of two or more of the above measures, in an amount sufficient to offset construction-period NO_x emissions to less-than-significant levels.				
4.3-2b: Chevron shall reduce construction-related ROG emissions to less-than-significant levels by implementing one or more of the following feasible mitigation measures, all of which have been found to result in emissions reduction for construction projects: ▪ Installing the tank dome Project Design Feature, and installing one additional tank dome, in the first 6 months of Project construction, thereby reducing net ROG emissions from the Facility before completing construction of the hydrogen plant or sulfur removal components of the Modernization Project; ▪ Using lower emitting construction equipment, increasing carpooling or otherwise reducing construction-worker automobile use in daily commutes, extending the duration of construction by 1 year by delaying the modifications required to increase the throughput capacity of the FCC FHT until after construction of the hydrogen plant and amine contactor, or reducing the hours of use of construction equipment; ▪ Retiring permanent ROG emission reduction credits to offset this temporary ROG construction increase, in an amount sufficient to offset construction-period ROG emissions; or ▪ Implementing a combination of the above measures, in an amount sufficient to offset construction-period ROG emissions to less-than-significant levels.	Chevron/Project Contractor	During construction activities	Chevron, BAAQMD, and City of Richmond Building Division and Engineering Services Department	Review and verification, continuous during construction. Chevron shall submit for City review and verification, in consultation with BAAQMD, quarterly Mitigation measure compliance reports demonstrating compliance with this mitigation measure. Such reports shall be submitted to Building.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
4.3-5: Chevron shall implement feasible mitigation measures to reduce CAP emissions below applicable BAAQMD significance thresholds and to ensure no net increase in Project CAP emissions over Baseline levels, as follows: 5a: NO_x Mitigation. Chevron shall implement the following measures in an amount sufficient to reduce NO_x emissions to below the BAAQMD NO_x significance threshold and to ensure no net increase in Project NO_x emissions above Baseline NO_x emission levels: (i) Chevron shall increase the average parcel size — the average ship cargo volume that is delivered or picked up from the Long Wharf— to reduce the number of ship calls, and thereby reduce NO_x emissions from shipping. (ii) Chevron shall fund and require installation of cleaner main and auxiliary engines on up to six tug boats serving the Long Wharf. Tugs are used to push barges, escort ships and barges, and assisting ships and barges into berths. Chevron shall fund the installation of new, cleaner Tier 4 main engines and Tier 3 auxiliary engines for the number of tugs required to remain below the BAAQMD NO_x significance threshold, and achieve the mandatory requirement that there be no net increase in Project NO_x emissions above Baseline NO_x emission levels. (iii) If, after implementing Mitigation Measures 4.3-5(a)(i) and 4.3-5(a)(ii), either Project NO_x emissions have not been reduced below the BAAQMD NO_x significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission reduction credits in quantities sufficient to fully offset Project NO_x emissions to Baseline levels on a	Chevron	Immediately following 1-year exceedance of the Baseline and continuous thereafter	BAAQMD and City of Richmond Building Division and Engineering Services Department	Verification of reduction in annual report and validation study prepared by Chevron and reviewed and verified by City, in consultation with BAAQMD, after 1-year exceedance of the Baseline and annually thereafter

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
net basis. (iv) If, after implementing Mitigation Measure 4.3-5(a)(iii), above, Project NO_x emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project NO_x emissions are reduced to Baseline levels on a net basis.				
5b: PM_{10} Mitigation. Chevron shall implement the following feasible mitigation measures in an amount sufficient to reduce PM_{10} emissions to below the BAAQMD significance thresholds and to ensure no net increase in Project PM_{10} emissions above Baseline PM_{10} emission levels: (i) Chevron shall increase the size of the Fluid Catalytic Cracking Electrostatic Precipitator (ESP) by approximately 50% to eliminate an existing NH_3 injection process in the flue gas in the Fluid Catalytic Cracking unit. (ii) If, after implementing Mitigation Measure 4.3-5b(i), above, PM_{10} emissions have not been reduced below the BAAQMD significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission reduction credits in quantities sufficient to reduce Project PM_{10} emissions to Baseline levels on a net basis. (iii) If, after implementing Mitigation Measure 4.3-5(b)(ii), above, Project PM_{10} emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project PM_{10} emissions are reduced to Baseline levels on a net basis.	Chevron	Immediately following 1-year exceedance of the Baseline and continuous thereafter	Chevron, BAAQMD, and City of Richmond Building Division and Engineering Services Department	Verification of reduction in annual report and validation study prepared by Chevron and reviewed and verified by City, in consultation with BAAQMD, after 1-year exceedance of the Baseline and annually thereafter

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
5c: $PM_{2.5}$ Mitigation. Chevron shall reduce $PM_{2.5}$ emissions to below BAAQMD significance thresholds, and to emission levels that ensure no net increase in Project $PM_{2.5}$ emission above Baseline $PM_{2.5}$ emissions by implementing Mitigation Measure 4.3-5b (PM_{10}), which would also reduce $PM_{2.5}$ emissions. Additionally, Chevron shall complete a validation study quantifying the relative amount of $PM_{2.5}$ reductions achieved by Mitigation Measure 4.3-5b, for review and approval by BAAQMD and the City, to ensure that adequate quantities of $PM_{2.5}$ reductions are achieved as required by this Mitigation Measure 4.3-5c. Finally, Chevron shall implement Mitigation Measure 4.3-6, to reduce health risks from all TACs, including but not limited to $PM_{2.5}$, below the BAAQMD significance thresholds for cancer, and chronic or acute non-cancer risks, and as necessary to ensure no net increase in health risks from all TACs.	Chevron	Immediately following 1-year exceedance of the Baseline and continuous thereafter	Chevron, BAAQMD, and City of Richmond Building Division and Engineering Services Department	Verification of reduction in annual report and validation study prepared by Chevron and reviewed and verified by the City, in consultation with BAAQMD, after 1-year exceedance of the Baseline and annually thereafter
5d: SO_x Mitigation. Chevron shall implement the following feasible mitigation measures in an amount sufficient to reduce SO_x emissions to below the BAAQMD significance threshold and to ensure no net increase in Project SO_x emissions above Baseline SO_x emissions: (i) Chevron shall increase the use of SO_x-reducing catalyst in the Fluid Catalytic Cracking unit that has been demonstrated to substantially reduce SO_x emissions in refinery flue gases. (ii) If, after implementing Mitigation Measure 4.3-5d(i), above, SO_x emissions have not been reduced below the BAAQMD significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission reduction credits in	Chevron	Immediately following 1-year exceedance of the Baseline and continuous thereafter	Chevron, BAAQMD, and City of Richmond Building Division and Engineering Services Department	Verification of reduction in annual report and validation study prepared by Chevron and reviewed and verified by the City, in consultation with BAAQMD, after 1-year exceedance of the Baseline and annually thereafter

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
quantities sufficient to reduce Project SO_x emissions to Baseline levels on a net basis. (iii) If, after implementing Mitigation Measure 4.3-5(d)(ii), above, Project SO_x emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project SO_x emissions are reduced to Baseline levels on a net basis.				
5e: CO Mitigation. Chevron shall implement the following feasible mitigation measures to ensure no net increase in Project CO emissions above Baseline CO emission levels: (i) Chevron shall reduce CO emissions to achieve the mandatory requirement that there be no net increase in Project CO emissions above Baseline CO emissions by retiring BAAQMD-verified emission reduction credits in quantities sufficient to reduce Project CO emissions to Baseline levels on a net basis. Permanent retirement of emission reduction credits would ensure that these banked emissions cannot occur within Richmond or elsewhere. (ii) If, after implementing Mitigation Measure 4.3-5(e)(ii), above, Project CO emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project CO emissions are reduced to Baseline levels on a net basis.	Chevron	Immediately following any 1-year exceedance of the Baseline	Chevron, BAAQMD, and City of Richmond Building Division and Engineering Services Department	Verification of reduction in annual report and validation study prepared by Chevron and reviewed and approved by the City and BAAQMD, after 1-year exceedance of the Baseline and annually thereafter.
5f: ROG Mitigation. Chevron shall complete the following feasible mitigation measures to reduce ROG emissions to below the BAAQMD significance thresholds and to ensure no net increase in Project ROG emissions above Baseline ROG emissions: (i) Prior to the commencement of Project operations, Chevron shall install a tank dome on Tank 3225;	Chevron	Immediately following any 1-year exceedance of the Baseline and as specified in this measure 5f.	Chevron, BAAQMD, and City of Richmond Building Division and Engineering Services Department	Verification of reduction in annual report and validation study prepared by Chevron and reviewed and approved by the City

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
(ii) Within three years following the commencement of Project operations, Chevron shall install tank domes on Tanks 3189 and 3202; (iii) Following the third anniversary of the commencement of Project operations, Chevron shall install domes on one or more of the following tanks to reduce VOC emissions as necessary to reduce ROG emissions below the BAAQMD significance threshold, and to ensure no net increase in Project ROG emissions above Baseline ROG emissions: Tanks 1491, 3213, 3134, 1688, 1514, 3133, 3071, 992, 3197, 1687, 990, 991, 3073, 1296, 3191, 1287, 3220, 3127, 1488, 1459, 3180, 3074, 3076, 3193, 3128, 3201, and 3075. If, following Project approval, Chevron identifies feasible ROG reduction measures other than tank domes that result in quantified emissions reductions as verified by BAAQMD, City shall consider implementation of such alternative reduction measures in lieu of, or in combination with, the reduction measures required by this Mitigation Measure 4.3-5f(iii), provided that such measures have completed all required CEQA review and permitting processes prior to implementation (it is noted, however, that no such measures are currently identified, planned or approved for implementation.) (iv) If, after implementing Mitigation Measure 4.3-5f(i) through 4.3-5(iii), above, ROG emissions have not been reduced below the BAAQMD significance threshold, or if such emissions remain above Baseline levels on a net basis, then Chevron shall permanently retire BAAQMD-verified emission reduction credits in quantities sufficient to reduce Project ROG emissions to Baseline levels on a net basis.				and BAAQMD, after 1-year exceedance of the Baseline and annually thereafter.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
(v) If, after implementing Mitigation Measure 4.3-5(f)(ii), above, Project ROG emissions remain above Baseline levels on a net basis, then Chevron shall curtail Facility operations such that Project ROG emissions are reduced to Baseline levels on a net basis.				
5g: Supplemental Mitigation for all CAPs. In any year that Chevron exceeds Baseline emissions for any CAP, Chevron shall contribute funding for, and participate in, a Clean Air Improvement Fund, which funding shall be in addition to, and payment thereof shall in no way relieve Chevron or the Project of the requirement that the Project achieve no net increase in CAP emissions, as follows: ▪ Funding shall be in an amount determined based on a benchmark price to be agreed to by the City, BAAQMD and Chevron, as thereafter annually adjusted by the Consumer Price Index value for the San Francisco Bay Area. ▪ Funding shall be paid annually within 60 days following approval by BAAQMD of the Emission Inventory for the prior calendar year. ▪ All payments into the Clean Air Improvement Fund shall be spent on emission reduction measures for criteria pollutant(s) that increased above Baseline in the following order: (1) reductions from Facility emissions, (2) reductions within the City, and (3) reductions from the North Richmond area closest to the Facility. ▪ Funding and implementation decisions shall be made in a public process by a stakeholder group consisting of representatives from the City, the community, and Chevron. ▪ A brief report shall be prepared for each major emission reduction measure implemented using	Chevron and City of Richmond	Immediately following any 1-year exceedance of the Baseline and as specified in this measure 5g.	Chevron, BAAQMD, and City of Richmond	Verification of reduction in annual report and validation study prepared by Chevron and reviewed and approved by the City and BAAQMD, after 1-year exceedance of the Baseline and annually thereafter.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
such funds, and be made available to help inspire similar emission reduction opportunities. Mitigation Measure 4.3-5g would not create any exception to Chevron's obligation to fully comply with all mitigation measures included in this EIR, including but not limited to Mitigation Measure 4.3-6, which requires the Project to ensure no net increase of health risks over Baseline levels caused by all TAC emissions.				
5h. Chevron shall secure a permit amendment from BAAQMD reducing the annualized throughput limit of the Solvent De-asphalting unit to 50,000 barrels per day. This must be completed prior to commencing operation of the new hydrogen plant. 5i: Chevron shall secure a permit amendment from BAAQMD reducing the hydrogen production limit of each train of the new hydrogen plant from 140 mmscf/day to 122 mmscf/day. This must be completed prior to commencing operation of the new hydrogen plant.	Chevron	Prior to commencement of Project operations.	Chevron, BAAQMD, and City of Richmond	Prior to commencement of Project operations, Chevron shall submit for City review and verification substantial evidence of compliance with this measure.
4.3-6: Chevron shall implement the following measures: 6a1: Prior to operation of the Project, Chevron shall implement the following measures to reduce DPM, inclusive of $PM_{2.5}$, to reduce health risk from all Project TAC emissions to below BAAQMD significance criteria (for the 93% Project shipping scenario) and to ensure no net increase of health risks from Project TAC emissions over Baseline levels: (i) Chevron shall fund and require installation of cleaner main and auxiliary engines on one tug boat serving the Long Wharf as well as non-Chevron facilities. Prior to operation of the Project, Chevron shall fund the installation of new, cleaner Tier 4 main	Chevron	Prior to the commencement of Project operations.	BAAQMD and City of Richmond Building Division and Engineering Services Department	Prior to the commencement of Project operation, Chevron shall submit for City and BAAQMD review and verification substantial evidence of compliance with this measure.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
engines and Tier 3 auxiliary engines for one of the six tugboats. (ii) Chevron shall fund and cause to have implemented the project design feature described in the EIR as the removal of three ocean-going vessels (called "SuezMax" because they can go through the existing Suez canal, and have cargo capacity of between 120,000 to 200,000 tons) from West Coast service, and replacement of these vessels with two new Chevron SuezMax ships. The main ship engines of each replacement ship shall meet a Tier 3 standard instead of the required Tier 2 standard, and the auxiliary engines shall be upgraded with turbochargers that are cleaner than Tier 3 standards.				
6a2: Prior to operating the Project in excess of 93% Project utilization, Chevron shall implement a combination of the following measures to reduce DPM, inclusive of $PM_{2.5}$, to reduce health risk from all Project TAC emissions to below BAAQMD significance criteria and to ensure no net increase of health risks from Project TAC emissions over Baseline levels, with all emission reduction amounts from such measures requiring validation by BAAQMD: (i) Chevron shall increase the average parcel size—the average ship cargo volume that is delivered or picked up from the Long Wharf— to reduce the number of ship calls, and thereby reduce DPM emissions from shipping. (ii) Chevron shall fund and require installation of cleaner main and auxiliary engines on up to five non-retrofitted six tug boat serving the Long Wharf as well as non-Chevron facilities. The Long Wharf is primarily served by six tugs, one of which will have been retrofitted as described in Mitigation Measure	Chevron	Prior to operating the Project in excess of 93% Project utilization.	Chevron, BAAQMD, and City of Richmond Building Division and Engineering Services Department	Verification in validation study prepared by Chevron and reviewed and approved by the City, in consultation with BAAQMD, following exceedance of baseline health risk from TACs and exceedance of the 93% Utilization level

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
4.3-a1(i) prior to Project operation. Chevron shall fund the installation of new, cleaner Tier 4 main engines and Tier 3 auxiliary engines on the number of tugs required to reduce DPM, and achieve the No Net Increase Project Objective. (iii) If, after implementing Mitigation Measures 4.3-6(a)(2)(i) and 4.3-6a(2)(ii), above, health risk from Project TAC emissions remains above Baseline levels on a net basis, as determined by the health risk assessment required by Mitigation Measure 4.3-6b, below, Chevron shall install electric shore power, and require one or more of the ships using the Long Wharf to use such shore power in lieu of continuing to burn diesel fuel while berthed. Before implementing this mitigation measure, Chevron shall apply to the City and other responsible agencies for necessary permits, and shall complete the environmental process required under CEQA. Implementation of this measure is not required to achieve the performance standard included in this Mitigation Measure 4.3-6. (iv) If, after implementing Mitigation Measures 4.3-6(a)(2)(i) though 4.3-6(a)(2)(iii), above, health risk from Project TAC emissions remains above Baseline levels on a net basis, as determined by the health risk assessment required by Mitigation Measure 4.3-6b, below, then Chevron shall curtail Facility operations as necessary to ensure that such health risk is reduced to Baseline levels on a net basis.				
6b: Chevron shall fund and participate in a Clean Air Improvement Fund for any net increase in health risks from TACs not avoided or mitigated as required in this EIR. (i) In any year for which the BAAQMD-approved	Chevron	As specified in this measure.	Chevron, BAAQMD, and City of Richmond	Chevron's compliance with Mitigation Measure 4.3-6b(i) to be verified by City, in consultation with BAAQMD, within

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
emissions inventory, combined with annual emission estimates from shipping, results in an increase over Baseline levels identified in Table 4.3-24 of the three primary risk drivers (DPM, benzene, and naphthalene), even if such emissions are adequately mitigated as CAP emissions through implementation of Mitigation Measure 4.3-5 such that there is no net increase of such CAP emissions over Baseline levels, then Chevron shall, within 60 days, fund the cost of the City's preparation of a new health risk assessment to identify whether these TAC emissions resulted in an increase in risk over Baseline. (ii) If the new risk assessment required by Mitigation Measure 4.3-6(b)(i), above identifies an increase in risk over Baseline risks, then Chevron shall contribute an additional $100,000 in further funding for the Clean Air Improvement Fund identified in this Mitigation Measure 4.3-6b.				60 days following issuance of the annual BAAQMD-approved emissions inventory, combined with annual emission estimates from shipping, for any year which results in an increase over Baseline levels. Chevron's compli-ance with Mitigation Measure 4.3-6b(ii), if applicable, to be verified within 30 days following City's receipt of the health risk assessment as may be required by Mitigation Measure 4.3-6b(i).
6c: Chevron shall monitor designated metals in Facility feedstock and refinery fuel gas (RFG) and report annually on the correlation, if any, between total annual designated metal emissions (as calculated from RFG samples) and average annual concentrations of such metals in feedstocks. The annual report shall address the following metals of concern: nickel, vanadium, selenium, cadmium, and mercury. Metals are TACs, and contribute to health risks, and any net increase in metal emissions would also trigger the mitigation measure compliance requirements in Mitigation Measures 4.3-6a and	Chevron	Following commencement of Project operations and continuously thereafter.	Chevron, BAAQMD, and City of Richmond Planning Division	Chevron shall submit, and City shall review and verify required reports annually in consultation with BAAQMD. City shall, in consultation with BAAQMD, verify compliance with Mitigation Measures 4.3-6a and 4.3-6b, if such measures

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
4.3-6b, above.				triggered by this measure 4.3-6c.
6d: Chevron shall monitor average annual sulfur and nitrogen concentrations in Facility feedstocks, and nitrogen-related refinery fuel gas air emissions, and report annually on the correlation, if any, between total annual nitrogen-related CAP and TAC emissions (as reported in the BAAQMD annual Emissions Inventory) and average annual concentrations of sulfur and nitrogen in feedstocks. Any such increase over Baseline would require compliance with mitigation measures specified above to ensure no net increase in CAPs or risks from TACs over Baseline levels.	Chevron	Annually	Chevron, BAAQMD, and City of Richmond Building Division and Engineering Services Department	Chevron shall submit, and City shall review and verify required reports annually in consultation with BAAQMD. City shall verify, in consultation with BAAQMD, compliance with Mitigation Measures 4.3-6a and 4.3-6b, if such measures triggered by this measure 4.3-6d.
4.3-7: Chevron shall implement Mitigation Measures 4.3-6a through 4.3-6d.		*See referenced mitigation measures.*		
4.3-8: Chevron shall implement the following measures: (a) Chevron shall report annually to the City in writing on the number of odor complaints confirmed by the BAAQMD, and shall specify in such report, where available, whether each complaint relates to hydrogen sulfide, NH_3, or an unspecified compound or source.	Chevron	Annually and in the event of an increase in odor complaints over the Baseline period	Chevron, BAAQMD, and City of Richmond Planning Division	City shall review reports annually and verify compliance, in consultation with BAAQMD, in the event of an increase in odor complaints over the Baseline period
(b) If, in any year following commencement of Project operations, there is an increase in odor complaints confirmed by the BAAQMD relative to the number of odor complaints that occurred during the Baseline period, and such increase is due to H_2S or NH_3 odors,	Chevron	Upon commencement of Project operations.	Chevron, BAAQMD, and City of Richmond Planning Division	Review and verification continuous during Project operations.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
Chevron shall prepare, and submit to the City and BAAQMD for approval, an Odor Management Plan. At minimum, the Odor Management Plan shall: ▪ Establish protocols for monitoring odors at or from the Facility on an ongoing basis; ▪ Provide for the establishment of a regular odor patrol to monitor odors at or from the Facility and to investigate, and take corrective actions with respect to, odor complaints on an ongoing basis; ▪ Establish protocols for the prompt recordation and annual reporting to City of odor complaints confirmed by BAAQMD; ▪ Establish community outreach protocols describing procedures for informing the public about how and where to submit odor complaints; ▪ Describe measures to be implemented as necessary to reduce BAAQMD-confirmed odor complaints below the BAAQMD threshold of significance, which measures shall include, but not be limited to, the following odor mitigation strategies recommended for refineries in the BAAQMD CEQA Guidelines (collectively, the "Odor Reduction Measures"): (i) implementation of water injections into the hydrocracking process; (ii) installation of vapor recovery systems; (iii) injection of masking odorants into refinery process streams; (iv) installation of flare meters and controls; (v) implementation of wastewater circulation technology for aerated ponds; (vi) implementation of thermal oxidizers; (vii) implementation of carbon absorption mechanisms;				

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
(viii) implementation of biofiltration and/or bio-trickling filters. ▪ Establish protocols for (1) the annual review and reporting on the effectiveness of any Odor Reduction Measures implemented pursuant to this Mitigation Measure 4.3-8 and (2) adaptively managing the implementation of Odor Reduction Measures as necessary to maintain complaints below the BAAQMD threshold of significance on an ongoing basis.				
(c) If, in any year following commencement of Project operations, there is an increase in odor complaints confirmed by the BAAQMD relative to the number of odor complaints that occurred during the Baseline period, and such increase is due to H_2S or NH_3 odors, Chevron shall implement the odor patrol provided for under the Odor Management Plan and cause it to immediately commence monitoring odors at or from Facility on an ongoing basis, to investigate any odor complaint, to ensure that appropriate action is taken to reduce odors from the affected source, and to document the implementation and effectiveness of the corrective action.	Chevron	Upon commencement of Project operations.	Chevron, BAAQMD, and City of Richmond Planning Division	Review and verification continuous during Project operations.
(d) If odor complaints above Baseline levels persist for more than 2 consecutive years following commencement of Project operations, Chevron shall fund a qualified third-party engineering firm to assume responsibility for: ▪ Immediately investigating odor complaints confirmed by the BAAQMD in accordance with Odor Management Plan protocols; ▪ Implementing and adaptively managing, at Chevron's sole expense and in consultation with the City and the BAAQMD, one or more of the Odor	Chevron	Upon commencement of Project operations.	Chevron, BAAQMD, and City of Richmond Planning Division	Review and verification continuous during Project operations.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
Reduction Measures described in the approved Odor Management Plan, to reduce or maintain BAAQMD-confirmed odor complaints below the BAAQMD threshold of significance; ▪ Monitoring and documenting the implementation and effectiveness of such Odor Reduction Measures and the adaptive management thereof in accordance with Odor Management Plan protocols; and ▪ Annually reporting in writing to the City and the BAAQMD on the implementation and effectiveness of such Odor Reduction Measures and the adaptive management thereof in accordance with Odor Management Plan protocols.				
(e) Chevron shall cause the Project to comply with the City's odor standards and with BAAQMD Regulation 7-303, which limits the concentration of NH_3 from stacks to 5,000 ppm. The Facility heaters shall comply with the BAAQMD Permit Condition 24136, Item #16 limit of 10 ppm NH_3 at 3% oxygen in the stack, which is less than 5,000 ppm. Chevron shall further cause the Replacement Hydrogen Plant to comply with BAAQMD Regulations 7-303 for NH_3 at the other sulfur recovery units. Chevron shall confirm concentration of NH_3 in the stacks of both source categories after construction.	Chevron	Upon commencement of Project operations.	Chevron, BAAQMD, and City of Richmond Planning Division	Review and verification continuous during Project operations.
4.4 BIOLOGICAL RESOURCES				
4.4-1a: To avoid construction-related direct impacts (nest removal) or indirect impacts (increased noise levels) on nesting birds (including California Department of Fish and Wildlife (CDFW) Fully Protected Species and Species of Special Concern), one of the following measures shall be implemented:	Chevron/Project Contractor	No more than 5 days prior to initiation of construction activities (including vegetation clearing and grubbing) (if	City of Richmond Planning and Building Services Department/ Biologist	Review of pre-construction survey prior to initiation of construction by Planning; review of buffer design and

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
▪ Conduct vegetation clearing and grubbing activities from September 1 through January 1, when birds (including raptors) are not likely to be nesting on the site; OR ▪ Conduct pre-construction surveys for nesting birds if construction is to take place during the nesting season (January 1 through August 31). A qualified wildlife biologist shall conduct a pre-construction nest survey no more than 5 days prior to initiation of construction activities (including vegetation clearing and grubbing) conducted within 300 feet of any vegetated area to provide confirmation of the presence or absence of active nests on or immediately adjacent to the storage tank dome Project Design Feature within the Tank Farm Area. If active nests are encountered, species-specific measures shall be prepared by a qualified biologist and implemented to prevent abandonment of the active nest. At a minimum, grading in the vicinity of the nest shall be deferred until the young birds have fledged. A minimum exclusion buffer of 50 feet (300 feet or more for raptors) shall be maintained during construction, depending on the species and location. The perimeter of the nest-setback zone shall be fenced or adequately demarcated with staked flagging at 20-foot intervals, and construction personnel and activities would be restricted in the area. A survey report by a qualified biologist verifying that (1) no active nests are present, or (2) the young have fledged, shall be submitted to the City and CDFW prior to initiation of grading in the nest-setback zone. The qualified biologist shall serve as a construction monitor during those periods when construction		required)		implementation, once prior to construction and throughout the construction period by Building; review survey report prior to initiation of grading in the nest-setback zone (if required) by Planning & Building

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Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
activities occur near active nest areas to ensure that no inadvertent impacts to these nests occur.				
4.4-1b: One of the following mitigation measures shall be implemented to lessen potential impacts on potential roost habitat and bat species: ▪ Construction activities near bat roost habitat or removal of potential bat roost habitat shall commence between September and October in order to avoid both the bat maternity period and the bat hibernation period; OR ▪ If this is not feasible, pre-construction bat roost surveys shall be conducted prior to removal of potential roost habitat. Pre-construction surveys for potential bat roost habitat shall be performed in all trees and buildings subject to removal or demolition for evidence of bat use (guano accumulation, acoustic or visual detections). If evidence is found, then acoustic surveys shall be conducted to determine whether a site is occupied. A minimum of three acoustic surveys shall be conducted in areas containing evidence of bat use between April and November under appropriate conditions using an acoustic detector (WBWG, 2002). If necessary, and with approval from CDFW, exclusion of bats from occupied roosts shall be performed in the fall prior to construction. A qualified wildlife biologist shall be present during exclusion.	Chevron/Project Contractor	Prior to removal of potential roost habitat (if required)	City of Richmond Planning & Building Services Department/ Biologist	Review of pre-construction survey prior to initiation of construction by Planning; review of acoustic surveys prior to construction (if required) by Planning
4.4-1c: One of the following mitigation measures shall be implemented to lessen potential impacts on potential winter roost habitat for Monarch butterfly: ▪ Conduct tree removal when Monarch butterflies are not present (typically between March 31 and	Chevron/Project Contractor	Prior to initiation of any tree removal activities and prior to construction (if required)	City of Richmond Planning & Building Services Department/ Biologist	Review of pre-construction survey prior to any tree removal activities by Planning; review

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
August 31); OR ▪ If conducting tree removal between March 31 and August 31 is not feasible, pre-construction Monarch butterfly roost surveys shall be conducted by a City-approved biologist within 100 feet of the storage tank dome Project Design Feature prior to initiation of any tree removal activities. If any winter roosts are encountered during the survey, construction shall be postponed until the roosting activity has ended. A follow-up survey shall be conducted by an approved biologist prior to construction in order to verify that the roosts have been vacated.				follow-up survey prior to construction by Planning & Building
4.5 CULTURAL RESOURCES				
4.5-1: In the event that any prehistoric or historic subsurface cultural resources, such as structural features or unusual amounts of bone or shell, artifacts, human remains, architectural remains (such as bricks or other foundation elements), or historic archaeological artifacts (such as antique glass bottles, ceramics, horseshoes, etc.), are discovered during ground-disturbing activities, all work within 50 feet of the resources shall be halted and Chevron and/or the lead agency shall consult with a qualified archaeologist to assess the significance of the find per CEQA Guidelines Section 15064.5. If any find is determined to be significant, representatives of Chevron and/or the lead agency and the qualified archaeologist shall meet to determine the appropriate avoidance measures or other appropriate mitigation, with the ultimate determination to be made by the lead agency. All significant cultural materials recovered shall be, as necessary and at the	Chevron/Project Contractor	During construction activities	City of Richmond Planning Division/ Archaeologist	Review and verification, continuous during construction

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
discretion of the consulting archaeologist, subject to scientific analysis, professional museum curation, and documented according to current professional standards. As part of the Mitigation Monitoring and Reporting Program for the EIR, Chevron shall have environmental monitors on-site during Modernization Project actions that involve ground-disturbing construction. The construction workers shall be trained by the monitors on environmental sensitivity and the identification of prehistoric or historic subsurface cultural resources. In considering any suggested mitigation proposed by the consulting archaeologist to mitigate impacts to historical resources or unique archaeological resources, the lead agency shall determine whether avoidance is necessary and feasible in light of factors such as the nature of the find, Project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) shall be instituted. Work may proceed on other parts of the Project site while mitigation for historical resources or unique archaeological resources is carried out.				
4.5-2: In the event of unanticipated paleontological discoveries, such as large deposits of fossil remains, Chevron shall notify a qualified paleontologist who shall document the discovery as needed, evaluate the potential resource, and assess the significance of the find under the criteria set forth in CEQA Guidelines Section 15064.5. In the event of an unanticipated discovery of a brea, true, and/or trace fossil during construction, excavations within 50 feet of the find shall be temporarily halted or diverted until the discovery is examined by a qualified paleontologist per Society of Vertebrate Paleontology standards	Chevron/Project Contractor	During construction activities	Chevron and City of Richmond Planning Division/ Paleontologist	Review and verification, continuous during construction

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
(SVP, 1995). The paleontologist shall notify the appropriate agencies to determine procedures that would be followed before construction is allowed to resume at the location of the find. If the lead agency determines that avoidance is not feasible, the paleontologist shall prepare an excavation plan for mitigating the impact of the Modernization Project on the qualities that make the resource important, and such plan shall be implemented. The plan shall be submitted to the lead agency for review and approval. As part of the Mitigation Monitoring and Reporting Program for the EIR, Chevron shall have environmental monitors on-site during Modernization Project actions that involve ground-disturbing construction. The construction workers shall be trained by the monitors on environmental sensitivity and the identification of prehistoric or historic subsurface cultural resources.				
4.5-3: In the event that human skeletal remains are uncovered during construction activities for the Modernization Project, Chevron shall immediately halt work, contact the Contra Costa County Coroner to evaluate the remains, and follow the procedures and protocols pursuant to Section 15064.5 (e)(1) of the CEQA Guidelines. If the County coroner determines that the remains are Native American, Chevron shall contact the NAHC, in accordance with Health and Safety Code Section 7050.5, subdivision (c), and Public Resources Code 5097.98 (as amended by Assembly Bill 2641). Per Public Resources Code 5097.98, the landowner shall ensure that the immediate vicinity, according to generally accepted cultural or archaeological standards or practices, where the Native American human remains are	Chevron/Project Contractor	During construction activities	Chevron and City of Richmond Planning Division/Archaeologist	Review and verification, continuous during construction

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
located is not damaged or disturbed by further development activity until the landowner has discussed and conferred, as prescribed in this section (Public Resources Code 5097.98), with the most likely descendants regarding their recommendations, if applicable, taking into account the possibility of multiple human remains.				
4.6 ENERGY				
Construction or operation of the Project would result in no-significant impacts related to energy. No mitigation is required or recommended.				
4.7 GEOLOGY, SOILS, SEISMICITY AND MINERAL RESOURCES				
Construction or operation of the Project would result in no-significant impacts related to geology, soils, seismicity and mineral resources. No mitigation is required or recommended.				
4.8 GREENHOUSE GAS EMISSIONS				
4.8-1: Consistent with air quality mitigation measures for construction activities, Chevron would be required to implement the following mitigation measures to reduce its Project construction emissions. Implementation of the mitigation measures would result in further reductions in greenhouse gas emissions. 1a: All vehicle speeds on unpaved roads shall be limited to 15 miles per hour (mph). 1b: Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California Airborne Toxic Control Measure (Title 13 of California Code of Regulations [CCR], Section 2485). Clear signage shall be provided for construction workers at all access points. 1c: All construction equipment shall be maintained and properly tuned in accordance with	Chevron/Project Contractor	During construction	Chevron, BAAQMD, and City of Richmond Planning & Building Services Department	Review and verification, regularly during construction Chevron shall submit for City review and verification quarterly Mitigation measure compliance reports reasonably demonstrating compliance with this mitigation measure. Such reports shall be submitted to Building and reviewed and verified in consultation with BAAQMD.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.				
1d: The idling time of diesel-powered construction equipment shall be limited to 2 minutes.				
1e: The Project shall develop a plan demonstrating that the off-road equipment (more than 50 horse-power) to be used in construction (i.e., owned, leased, and subcontractor vehicles) would achieve a Project-wide fleet-average 20% nitrogen oxide reduction and 45% particulate matter reduction compared to the most recent CARB fleet average. Acceptable options for reducing emissions include the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available. (Several of these measures would also reduce greenhouse gas emissions.)				
1f: All contractors shall be required to use equipment that meets CARB's most recent certification standard for off-road heavy duty diesel engines.				
1g: Reuse and recycle construction and demolition waste (including, but not limited to, soil, vegetation, concrete, lumber, metal, and cardboard).				
1h: Enforce and follow limits on idling time for commercial vehicles, including delivery and construction vehicles.				
1i: Using alternative fueled (e.g., biodiesel, electric) construction vehicles/equipment on at least 15% of the fleet.				
1j: Using local building materials of at least 10%.				
1k: Recycling or reusing at least 50% of construction				

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
waste or demolition materials.				
1l: For each year of Project construction, Chevron shall hire, at commercially reasonable rates and at Chevron's expense, a qualified third-party entity reasonably acceptable to the City to quantify and verify in writing whether the reductions achieved from the above described construction greenhouse gas mitigation measures for that year of Project construction adequately mitigated this potentially significant impact, which report shall be subject to City's reasonable approval. For any year of construction for which construction-related diesel emissions are not reduced to or below the 10,000-MT CO_2e per year significance threshold, Chevron shall implement one or more of the following measures in an amount sufficient to reduce construction period greenhouse gas emissions to less than significant levels: (i) Reduce diesel emissions from other equipment at the Facility, such as a diesel-powered generator, in an amount equal to the construction-related greenhouse gas emissions in excess of 10,000 MT CO_2e per year for any calendar year of Project construction, which reduced emission level Chevron shall maintain for the following 2 years. (ii) Permanently retire, or retrofit from diesel to electric power, one or more Facility sources that emit more than 300 MT CO_2e per year.	Chevron/Project Contractor	Annually, as specified in this measure.	Chevron, BAAQMD, and City of Richmond Engineering Services Department	Review of annual construction emissions reports and verification, in consultation with BAAQMD, of compliance additional measures if significance threshold is exceeded
As explained in the Draft EIR, Page 4.8-53, in the event the City selects the 2MW-solar project contemplated by the EIR as a potential Community Greenhouse Gas Reduction Program (CGRP) and such solar project is funded all or in part with funds	Solar Project Developer/City of Richmond Planning & Building Services Department	Prior to and during construction of solar project	City of Richmond Planning & Building Services Department	Verification prior to and during construction of solar project –Protection measures and areas

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
required by Mitigation Measure 2.8-2e below, then, City shall ensure implementation of CGRP Solar Mitigation Measure Haz-1, Haz-2, Bio-1 and Bio-2 described in Section 4.8 of the EIR as follows: CGRP Solar Project Mitigation Measure Haz-1: Prior to commencing construction of the solar project, Chevron shall submit for City and RWQCB review the design of the facility, and sufficient information about construction and operational parameters as are determined by the City and/or RWQCB to be needed to assure that the solar project would not reduce the effectiveness of the remediation measures implemented in the solar site area. CGRP Solar Project Mitigation Measure Haz-2: Prior to commencing construction of the solar project, Chevron shall update the Facility emergency response and evacuation plans to account for the presence of the solar site on the Facility, and to assure that the modified emergency response and evacuation plans remain effective given the presence of the solar project. CGRP Solar Project Mitigation Measure Bio-1: Standard construction BMPs and specific Project Design Features shall be implemented to treat and minimize discharge of soil and pollutants into the marsh and other off-site vegetated areas during construction and operation of the proposed project. Standard construction BMPs shall be implemented according to a Stormwater Pollution Prevention Plan required under the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit). Catch basin inlet protection and installation				shall also be included in the Plans submitted for grading and/or construction permits

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
of straw wattles (fiber rolls) shall be used throughout the Project site during construction. Additional construction BMPs required by the Regional Water Quality Control Board and San Francisco Bay Conservation and Development Commission shall also be implemented. Potential impacts on the coastal brackish marsh during construction activities shall also be avoided by placement of exclusion fencing 5-10 feet from the perimeter of the coastal brackish marsh boundary or on the edge of the temporary disturbance area when this distance is greater. The Facility shall provide environmental awareness training for all construction personnel, bright-colored fencing and signage shall identify and restrict construction within environmentally sensitive areas, and a construction monitor/environmental inspector shall confirm the fence integrity on a daily basis to protect the area from accidental equipment damage. Fence repair and/or reinforcements shall be completed immediately.				
CGRP Solar Project Mitigation Measure Bio-2: Although Herman's Slough contains marginally suitable habitat for mammal species, there is small potential that one could migrate onto the solar facility site from nearby degraded marsh habitat. To avoid inadvertent construction impacts on salt marsh harvest mouse, Suisun ornate shrew, saltmarsh wandering shrew, and San Pablo vole, a qualified biological monitor shall be present during initial clearing and grubbing activities prior to installation of solar panel arrays in the vicinity of Herman's Slough. The monitor shall pre-survey disturbance areas to confirm the absence of special-status small mammals. Contractor education shall include a section specific to species identification and	Solar Project Developer	Prior to and during construction of solar project	City of Richmond Planning & Building Services Department/ Biologist	Verification prior to and during construction of solar project

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
protection measures. The entire project construction area abutting coasts brackish marsh habitats shall be surrounded by exclusion fencing. Fencing installed around the project disturbance area during construction shall be adequate to exclude these species. A maximum speed limit of 25 mph shall be observed by construction and maintenance vehicles. The Facility shall provide environmental awareness training for all construction personnel, bright-colored fencing and signage shall identify and restrict construction within environmentally sensitive areas, and a construction monitor/environmental inspector shall confirm the fence integrity on a daily basis to protect the area from accidental equipment damage. Fence repair and/or reinforcements shall be completed immediately.				
4.8-2: Chevron shall implement all greenhouse gas Project Design Features described above, including those measures described in subsections 2a through 2f below. If implementation of subsections 2a through 2f, below, does not reduce Facility greenhouse gas emissions to Baseline levels on an annual net basis, then Chevron shall implement subsection 2g, below. If implementation of subsections 2a through 2g, below, does not reduce Facility greenhouse gas emissions to Baseline levels on an annual net basis, then Chevron shall implement subsection 2h, below: 2a: Implement water conservation measures during Modernization Project construction; 2b: Install LED Lighting at the Facility during Modernization Project construction; 2c: Implement fluid catalytic cracker cooling water tower motor upgrades during Modernization Project	Chevron/Project Contractor	Mitigation Measures 4.8-2a though 2c shall be implemented prior to commencement of Project operation.	City of Richmond Planning & Building Services Department	Verification prior to completion of construction

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
construction;				
2d: Participate, for Chevron Commercial Facilities (and industrial accounts, if practicable), in the Marin Clean Energy Program prior to commencement of construction;	Chevron	Prior to commencement of construction	City of Richmond Planning & Environmental Initiatives	Review and verification prior to commencement of construction
2e: Provide $30M over ten years in funding for implementation of the Community Greenhouse Gas Reduction Measures, which measures shall be selected by the City through a public process with input from stakeholders from the City, North Richmond, and Chevron, as described above;	Chevron	Annually for 10 years beginning with issuance of first building permit of Hydrogen Plant Replacement	City of Richmond City Manager's Office	Review and verification annually
2f: Acquire and timely surrender to CARB Cap and Trade Emission Allowances in quantities sufficient to reduce Facility greenhouse gas emissions to or below Baseline levels on a net basis (rounded up to the nearest metric ton), after taking into account reductions achieved by Mitigation Measures 2a-2e above;	Chevron	In accordance with the Facility's compliance obligation schedule pursuant to CARB cap-and-trade regulations (Cal Code Regs., tit, 17, § 95800 et seq.)	Chevron/City of Richmond Planning Services & Building Department/ BAAQMD	Review annually and verification in accordance with the Facility's compliance obligation schedule pursuant to CARB cap-and-trade regulations (Cal Code Regs., tit, 17, § 95800 et seq.)
2g: Acquire greenhouse gas reduction credits through the California Air Pollution Control Officers Association (CAPCOA) GHG Rx credit exchange, or through a similar exchange certified by the BAAQMD or CARB, in quantities sufficient to reduce Facility greenhouse gas emissions to or below Baseline levels on a net basis (rounded up to the nearest metric ton), after taking into account reductions achieved by Mitigation Measures 2a-2e above, and after taking into account net reductions achieved by Mitigation Measure 2f above;	Chevron	In accordance with schedule and process described in EIR Section 4.8.4.1.2.3.3.2.	Chevron/City of Richmond Planning Services & Building Department/ BAAQMD	Review annually and verification in accordance with schedule and process described in EIR Section 4.8.4.1.2.3.3.2.
2h: Curtail facility operations such that Facility greenhouse gas emissions are reduced to or below				

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
Baseline levels on a net basis (rounded up to the nearest metric ton), after taking into account reductions achieved by Mitigation Measures 2a-2e above, and after taking into account net reductions achieved by Mitigation Measures 2f-2g above.				
4.8-2B: *Clean Air Improvement Fund.* Chevron shall fund and participate in a Clean Air Improvement Fund for any Facility greenhouse gas emissions over Baseline. ▪ Funding shall be in an amount equivalent to the difference between Project and Baseline greenhouse gas emissions (in MT CO_2e) multiplied by the settlement price of greenhouse gas emission allowances determined at the 1st quarter 2014 California Air Resources Board (CARB) auction, annually adjusted by the Consumer Price Index value for the San Francisco Bay Area. The difference between Project and Baseline greenhouse gas emissions shall be determined in accordance with the procedures for determining the Remaining Offset described above in *Section 4.8.4.1.2.3.3.2*. ▪ Funding shall be paid annually and in accordance with the procedures described above in *Section 4.8.4.1.2.3.3.2*. ▪ Funding shall be spent on greenhouse gas emission reduction measures in the following priority order: (1) reductions from Facility emissions; (2) reductions within the City; and (3) reductions from the North Richmond area closest to the Facility. ▪ Funding and implementation decisions shall be made by the City, as part of a public process, with input from stakeholders including representatives from the City, North Richmond, and Chevron. ▪ A brief report shall be prepared for each major	Chevron	In accordance with schedule and process described in EIR Section 4.8.4.1.2.3.3.2.	Chevron/City of Richmond Planning Services & Building Department	Review and verification annually following in accordance with schedule and process described in EIR Section 4.8.4.1.2.3.3.2.

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Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
emission reduction measure implemented using such funds, and be made available to help inspire other emission reduction opportunities.				
4.9 HYDROLOGY AND WATER QUALITY				
4.9-1a: Chevron shall prepare and submit a SWPPP to the RWQCB that includes best management practices to treat stormwater runoff during the construction period (and achieve water quality objectives) at least 10 days prior to commencement of construction activities. The BMPs included in the SWPPP shall be implemented during construction.	Chevron/Project Contractor	At least 10 days prior to construction	City of Richmond Building Division and Engineering Services Department/ Hydrologist	Review and approval prior to construction, and verification during construction
4.9-1b: Chevron shall implement two Project Design Features (Stripped Sour Water Reuse/Distillation and Reforming Area and Stripped Sour Water Reuse in South Isomax Area) to offset average annual process wastewater flows under the 93% Utilization Scenario.	Chevron	Prior to commencement of Project operations	City of Richmond Building Division and Engineering Services Department/ Hydrologist	Review and verification, continuous during construction
4.9-1c: If the Modernization Project increases wastewater generation above the 93% Utilization Scenario, any increases in wastewater generation shall be offset by implementation of additional water reuse projects, which may include (1) reuse of stripped sour water from 8 and 18 plants to supply wash water for the FCC FHT and hydrocracker located in the North Isomax area; and (2) reuse stripped sour water from 8 and 18 plants to supply wash water for lube crackers in the Richmond lube oil plant area. Additional or alternative stripped sour water reuse measures could also be implemented to assure no net increase in wastewater generation with City approval.	Chevron	Immediately following any increase in utilization above the 93% scenario	City of Richmond Building Division and Engineering Services Department/ Hydrologist	Review and verification, once after new hydrogen plant is fully operational and at least annually thereafter
4.9-2: Any stockpiles of soils containing contaminants generated under the Modernization Project shall be covered with plastic sheeting to ensure that sediments and pollutants are not entrained in runoff	Chevron/Project Contractor	During construction; within 90 days of hazardous waste generation (if	City of Richmond Building Division and Engineering Services Department/	Review and verification, continuous during construction

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
or infiltrated into the subsurface during rainfall events. Reuse or disposal of contaminated soils shall be completed in accordance with applicable laws and regulations. If the soil is a hazardous waste, it shall be disposed of off-site at a licensed facility within 90 days of generation.		required)	Hydrologist	
4.9-7: Within 5 years, Chevron shall retain qualified professionals to develop a Facility flood contingency plan that addresses all types of coastal flooding (i.e., storm-related flooding, extreme high tides, and tsunamis) and how these coastal flooding hazards will increase over time due to sea level rise. The contingency plan shall be submitted to the City of Richmond for review and approval.	Chevron/Project Contractor	Within 5 years of completion of construction	City of Richmond Planning & Building Services and Engineering Services Departments/ Hydrologist	Review and approval of contingency plan
4.10 LAND USE, PLANS, AND POLICIES				
Construction or operation of the Project would result in no-significant impacts related to land use, plans and policies. No mitigation is required or recommended.				
4.11 NOISE				
4.11-1a: If nighttime construction is required, no pile driving shall be allowed and the types and intensity of any construction activities shall be limited to ensure noise generation does not exceed the City's nighttime noise limit of 50 dBA or cause an increase greater than 5 dBA.	Chevron/Project Contractor	During nighttime construction activities	City of Richmond Building Division	Verification, continuous during nighttime construction

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Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
4.11-1b: If nighttime construction is required and the City of Richmond or the construction compliance and complaint manager receive verified complaints due to noise from the use of backup alarms, Chevron shall implement feasible measures to reduce this noise at the Facility boundary. Measures may include the use of alarms with ambient sensing/broadband technology instead of the traditional fixed level/ narrowband alarms or the use of administrative controls such as using a spotter or flagger and prohibiting all foot traffic in the work area.	Chevron/Project Contractor	During nighttime construction activities	Chevron and City of Richmond Planning & Building Services Department	Verification, continuous during nighttime construction
4.12 EMPLOYMENT, POPULATION, AND HOUSING				
Construction or operation of the Project would result in no-significant impacts related to employment, population or housing. No mitigation is required or recommended.				
4.13 PUBLIC SAFETY				
4.13-2a: Store hazardous materials for Modernization Project construction activities only in the construction staging locations identified in Figure 3-1 (*Chapter 3, Project Description*) unless an alternate location within a previously developed portion of the Facility is approved as part of the building permit approval process.	Chevron/Project Contractor	During construction	Chevron and City of Richmond Building Division	Verification, continuous during construction
4.13-2b: Implement worker training and safety requirements for construction workers, including emergency response and hot work and contractor refinery instructions as more fully described in *Section 4.13.2.3* and *Appendix 4.13-DET*, and report training and implementation of safety requirements monthly to the City during construction and demolition activities. Communicate location and scope of Modernization Project-related construction activities weekly to City and Facility management to avoid any conflicts between construction and refining	Chevron/Project Contractor	Prior to construction, and weekly and monthly during construction and demolition	Chevron and City of Richmond Building Division and Fire Prevention Bureau	Review monthly reports and weekly communication during construction

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
activities. The required implementation will include the new Leak Response Protocol developed since August 2012 (Chevron, 2012a).				
4.13-3a: Demolition and other construction wastes, and hazardous wastes, must be stored only in Facility locations approved by the City.	Chevron/Project Contractor	Prior to construction and during construction and demolition	Chevron and City of Richmond Building Division And Fire Prevention Bureau	Review and approval during construction and demolition
4.13-3b: Hazardous wastes must be transported off-site to an authorized disposal, treatment, or recycling facility by a transportation company with appropriate federal and state transporter licenses within 90 days after the wastes are generated.	Chevron/Project Contractor	Prior to construction and during construction and demolition	Chevron and City of Richmond Building Division	Review and approval during construction and demolition
4.13-3c: Non-hazardous demolition and construction waste must be transported off-site to an authorized disposal, recycling, or reuse facility by a transportation company with required transporter licenses within 180 days after the wastes are generated.	Chevron/Project Contractor	Within 180 days of waste generated during construction and demolition	Chevron and City of Richmond Building Division	Verification continuous during and 180 days after completion of construction and demolition
4.13-4a: Chevron will implement its Modernization Project Reliability Program (*Appendix 4.13-PROG*) including updating the detailed PHAs prepared for the 2008 Project for all new and modified Modernization Project components, which shall include ISSAs, damage mechanism reviews, and evaluation of the consequences thereof resulting from the Project, and LOPA, as part of these PHAs, prior to recommencement of construction of the Modernization Project, and again post-construction but before startup of Project operations for any changes that arise during construction that may affect the earlier PHAs, ISSAs, and LOPAs. Chevron will notify CCHS and the City of the availability of these PHAs, and make these PHAs available for review by CCHS and the City. The PHAs (initial and updates/revalidations), ISSAs, damage mechanisms	Chevron/Project Contractor	Prior to construction and again post-construction but before operations	Chevron, City of Richmond Planning Division, Fire Prevention Bureau, and Contra Costa Health Services	Review and verification prior to construction and again post-construction but before operations

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
reviews, and LOPAs shall be consistent with (proposed) amendments to the RISO. Chevron shall conduct the LOPAs and submit written LOPA reports, prepared in accordance with industry best practices (such as those issued by the Center for Chemical Process Safety) to CCHS and the City for review prior to construction (and post-construction, for those LOPAs warranting changes based on changes that arise during construction). CCHS will work with the City in implementing these and other Public Safety mitigation measures.				
4.13-4b: Chevron will submit to CCHS a revised RMP and Safety Plan for the modified and new equipment at the Facility, and shall cause a revised RMP and Safety Plan to be submitted by the operator of the new hydrogen plant, in accordance with the requirements established in the applicable regulations. The revised RMPs and Safety Plans shall be submitted by the earlier of: 1) prior to operations; and 2) timing requirements under applicable regulations. The revised RMPs and Safety Plans shall reflect integration of ISSA, including consideration of damage mechanisms and evaluation of the consequences thereof resulting from the changes, as well as the LOPAs, conducted as a part of PHAs (initial and PHA updates/revalidations), consistent with (proposed) amendments to the RISO. The RMPs must include all required components, including but not limited to a revised "off-site consequence" analysis of worst case and alternate scenarios (EPA, 2009), a revised accident prevention and training program, pre-startup safety reviews and prescribe training and safety requirements for contractors conducting hot work and other designated types of activities. The RMPs must cover accident risks that	Chevron	The earlier of: 1) prior to operations; and 2) timing requirements under applicable regulations.	City of Richmond Planning Division and Fire Prevention Bureau, and, Contra Costa Health Services	Review and verification prior to operations

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
have been identified in the Project-related PHAs, including inherently safer systems analyses conducted as a part of Project-related PHAs and management of change procedures. Chevron will report to the City acceptance of these plans by the CCHS prior to start-up of Modernization Project operations.				
4.13-4c: Chevron will submit an amended hazardous materials business plan to CCHSHMP via the California Environmental Reporting System (CERS) consistent with the timing requirements of the applicable regulations. Chevron shall cause to be submitted by the operator of the hydrogen plant an amended hazardous materials business plan to CCHSHMP. The amendments will reflect the modified and new equipment at the Facility, including the hydrogen plant. Chevron will provide written confirmation to the City of CCHSHMP's acceptance of the amended plans.	Chevron	Consistent with timing requirements of the applicable CCHSHMP regulations	City of Richmond Fire Prevention Bureau Department, CCHSHMP, and Contra Costa Health Services	Review and verification consistent with timing requirements of the applicable CCHSHMP regulations
4.13-4d: Chevron will revise the Facility's SPCC Plans and Facility ERPs consistent with the timing requirements of the applicable regulations, and shall cause the SPCC and ERPs for the hydrogen plant to be updated as well. Plan revisions must address the modified and new equipment at the Facility including the hydrogen plant. Chevron shall make the plans available for review upon request by CCHSHMP and EPA.	Chevron	Consistent with timing requirements of the applicable regulations	Applicable oversight agencies and City of Richmond Building Division; and Contra Costa Health Services	Review and verification consistent with timing requirements of the applicable regulations
4.13-4e: For the additional catalyst identified in Table 4.13-4 (at hydrogen plant and FCC FHT), Chevron will either send spent catalyst for metal reclamation or dispose of the spent catalyst that cannot be reclaimed to a secure and licensed facility. Chevron will maintain records on the amount of catalyst sent	Chevron	Annually post commencement of operations	Chevron and City of Richmond Building Division	Review and verification annually post commencement of operations

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
for reclamation and for disposal and report to the City annually on these amounts.				
4.13-4f: Chevron shall ensure, through its contractual arrangements with Praxair, that Praxair will comply with all mitigation measures in this EIR as they pertain to the new hydrogen plant, and shall require Praxair to cooperate with Chevron as needed to ensure the mitigation measures with regard to the hydrogen plant are effectively implemented. Prior to construction of the new hydrogen plant, Chevron shall provide to the City and County documentation reflecting that these requirements are included in contractual agreements between Chevron and Praxair.	Chevron	Prior to construction of Project's new hydrogen plant	Chevron and City of Richmond Building Division	Review and verification consistent with timing requirements of this measure.
4.13-5a: Chevron is required to continue to implement the following mitigations from the Long Wharf EIR (Chambers Group, Inc., 2006, 2007): OS-3b, OS-3c; OS-4; OS-6b; and OS-7a,b.	*See Mitigation Measures OS-3b, OS-3c; OS-4; OS-6b; and OS-7a,b from the Long Wharf Final EIR below.*			
4.13-5b: Implement Mitigation Measure 4.13-4d.	*See Mitigation Measure 4.13-4d.*			
4.13-5c: All spills and releases of hazardous materials or hazardous waste to the environment, including those from the transportation of these materials, must be reported within 48 hours to the City, and to the other appropriate regulatory agencies in accordance with the timing and other notification and reporting requirements prescribed by the applicable laws and regulations. Prompt cleanup of all such spills is also required.	Chevron/Project Contractor	Within 48 hours after all spills and releases of hazardous materials or hazardous waste, and in accordance with applicable laws and regulations	Chevron, City of Richmond Building Division, and Fire Department, and other appropriate regulatory agencies	Verification within 48 hours after all spills and releases of hazardous materials or hazardous waste, and in accordance with applicable laws and regulations
4.13-6: Prior to commencing construction, Chevron shall: 6a: For all Modernization Project new and modified equipment, including but not limited to the hydrogen plant, Chevron shall obtain new or amended building permits from the City's Building Department	Chevron	Prior to construction	City of Richmond Planning and Building Services Department	Review and verification prior to issuing building permits

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
pursuant to City Building Code and CBC requirements in effect at the time the permits are issued.				
6b: For all Modernization Project new and modified equipment, including but not limited to the hydrogen plant, that are subject to City of Richmond Fire Department permit requirements, Chevron shall obtain new or amended fire permits from the City of Richmond Fire Department pursuant to City Fire Code and the CFC requirements in effect at the time the permits are issued.	Chevron	Prior to construction	City of Richmond Fire Department	Review and verification prior to issuing permits
4.13-7a: Chevron shall implement the Modernization Project Reliability Program for all units and processes affected by the Modernization Project, including written reports specified in the Modernization Project Reliability Program. An initial Reliability Program report shall be submitted to the City and County prior to Project construction. Annual reports shall be submitted thereafter, including a report prior to commencement of Project operations. For the PHAs (initial and revalidations) specified in the Modernization Project Reliability Program, Chevron would complete the PHAs prior to commencement of Project construction, and again after construction but before startup of Project operations for any changes that may have arisen during construction that could affect the earlier PHAs. Chevron will thereafter update and revalidate PHAs in accordance with the RISO but not less than once every 5 years. As indicated in Mitigation Measure 4.13-4a, the PHAs shall include LOPAs, and written LOPA reports must be submitted to the County prior to construction for review, and Chevron shall submit a copy to the City simultaneously. To the extent that any post-construction PHA revalidations are warranted, Chevron shall submit LOPA reports for the post-	Chevron	Prior to construction, again prior to operations, annually thereafter, and in accordance with the RISO but not less than once every 5 years thereafter	City of Richmond Planning & Building Services Department and Contra Costa County Health Services	Review and verification prior to construction, again prior to operations, annually thereafter, and in accordance with the RISO but not less than once every 5 years thereafter

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
construction PHA revalidations to the County for review prior to the startup of Project operations, and Chevron shall submit a copy to the City simultaneously.				
4.13-7b: Chevron shall complete an ISSA (as defined in the RISO), including review damage mechanisms and evaluation of their consequences, and LOPAs with written LOPA reports submitted by Chevron to the County for review, for new and modified Modernization Project components as part of the PHA revalidation process specified in the Modernization Project Reliability Program and Mitigation Measure 4.13-9a. Chevron will make the ISSA and PHAs available for review by the CCHS and the City, and will submit the LOPA reports to the County prior to construction for review.	Chevron	Prior to construction, again prior to operations	City of Richmond Building Division and Engineering Services Department and Contra Costa Health Services	Review prior to construction, again prior to operations, annually and every 5 years thereafter
4.13-7c: Chevron will continue to review its procedures and programs for evaluating the hazards of planned changes at the Facility, and update them to incorporate damage mechanism review, including the identification of applicable damage mechanisms as well as the evaluation of the potential impacts of the damage mechanisms in light of the proposed changes, and layers of protection analysis consistent with the Reliability Program. Chevron's review and update of programs and procedures shall include, at a minimum, the Facility's management of change program/procedure and its PHA program/procedure. Chevron shall include, in its annual Modernization Project Reliability Program reports to the City, a description of the status of this documentation review and update process, as well as how the changes to these programs/procedures are being implemented at the Facility.	Chevron	Prior to operations	Chevron and City of Richmond Building Division and Engineering Services Department and Contra Costa Health Services	Prior to construction, again prior to operations, and annually thereafter

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
4.13-7d: Chevron will fund the costs of qualified third-party experts to assist CCHS and the City in the review of PHAs, ISSAs, and LOPAs completed for the Modernization Project pre- and post-construction, and will cooperate in providing access to Chevron documentation and facilities, as needed, for the third-party expert, CCHS, and the City to complete these reviews. At such time as the RISO is amended, and to the extent this amendment requires Chevron to fund a new, full-time chemical process safety inspector to do inspections at the Facility, Chevron shall provide to CCHS and/or the City the level of funding required to hire a new, full-time chemical process safety inspector for the Facility, and thereafter shall no longer be required to fund a separate third-party expert for post-construction reviews of PHAs, ISSAs, and LOPAs or other inspections.	Chevron /Project Contractor	Ongoing, as costs are incurred	City of Richmond Building Division and Engineering Services Department in consultation with Contra Costa Health Services	Review prior to construction and post-construction
4.13-7e: Chevron shall provide funding in a reasonable amount sufficient for the City to complete an air deposition background study of air quality at up to 20 locations in Richmond. The study may be done in conjunction with local high school science departments or otherwise, and may include quarterly sampling, using surface sampling collection pads, and certified laboratory analysis of such pads at locations to be determined. Study results shall be compiled annually, and made publicly available. Chevron will fund this program for a 5-year period following commencement of Modernization Project operations. In the event of a future accidental fire or other significant accidental release of air pollutants from the Facility, Chevron shall reimburse the City for the cost of engaging a qualified consultant to perform additional air deposition sampling and analysis to evaluate the magnitude and significance	Chevron	Ongoing, as costs are incurred	City of Richmond Building Division and Engineering Services Department	Verification of funding obligation prior to commencement of operations; verification of reimbursement obligations continuous thereafter, as necessary.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
of the release. The results of the post-accident deposition sampling will be publicly available.				
4.13-7f: Given the Modernization Project would include new equipment and operational practices at the Facility, Chevron will provide further training for and coordinate with the Richmond Fire Department prior to Modernization Project operations. Training would continue annually during Project operations.	Chevron	Prior to operation and annually thereafter	City of Richmond Fire Department	Verification prior to operation and annually thereafter
4.13-7g: Chevron shall work with the Contra Costa Sheriff's Department, the City, and other interested stakeholders, prior to the commencement of Project operations, to evaluate the existing CWS and to determine whether additional services would be beneficial, including but not limited to mechanisms for the provision of emergency messages and communications, translated into multiple different languages (considering possible integration with existing cell phone registration, email, and social media notification databases and systems), and the provision of emergency notifications to locations in the community where large numbers of people may congregate at any given time (such as shopping centers, transit centers such as Bay Area Regional Transit stations, Amtrak stations, and bus stations). Chevron shall contribute toward, and help identify additional funding for, such additional services.	Chevron	Prior to operation	Contra Costa County Sheriff's Department and City of Richmond Public Safety Department	Verification prior to operation

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
4.13-7h: Chevron will fund the costs of a third-party expert to assist the County and the City with the review of the Reliability Program reports and other submittals required by the Reliability Program and related mitigation measures, as needed. The third-party expert will be selected and retained by the County or the City within the County's or City's discretion. This funding obligation survives any amendment of the RISO that may require funding of an inspector for the Facility.	Chevron	Upon commencement of operations and continuous thereafter	City of Richmond Planning & Building Services Department, City of Richmond Building Division and Engineering Services Department; and Contra Costa Health Services	Review and verification upon commencement of operations and continuous thereafter.
4.13-7i: Chevron shall adhere to the total acid number (TAN) limits of 0.3 mg milligrams potassium hydroxide per gram (KOH/g) for crude, 1.5 mg KOH/g for sidecuts produced from the crude unit, and 1.0 for gas oils and blends processed through the fluid catalytic cracker, fluid catalytic cracker feed hydrotreater, hydrocracker, heavy neutral hydrocracker, and light neutral hydrocracker. If Chevron intends to process a feedstock for a short-term basis (i.e., up to 6 months) that exceeds these TAN limits, it must complete its Management of Change (MOC) process, which shall include a corrosion review, for the proposed deviation, and shall take into account any existing damage mechanism reviews as specified in Mitigation Measure 4.13-7c that have been prepared for the identified units and piping circuits. If Chevron intends to process a feedstock for a longer-term basis (i.e., more than 6 months) that exceeds these TAN limits, it must complete its MOC process for the proposed deviation, and the MOC shall include a reliability analysis to evaluate, among other things, existing process conditions, monitoring and inspection data, expected corrosion rates, metallurgy, existing damage mechanism reviews, and monitoring and	Chevron	Upon commencement of operations and continuous thereafter.	City of Richmond Planning & Building Services Department, City of Richmond Building Division and Engineering Services Department; and Contra Costa Health Services	Review and verification upon commencement of operations and continuous thereafter.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
inspection frequency. The MOC evaluation, for short or longer duration TAN deviations, shall include an evaluation of the potential hazards that could result from the TAN deviation in all affected units and piping circuits, including naphthenic acid corrosion impacts. Chevron shall designate a Facility Area Business Unit Manager with final decision-making authority to approve any TAN deviation from the TAN limits. Chevron shall provide the results of any TAN deviation MOC evaluation to the City and County before processing the feedstock that deviates from the established TAN limits. Chevron shall include in its annual Reliability Program reports: (a) details regarding the results of its MOC for any TAN deviations; (b) average annual TAN for crudes and gas oils/blends processed at the Facility for each calendar year starting with 2008; and (c) for any feedstock runs with TAN levels higher than established TAN limits, include the actual TAN levels of the deviating feeds and the duration of the deviating feedstock runs.				
4.13-7j: Chevron shall include in its annual Reliability Program reports the annual average sulfur content of feedstocks, including separate annual averages for crude oils/blends and gas oils/blends, processed at the Facility for each year since and including 2008.	Chevron	Upon commencement of operations and continuous thereafter	City of Richmond Building Division and Engineering Services Department; and Contra Costa Health Services	Verification due annually
4.13-8: Implement Mitigation Measures 4.13-4a, b, c, d, f; 4.13-5a, b, c; 4.13-6a, b; 4.13-7a, b, c, d, e, f, g, h, i, j; 4.13-11a, b, c.	*See referenced mitigation measures.*			

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
4.13-9a: Chevron will coordinate with the Contra Costa County Sheriff's Department, as owner and operator of the CWS, and other stakeholders, to work with local area schools (Washington Elementary School, Lincoln Elementary School, Peres Elementary School, Verde Elementary School) to ensure that their emergency response procedures and plans are adequate to minimize the risk to students in the event of a refinery incident. This shall include, as necessary, updating plans and procedures, providing emergency response equipment, and providing training to school staff. Chevron will coordinate with the Sheriff's Department and local area schools to ensure that the schools have operational National Oceanic and Atmospheric Administration weather radios and receive training on how to use them. Coordination will be completed prior to start of Modernization Project operations.	Chevron	Prior to operation	Chevron and Contra Costa County Sheriff's Department	Verification prior to operation
4.13-9b: Implement Mitigation Measures 4.13-4a, b, c, d; 4.13-6a, b; 4.13-7a, b, c, d, e, f, g; 4.13-11a, b, c.	*See referenced mitigation measures.*			
4.13-10a: If contamination is discovered during Modernization Project construction, the Facility will report the discovery to the City, the RWQCB, and any agency required to receive such notice under applicable law, and shall promptly manage, contain, treat, transport, and/or arrange for off-site disposal of such contaminated material as required by applicable law and existing RWQCB Order. Chevron shall also train construction workers to recognize contamination, and shall use authorized remediation contactors with trained workers to characterize and manage any contaminated media discovered during Modernization Project construction.	Chevron	During construction, in the event of contamination	Chevron, City of Richmond Building Division and Engineering Services Department, and RWQCB	Review and verification during construction, in the event of contamination

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
4.13-10b: If Modernization Project construction occurs in areas subject to RWQCB Order R2-2011-0036, Chevron will first receive approval of the construction activities from the RWQCB, as required under the order, and report the approval conditions to the City. Chevron will comply with applicable regulatory requirements and RWQCB approval conditions in managing the Modernization Project construction activities.	Chevron	Prior to construction in areas subject to RWQCB Order R2-2011-0036	Chevron, City of Richmond Building Division and Engineering Services Department, and RWQCB	Review and verification during construction, in the event of contamination
4.13-11a: Update the Facility's emergency plan to assure that the Modernization Project would not impair implementation of the plan, and to assure that the plan is effective. Develop Emergency Operating Procedures for new and modified Modernization Project equipment. Revisions to the plan and procedures would include clear instructions to ensure all non-essential personnel stay outside of hazardous areas during an emergency. Incorporate revisions into a revised Safety Plan submitted to CCHS for approval and acceptance prior to commencement of Modernization Project operation, and report submission date and CCHS approval to the City.	Chevron	Prior to operation	City of Richmond Public Safety Department and Contra Costa Health Services	Review and verification prior to operation
4.13-11b: Ensure Facility personnel and contractors are trained on the revised emergency procedures, including to ensure all non-essential personnel stay outside of hazardous areas during an emergency. Maintain records on initial training and annual refreshers that can be provided to the City or County upon request.	Chevron	Prior to operation and annually thereafter	Chevron, City of Richmond Planning & Building Services Department, City of Richmond Public Safety Department, and Contra Costa Health Services	Review and verification prior to operation
4.13-11c: Chevron shall coordinate with the City, County, and other local and regional agencies, including BAAQMD and fire departments in neighboring communities, to plan and conduct periodic emergency response drills, to establish joint	City of Richmond Public Safety Department, Contra Costa Health Services, and	Prior to operation and annually thereafter	Chevron, City of Richmond Public Safety Department, and Contra Costa Health Services	Coordination, review, and verification prior to operation

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
operations centers and joint information centers, and to establish communications networks and protocols for emergency response communications extending to these neighboring communities and agencies to further develop the infrastructure and readiness for mutual aid as between these various agencies and fire departments, in the event of emergency response incidents.	Chevron			
4.13-12: Chevron will update its fire protection plan to address vegetated open space areas adjacent to process areas, and to assure that Chevron Fire Department personnel are trained and equipped to serve as first responders to a fire in these vegetated areas. The plan will be provided to and accepted by the Richmond Fire Department prior to start of Modernization Project operations. The plan must include: 12a: Fuel management, including seasonal mowing, removal of brush, trimming of trees, or other measures to reduce fuel loads during the dry season (i.e., from April 1 through November 30, unless extended by the Richmond Fire Department) in areas within 100 feet of process areas. 12b: Construction and seasonal maintenance of appropriate fire breaks (e.g., maintenance of unvegetated areas) to minimize size of fire in vegetated open space areas, provided no new vegetative clearing shall be completed until surveys have been completed for protected plants and animals, and the absence of such resources has been confirmed. 12c: Maintenance of fire roads in vegetated open space areas to provide immediate access to emergency responders, including removal of	Chevron	Prior to operation	City of Richmond Fire Department	Review and verification prior to operation

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
potential obstacles and brush and leveling of dirt roads on steep hillsides following the end of each rainy season (approximately April or May). 12d: Emergency response coordination, including enhanced mutual aid, protocols to assure adequate firefighter responses to vegetated open space area fires as well as Facility area.				
4.13-13a: Prior to restarting construction of the Modernization Project, and again prior to commencement of Project operations, Chevron shall submit to the City a report describing the status of its compliance with all corrective action measures (including, but not limited to, compliance with probationary terms) imposed or agreed to as a result of the agency proceedings relating to the August 6, 2012 fire. As part of this report, Chevron shall describe its ongoing consultations with the agencies that investigated the August 6, 2012 fire, including Cal/OSHA, the CSB, and Contra Costa County, including any feedback or direction that has been provided by those agencies concerning implementation of the corrective action and agency recommendations and Chevron's response thereto.	Chevron	Prior to construction and again prior to operation	City of Richmond Building Division and Engineering Services Department	Review prior to construction and again prior to operation
4.13-13b: Chevron will fund the costs of a qualified expert in refinery safety, to be selected and retained by the County and/or the City within the County's and/or City's discretion, to review the ISSAs, PHAs, LOPAs, and other safety documentation associated with events triggering such ISSAs, PHAs, or LOPAs. Chevron will also cooperate in providing access to Chevron documentation and facilities, as needed, for the expert, the County, and the City review. At such time as the RISO is amended, and to the extent this amendment requires Chevron to fund a new, full-time	Chevron	Prior to construction and continuous thereafter	City of Richmond Building Division and Engineering Services Department; and Contra Costa Health Services	Review prior to construction and continuous thereafter.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
chemical process safety inspector to do inspections at the Facility, Chevron shall provide to CCHS and the City the level of funding required to hire a new, full-time chemical process safety inspector for the Facility, and thereafter shall no longer be required to fund a separate third-party expert for reviews of PHAs, ISSAs, LOPAs, or other inspections.				
4.13-13c: Chevron will complete the tri-annual safety audits required by RISO. In addition, upon request by the County and/or City, Chevron shall fund the costs of a qualified third-party expert in refinery safety to perform a safety or compliance audit that would be provided to the County and/or City for review.	Chevron	Ongoing	City of Richmond Building Division and Engineering Services Department; and Contra Costa Health Services	Review and verification every 3 years
4.13-13d: Chevron will report to the City quarterly, and shall provide a copy of this report to the County, after Project approval on the status of the corrective actions taken to implement agency recommendations to Chevron resulting from the August 6, 2012 fire, as well as any corrective actions taken by Chevron as a result of its own investigation. To the extent that Chevron elects not to implement a recommendation made by an agency, Chevron shall include in these quarterly reports a detailed explanation of its rationale for doing so.	Chevron	Quarterly after Project approval	City of Richmond Building Division and Engineering Services Department	Review quarterly after project approval
4.13-13e: Chevron shall fund the City's coordination with the CSB, Cal/OSHA, the BAAQMD, and the EPA on their investigations regarding the Facility to the extent these agencies request City involvement or consultation.	Chevron	Upon agency request to City	City of Richmond Building Division and Engineering Services Department	Coordination upon agency request to City
4.13-13f: Chevron shall designate a Facility Area Business Unit Manager as the management level position bearing responsibility for any and all decisions to not implement a recommendation made during an inspection or turnaround. Chevron shall also designate a Facility Area Business Unit Manager	Chevron	Prior to commencement of operations and as required by this measure.	City of Richmond Building Division and Engineering Services Department; and Contra Costa Health Services	Review and verification prior to commencement of operations and at least annually thereafter

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
as the management level position bearing responsibility for the establishment of the parameters in the Integrity Operating Window program, as well as for any decisions to override, bypass, or otherwise disregard an alert or flag that arises through the Integrity Operating Window program. The annual Reliability Program reports shall include clear identification of the individuals acting as Area Business Unit Managers to whom these accountabilities have been assigned. If the management position bearing any of these responsibilities changes within Chevron from the Area Business Unit Manager to another management-level job title, Chevron shall notify the City and include an update to this effect in its Reliability Program annual report.				
4.13-13g: Prior to the issuance of building and fire permits for the Project, Chevron shall provide to the City documentation demonstrating that it has completed implementation of (to Cal/OSHA's satisfaction) or otherwise discharged (through administrative appeal) all corrective or abatement actions resulting from Cal/OSHAs investigation following the August 2012 fire, and from Cal/OSHAs temporary leak seal investigation.	Chevron	Prior to issuance of building and fire permits	City of Richmond Building Division and Engineering Services Department	Review and verification prior to issuance of building and fire permits.
4.13-13h: Chevron shall establish Integrity Operating Windows (IOWs) to monitor process temperatures for purposes of identifying process temperature increases above the baseline period (2008-2010) for any individual circuit affected by the Modernization Project (as indicated in the Reliability Analysis Appendix 4.13-REL). The IOW shall establish temperature "flags" for each temperature monitoring location based on industry-standard damage curves. Prior to implementation of the IOW temperature flags,	Chevron	Upon commencement of Project operations and continuously thereafter	City of Richmond Planning & Building Department; City of Richmond Building Division and Engineering Services Department; Contra Costa Health Services	Annually and as reports are submitted

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
Chevron shall provide information to the City and County regarding the flag trigger temperature levels and the basis for them, and provide the City and County an opportunity to review and comment on them before they are implemented. The IOW-2 temperature flag shall be triggered if the process temperature exceeds the established temperature for a cumulative 365 days, and shall require Chevron to perform a reliability analysis to evaluate, among other things, existing process conditions, flag dates for wall thickness, monitoring and inspection data, expected corrosion rates, metallurgy, existing damage mechanism reviews, and monitoring and inspection frequency. Chevron shall report the results of these reliability analyses in its annual Reliability Program report, and shall make process temperature data for all temperature monitoring locations within each process unit and circuit included in the Reliability Analysis (Appendix 4.13-REL) available for review by the City or County at the refinery. Chevron also shall include in its annual Reliability Program reports a listing of all events relating to process temperatures reaching levels that triggered a IOW-level 2 (defined by Chevron as a "slower acting event that requires technical evaluation and recommendations within one week") alert during the calendar year that is the subject of the annual report, as well as a description of the resolution of each such event. Chevron shall report to the City and County within one week of any IOW-level 1 (defined by Chevron as a "fast acting event that requires operator action within a shift or two") alert event relating to IOW process temperature parameters for circuits affected by the Modernization Project (as indicated by the Reliability Analysis Appendix 4.13-REL).				

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
Note: See Table 9-3 for the Mitigation Measures from the Long Wharf Final EIR that are applicable to the Modernization Project.				
4.14 PUBLIC SERVICES				
Construction or operation of the Project would result in no-significant impacts related to public services. No mitigation is required; however some improvement measures are recommended (see Table 9-2).				
4.15 PARKS AND RECREATION				
Construction or operation of the Project would result in no-significant impacts related to parks and recreation. No mitigation is required or recommended.				
4.16 TRANSPORTATION				
4.16-1: Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) and Caltrans to provide modified traffic control implemented at the intersection of Castro Street/I-580 Westbound Ramps during peak arrival and departure times in the PM peak hour. The modified traffic control shall be accomplished by one or more of the following methods: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs of Richmond police officers or other law enforcement personnel to provide the traffic control under above-cited methods (1) or (3).	Chevron/Project Contractor	During construction in PM peak period	City of Richmond Public Works Department in consultation with Caltrans	Coordination and verification, continuous during construction
4.16-2: The following measures shall be implemented at the intersection of Richmond Parkway/Gertrude Avenue: 2a: Chevron shall work with the director of the City of Richmond Public Works Department (or the director's	Chevron/Project Contractor	During construction in PM peak period	City of Richmond Public Works Department in consultation with Caltrans	Coordination and verification, continuous during construction

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
designated representative) to provide modified traffic control during peak arrival and departure times in the PM peak hour. The modified traffic control shall be accomplished by one or more of the following methods: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs for sheriff's deputies or other law enforcement personnel to provide the traffic control under above-cited methods (1) or (3). 2b: During the peak congestion periods, through the use of traffic cones (and flaggers as needed), Chevron shall reconfigure the southbound (Richmond Parkway) approach to the intersection to provide one shared left-through lane, one through lane, and one shared right-through lane.				
4.16-3: Mitigation Measure 4.16 1 shall be implemented.		*See Mitigation Measure 4.16-1.*		
4.16-4: The following measure shall be implemented at the intersection of Castro Street/Hensley Street: Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) to provide modified traffic control during peak arrival and departure times in the PM peak hour. The modified traffic control shall be accomplished by one or more of the following methods: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers);	Chevron/Project Contractor	During construction in PM peak period	City of Richmond Public Works Department	Coordination and verification, continuous during construction

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
(2) programming an alternate signal timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs of law enforcement personnel to provide the traffic control under above-cited methods (1) or (3).				
4.16-5: Mitigation Measure 4.16-2 shall be implemented.		*See Mitigation Measure 4.16-2.*		
4.16-6: Mitigation Measure 4.16-1 shall be implemented.		*See Mitigation Measure 4.16-1.*		
4.16-7: The following measures shall be implemented, in consultation with the Public Works Director or his designee, at the intersection of Castro Street/General Chemical Access:				
7a: During the AM peak period, through the use of traffic cones (and flaggers as needed), Chevron shall reconfigure the northbound (Castro Street) approach to the intersection to provide two left-turn lanes and one shared right-through lane. The inbound approach on General Chemical Access shall also be reconfigured to provide two receiving lanes.	Chevron/Project Contractor	During construction in AM peak period	City of Richmond Public Works Department	Verification, continuous during construction
7b: During the PM peak period, through the use of traffic cones (and flaggers as needed), Chevron shall reconfigure the eastbound (General Chemical Access) approach to the intersection to provide two exclusive right-turn lanes and one exclusive left-turn lane.	Chevron/Project Contractor	During construction in PM peak period	City of Richmond Public Works Department	Verification, continuous during construction
7c: Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) to provide modified traffic control during peak arrival and departure times in the AM and PM peak hours. The modified traffic control shall be accomplished by one or more of the	Chevron/Project Contractor	During construction in AM and PM peak periods	City of Richmond Public Works Department	Coordination and verification, continuous during construction

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
following methods: (1) posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers); (2) programming an alternate signal timing plan that would be in operation during specified peak commute periods; and/or (3) posting traffic control officers at the intersection to manually control traffic movements. Chevron shall pay the full cost of this measure, including costs of law enforcement personnel to provide the traffic control under above-cited methods (1) or (3).				
4.16-8: Mitigation Measure 4.16-4 shall be implemented.		*See Mitigation Measure 4.16-4.*		
4.16-9: Mitigation Measure 4.16-2 shall be implemented.		*See Mitigation Measure 4.16-2.*		
4.16-10: Chevron shall repair any roads damaged as a result of Modernization Project construction activity to a structural condition equal to that which existed prior to construction activity. Prior to Project construction, City of Richmond Public Works Department or the Director's designated representative would document road conditions for all routes that would be used by Project construction-related vehicles. The City would also document road conditions after Project construction is completed. The pre- and post-construction conditions of the haul routes shall be reviewed, and Chevron or contractor(s), and staff of the Public Works Department, would enter into an agreement prior to construction that details the pre-construction conditions and the post-construction requirements of a rehabilitation program.	Chevron/Project Contractor	Prior to and after construction	City of Richmond Public Works Department	Document road conditions prior to construction and after construction, verification of any needed repairs
4.16-11: These intersections are maintained by the County, and thus the City has no independent jurisdiction to enforce any requirement to mitigate	Chevron and City of Richmond Public Works Department	During construction	City of Richmond Public Works Department	Coordination and verification, continuous during

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
impacts at these intersections. However the City and Chevron shall coordinate with the Contra Costa County Department of Public Works to implement the following mitigation measure at the intersections of Richmond Parkway and Pittsburg Avenue and Richmond Parkway and Parr Boulevard: 11a: Collect traffic data at the Richmond Parkway/Pittsburg Avenue and Richmond Parkway/Parr Boulevard intersections two weeks after start of construction during the AM and PM peak commute periods (6:00 to 9:00 a.m. and 4:00 to 6:00 p.m.). If traffic data indicate that either or both intersections operate below the established standard (i.e., LOS E or LOS F), Chevron shall work with the director of the City of Richmond Public Works Department (or the director's designated representative) in coordination with the Contra Costa County Public Works Department to implement one or more of the of the following during the construction period: 1. Provide modified traffic control during the peak AM and/or PM peak commute periods. The modified traffic control shall be accomplished by one or more of the following methods: a. Posting a technician at the intersection to manually operate signal controls (using the police key feature of standard traffic signal controllers) b. Programming an alternate signal timing plan that would be in operation during the peak commute periods c. Posting traffic control officers to manually control traffic movements during peak				construction

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
commute periods 2. Using cones and/or flaggers, temporarily reconfigure the lane assignments at the intersection during peak AM and/or PM peak commute periods Chevron shall pay the full cost of this measure, including costs of law enforcement personnel to provide the traffic control under above-cited methods (1) or (2).				
4.16-12: Chevron shall post the correct emergency information at the Richmond Lane rail spur crossings in accordance with GO 75-D and evidence of compliance shall be provided to the City prior to issuance of any building or grading permits. All construction located near the rail track within the Project site shall comply with the Public Utilities Commission's General Orders (GO). Details on the Commission's General Orders are located here: http://www.cpuc.ca.gov/crossings. These General Orders consist of: ▪ GO 26-D: Clearances on railroads and street railroads as to side and overhead structures, parallel tracks and crossings ▪ GO 72-B: Construction and Maintenance – Standard types of pavement construction at railroad grade crossings ▪ GO 75-D: Warning Devices for at-grade railroad crossings ▪ GO 88-B: Alterations of railroad crossings ▪ GO 118: Construction, reconstruction and maintenance of walkways and control, of vegetation adjacent to railroad tracks.	Chevron	Prior to grading permit issuance	City of Richmond Public Works Department	Review and verification prior to grading permit issuance.

TABLE 9-1 MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Mitigation Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency
4.17 UTILITIES AND SERVICES				
Construction or operation of the Project would result in no-significant impacts related to utilities and services. No mitigation is required; however an improvement measure is recommended (see Table 9-2).				

TABLE 9-2 IMPROVEMENT MEASURE MONITORING AND REPORTING PROGRAM

Improvement Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency	Verification By/Date
AIR QUALITY					
4.3-3: The Modernization Project shall implement reasonable and prudent practices to reduce PM_{10} and $PM_{2.5}$ emissions from construction equipment to further reduce this less-than-significant impact. Such practices may include, but are not limited to, the following: 3a: Idling time of diesel-powered construction equipment shall be minimized. 3b: Off-road equipment (more than 50 horsepower) to be used in the construction project (i.e., owned, leased, and subcontractor vehicles) shall be newer, since newer equipment may achieve a Project-wide fleet-average 20% NO_x reduction, and 45% PM reduction compared to the most recent CARB fleet average. Acceptable options for reducing emissions include the use of late-model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available. 3c: All construction equipment, diesel trucks, and generators shall be equipped with Best Available Control Technology for emission reductions of NO_x and PM. 3d: Contractors should use equipment that meets CARB's most recent certification standard for off-road heavy duty diesel engines.	Chevron/Project Contractor	During construction activities	Chevron, BAAQMD and, City of Richmond Building Division and Engineering Services Department	Review and verification, regularly during construction	

TABLE 9-2 IMPROVEMENT MEASURE MONITORING AND REPORTING PROGRAM

Improvement Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency	Verification By/Date
4.14 PUBLIC SERVICES					
4.14-1: 1a: During the construction phase, Chevron shall hire additional security services as necessary to compensate for the increase in personnel on-site. 1b: Mitigation Measures 4.16-1 through 4.16-5 and Improvement Measure 4.16-1 through 9 (see Section 4.16, Transportation and Traffic) shall be implemented to reduce the demand for help from the Richmond Police Department for traffic-related issues.	Chevron/Project Contractor	During construction	City of Richmond Public Safety Department	Review and verification, continuous during construction	
4.14-2: Chevron and the Richmond Fire Department shall establish an agreement that ensures training on new equipment and the acquisition of any necessary heavy equipment (e.g., large diameter hoses, large scale pumping equipment).	Chevron/Project Contractor and City of Richmond Fire Department	During construction, prior to and during operations	City of Richmond Fire Department	Review and verification, continuous during construction, prior to and during operations	
4.16 TRANSPORTATION					
4.16-1 through 9: Chevron shall implement one or more of the following measures to further reduce Modernization Project construction impacts by reducing construction-related traffic trips during the AM and PM peak hours. 1 through 9a: Chevron shall stagger the hours of operation of the craft labor so that the construction-related traffic would be distributed over the peak and non-peak hours of traffic operation.	Chevron/Project Contractor	During construction	City of Richmond Public Works Department	Review and verification, continuous during construction	

TABLE 9-2 IMPROVEMENT MEASURE MONITORING AND REPORTING PROGRAM

Improvement Measures	Implemented By	When Implemented	Monitored By	Monitoring Action and Frequency	Verification By/Date
1 through 9b: Chevron shall promote the use of car-sharing by the craft labor. 1 through 9c: Chevron shall coordinate the schedule among construction of the Modernization Project, construction of the other projects, and the major facility turnaround to minimize combined traffic generation on any single day.					
4.17 UTILITIES AND SERVICES					
4.17-1: Prior to issuance of a demolition, grading, or building permit, Chevron shall submit a Debris Recovery Plan and Debris Recovery Report demonstrating that at least 50% of the construction and demolition debris generated on the jobsite is reused, recycled, or otherwise diverted. The Debris Recovery Plan shall be submitted to the City for review and approval.	Chevron/Project Contractor	Prior to issuance of a demolition, grading, or building permit	City of Richmond Building Division and Engineering Services Department	Review Debris Recovery Plan and Debris Recovery Report prior to issuance of a demolition, grading, or building permit	

TABLE 9-3 EXCERPTS FROM CHEVRON LONG WHARF MARINE TERMINAL EIR – MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Impact	Mitigation Measure	Monitoring/ Reporting Action	Effectiveness Criteria	Responsible Agency	Timing
OS-3: Chevron's response capability for containment of spills during transfer operations would result in adverse and significant impacts for spills greater than 50 bbls. Consequences would range from spills that can be contained during first response efforts with rapid cleanup (Class II), to those complex spills that result in a significant impact (Class I) with residual effects after mitigation.	**OS-3b:** Install tension-monitoring devices at Berth 1 to monitor mooring lines and avoid excessive tension or slack conditions that could result in spills. An alarm system (visual and sound) that incorporates communication to the control-building operator shall also be a part of the system. In addition, if any vessel drifts (surge or sway) more than 7 feet from its normal manifold or loading arm position at any other terminal berth, Chevron shall install, within 6 months after the incident, tension-monitoring devices at such berth.	CSLC monitor to observe devices after installation.	Reduces potential for damages and spills.	CSLC	Within 12 months of lease implementation, unless otherwise specified. If any vessel drifts more than 7 feet from its normal position, install within 6 months of occurrence.
	OS-3c: Install Allision Avoidance System (AAS) at the terminal to prevent damage to the pier and/or vessel during docking operations. Prior to implementing this measure, Chevron shall consult with the San Francisco Bar Pilots, the U.S. Coast Guard, and the staff of the CSLC and provide information that would allow the CSLC to determine, on the basis of such consultations and information regarding the nature, extent and adequacy of the existing berthing system, the most appropriate application and timing of an AAS at the Chevron Long Wharf.	CSLC monitor to observe devices after installation.	Reduces potential for damages and spills.	CSLC	Within 12 months of lease implementation, unless otherwise specified.

TABLE 9-3 EXCERPTS FROM CHEVRON LONG WHARF MARINE TERMINAL EIR – MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Impact	Mitigation Measure	Monitoring/ Reporting Action	Effectiveness Criteria	Responsible Agency	Timing
OS-4: Group V oils have a specific gravity greater than 1 and do not float on the water; instead, they will sink below the surface into the water column or possibly to the bottom. Chevron states in their Spill Preparedness and Emergency Response Plan that no reasonable technology currently exists for a Group V response in the San Francisco Bay. Thus, a release of a Group V oil could result in significant impacts (Class I).	**OS-4:** Chevron shall confer with the California State Lands Commission (CSLC) regarding Group V oil spill response technology including potential new response equipment and techniques that may be applicable for use at the Long Wharf. Chevron shall work with the CSLC in applying these new technologies, as agreed upon, if recommended for this facility**.**	Chevron shall submit biannual report on status of new technology and equipment to CSLC.	Provides flexibility in lease to up MM and improve response capability.	CSLC	Submit biannual report for life of lease.
OS-6: Public areas are beyond the hazard footprint boundary; thus fires and explosions would not cause a public safety risk. However, the Wharf's Operations Manual does not address fire emergency procedures and a fire and/or explosion could lead to a release of oil. Since MOTEMS became effective, February 6, 2006, Chevron is required to be consistent with the requirements of sections 3102F3.8 and 3108F2.2 of 24 CCR, Part 2, California Building Code, Chapter 31F for a MOT Fire Plan.	**OS-6b:** Chevron shall develop a set of procedures and conduct training and drills for dealing with tank vessel fires and explosions for tankers berthed at the Long Wharf. The procedures should include the steps to follow in the event of a tank vessel fire and describe how Chevron and the vessel will coordinate activities. The procedures shall also identify other capabilities that can be procured if necessary in the event of a major incident. The procedures shall be submitted to the U.S. Coast Guard and California State Lands Commission within 90 days of lease renewal.	Chevron shall prepare and submit procedures to CSLC and US Coast Guard for review and approval.	Provides planning and procedures for emergency response.	CSLC	Submit to CSLC within 90 days of lease implementation.

TABLE 9-3 EXCERPTS FROM CHEVRON LONG WHARF MARINE TERMINAL EIR – MITIGATION MEASURE MONITORING AND REPORTING PROGRAM

Impact	Mitigation Measure	Monitoring/ Reporting Action	Effectiveness Criteria	Responsible Agency	Timing
OS-7: Spills from accidents in the Bay could result in impacts to water quality or biological resources that could be significant adverse (Class II) impacts for those that can be contained during first response efforts; or significant adverse (Class I) impacts that would have residual impacts. While Chevron does not have legal responsibility for tankers it does not own, it does have responsibility to participate in improving general response capabilities.	**OS-7a:** Chevron shall participate in an analysis to determine the adequacy of the existing VTS in the Bay Area, if such a study is conducted by a Federal, State, or local agency during the life of the lease. Agencies such as the San Francisco Bay Harbor Safety Committee often conduct studies of safety issues within the Bay Area. As vessel traffic increases in and around the Bay Area and as technology improves, it may be necessary and feasible to upgrade and expand the VTS in and around the Bay Area. Chevron shall participate in this analysis and contribute a pro-rata share toward the upgrade and expansion of the system, if required to do so by the CSLC.	This shall be implemented as a lease condition. Chevron shall demonstrate to CSLC their participation in program strategies to protect sensitive resources.	Reduces potential damage to resources.	CSLC	Life of lease.
	OS-7b: Chevron shall respond to any spill from a vessel traveling to or from the wharf, moored at its wharf, related in any way to the wharf, or carrying cargo owned by Chevron, as if it were its own, without assuming liability, until such time as the vessel's response organization can take over management of the response actions in a coordinated manner.	This shall be implemented as a lease condition. CSLC monitor to observe emergency actions.	Reduces potential damage to resources.	CSLC	Life of lease.