Jordan Cove Energy Project L.P.

Resource Report No. 1

General Project Description

Jordan Cove Energy Project

March 2017

JCEP LNG TERMINAL PROJECT

Resource Report 1 - General Project Description

MINIMUM FILING REQUIREMENTS	**See the Following Resource Report Section :**
1. Provide a detailed description and location map of the project facilities –18 CFR § 380.12(c)(1)	Section 1.3 Figure 1.1-1
2. Describe any nonjurisdictional facilities that would be built in association with the project – 18 CFR § 380.12(c)(2)	Section 1.9
3. Provide current original U.S. Geological Survey (USGS) 7.5-minute-series topographic maps with mileposts showing the project facilities – 18 CFR § 380.12(c)(3)	Figure 1.10-1
4. Provide aerial images or photographs or alignment sheets based on these sources with mileposts showing the project facilities 18 CFR § 380.12(c)(3)	Figure 1.10-2
5. Provide plot/site plans of compressor stations showing the location of the nearest noise-sensitive areas (NSA) within 1 mile – 18 CFR § 380.12(c)(3,4)	Figure 1.1-2 and Resource Report 9
6. Describe construction and restoration methods – 18 CFR § 380.12(c)(6)	Section 1.5
7. Identify the permits required for construction across surface waters – 18 CFR § 380.12(c)(9)	Section 1.8 Table 1.6-1
8. Provide the names and address of all affected landowners and certify that all affected landowners will be notified as required in § 157.6(d) – 18 CFR § 380.12(c)(10)	Section 1.8.1.1 Appendix A.1 (to be provided in a subsequent filing)

INFORMATION OFTEN MISSING AND RESULTING IN DATA REQUESTS	**See the Following Resource Report Section:**
1. Describe all authorizations required to complete the proposed action and the status of applications for such authorizations, including actual or anticipated submittal and receipt dates.	Section 1.8 and Table 1.6-1
2. Provide plot/site plans of all aboveground facilities that are not completely within the right-of-way.	Figure 1.1-2
3. Provide detailed typical construction right-of-way cross-section diagrams for each proposed right-of-way configuration showing information such as widths and relative locations of existing rights-of-way, new permanent rights-of-way, and temporary construction rights-of-way. Clearly identify any overlap of existing rights-of-way for projects involving collocation. Identify by pipeline facility and milepost where each right-of-way configuration would apply.	Figure 1.1-5
4. Summarize the total acreage of land affected by construction and operation of the project.	Table 1.4-1
5. Describe cathodic protection system; include associated land requirements as appropriate.	Not Applicable
6. Describe construction and restoration methods for offshore facilities as well as onshore facilities.	Section 1.5
7. For proposed abandonments, describe how the right-of-way would be restored, who would own the site or right-of-way after abandonments, who would be responsible for facilities that would be abandoned in place, and whether landowners were given the opportunity to request removal.	Not Applicable
8. If Resource Report 5, Socioeconomics is not provided, provide the start and end dates of construction, the number of pipeline spreads that would be used, and the workforce per spread.	Section 1.5.1
9. If project includes construction in the federal offshore area, include in the discussion of required authorizations and clearances the status of consultations with the Bureau of Ocean Energy Management, Regulation and Enforcement. File with the Bureau of Ocean Energy Management, Regulation and Enforcement for right-of-way grants at the same time or before filing the Federal Energy Regulatory Commission (FERC) application.	Not Applicable
10. For project involvement the import or export of natural gas/liquefied natural gas and construction of liquefied natural gas facilities, include in the discussion of required authorizations and clearances the status of consultations and authorizations required from the U.S. Department of Energy, U.S. Coast Guard, and the Federal Aviation Administration, as applicable.	Section 1.8 and Table 1.6-1
11. Send two (2) additional copies of topographic maps and aerial images/photographs directly to the environmental staff of the Office of Energy Projects.	Figures 1.10-1 and 1.10-2
12. Provide an electronic copy of the landowner list directly to the FERC environmental staff (check with FERC staff for required format).	Appendix A.1

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ACRONYMS

µg/Nm^3	Micrograms per Normal Cubic Meter
ACC	Air Cooled Condenser
API	American Petroleum Institute
BOG	Boil-off Gas
Bcf/d	Billion Cubic Feet Per Day
C&H	Coast and Harbor Engineering
CBEMP	Coos Bay Estuary Management Plan
CBNBWB	Coos Bay-North Bend Water Board
CCM	Concrete Cellular Mattress
CO_2	Carbon Dioxide
cy	Cubic Yards
DCS	Distributed Control System
DLCD	Oregon Department of Land Conservation and Development
DOE	United States Department of Energy
DOE/FE	United States Department of Energy Office of Fossil Energy
DOT	United States Department of Transportation
Dth/d	Dekatherms Per Day
EIA	Energy Information Administration
ESD	Emergency Shutdown System
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FGS	Fire and Gas Systems
FTA	Free Trade Agreement
gpm	Gallons Per Minute
H	Horizontal
H_2S	Hydrogen Sulfide
HRSG	Heat Recovery Steam Generator
ICSS	Instrument Control and Safeguarding System
I/O	Input/Output
IWWP	Industrial Waste Water Pipeline
JCEP	Jordan Cove Energy Project, L.P.
kV	Kilovolt
LNG	Liquefied Natural Gas
LOI	Letter of Intent
LOR	Letter of Recommendation
m^3	Cubic Meter
m^3/hr	Cubic Meter Per Hour
mcy	Million Cubic Yards
MLLW	Mean Lower Low Water
mtpa	Million Tonnes Per Annum
MOF	Material Offloading Facility
MW	Megawatt
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act

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ACRONYMS (Continued)

NFPA	National Fire Protection Association
NGA	Natural Gas Act
NMFS	National Marine Fisheries Service
ODEQ	Oregon Department of Environmental Quality
ODSL	Oregon Department of State Lands
PCGP	Pacific Connector Gas Pipeline, LP
PHE	Powerhouse Enclosure
PLF	Project Loading Facility
ppmv	Parts Per Million Volume
psig	Pounds Per Square Inch Gauge
RFP	Roseburg Forest Products Company
SIS	Safety Instrumented Systems
SMR	Single Mixed Refrigerant
SORSC	Southwest Oregon Regional Safety Center
STG	Steam Turbine Generator
Tcf	Trillion Cubic Feet
US 101	U.S. Highway 101
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
V	Vertical
WSA	Waterway Suitability Assessment
WSR	Waterway Suitability Report

RESOURCE REPORT 1
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1.0 INTRODUCTION

Jordan Cove Energy Project, L.P. ("JCEP") is seeking authorization from the Federal Energy Regulatory Commission ("FERC" or "Commission") under Section 3 of the Natural Gas Act ("NGA") to site, construct, and operate a natural gas liquefaction and liquefied natural gas ("LNG") export facility ("LNG Terminal"), located on the bay side of the North Spit of Coos Bay, Oregon. JCEP will design the LNG Terminal to receive a maximum of 1,200,000 dekatherms per day ("dth/d") of natural gas and produce a maximum of 7.8 million tons per annum ("mtpa") of LNG for export. The LNG terminal will turn natural gas into its liquid form via cooling to about -260^{o}F, and in doing so it will reduce in volume to approximately 1/600th of its original volume, making it easier and more efficient to transport.

In order to supply the LNG Terminal with natural gas, Pacific Connector Gas Pipeline, LP ("PCGP") is proposing to contemporaneously construct and operate a new, approximately 235-mile-long, 36-inch-diameter natural gas transmission pipeline from interconnections with the existing Ruby Pipeline LLC and Gas Transmission Northwest LLC systems near Malin, Oregon, to the LNG Terminal ("Pipeline," and collectively with the LNG Terminal, the "Project"). PCGP will submit a contemporaneous application to FERC that will include its own set of resource reports with references to certain materials in the LNG Terminal resource reports.

FERC's National Environmental Policy Act ("NEPA") review process requires that an applicant submit an Environmental Report consisting of up to 13 individual resource reports. While the LNG Terminal and the Pipeline are interrelated projects, this Resource Report 1 provides a description of only the LNG Terminal and its purpose and need, as well as a specific description of the LNG Terminal facilities and certain non-jurisdictional facilities. This resource report also includes a description of the benefits to the local LNG Terminal area, land requirements, construction and operation procedures, and applicable regulatory approvals and coordination, as well as the current construction schedule for the LNG Terminal. Additionally, Appendix B.1 provides a discussion of the cumulative impacts that may result when the environmental effects associated with the Project are added to the impacts associated with other past, present, or reasonably foreseeable future actions.

This resource report is consistent with and meets or exceeds all applicable FERC filing requirements. A checklist showing the status of FERC's filing requirements for Resource Report 1 (18 CFR § 380.12) is included following the table of contents.

1.1 STATEMENT OF PURPOSE AND NEED

The overall Project purpose and need is to construct a natural gas liquefaction and deep-water export terminal capable of receiving and loading ocean-going LNG carriers, that receives its natural gas supply from a point near the intersections of the GTN Pipeline system and Ruby Pipeline system in Malin, Oregon. The Pipeline receipt point in Malin is strategically located to give international customers in Asia access to abundant supplies of natural gas from two burgeoning natural gas supply basins – one in the U.S. Rocky Mountains (through the existing Ruby Pipeline) and a second in western Canada (through the existing GTN Pipeline). The LNG Terminal, on the bay side of the North Spit of Coos Bay, would support receipt, liquefaction, storage, and loading of LNG onto ocean-going LNG tankers for delivery to export markets. The Project is a market-driven response to the availability of these burgeoning and abundant natural gas supplies, giving those supplies an efficient and cost-effective outlet. The Project is also a market-driven response to the growth of international, particularly Asian, natural gas markets.

1.2 PROJECT SUMMARY

1.2.1 Background

On September 4, 2007, JCEP filed an application with FERC to construct and operate an LNG import terminal at Coos Bay, Oregon, in Docket No. CP07-444-000. That same day, PCGP, in Docket No. CP07-441-000, filed an application with FERC to construct and operate a natural gas sendout pipeline connecting the JCEP LNG import terminal with existing natural gas transportation systems. In May 2009, FERC produced a final environmental impact statement ("FEIS") for Docket Nos. CP07-441-000 and CP07-444-000. The Commission authorized both the import terminal and the natural gas sendout pipeline on December 17, 2009. On April 16, 2012, the Commission vacated the previously issued certificates for the LNG import terminal in Docket No. CP07-444-000 and the associated sendout pipeline in Docket No. CP07-441-000.

On May 21, 2013, JCEP filed an application seeking authorization for its proposed LNG export terminal on the North Spit of Coos Bay in Coos County, Oregon, in Docket No CP13-483-000. PCGP filed its companion application with FERC for the supply pipeline to the proposed terminal on June 6, 2013, in Docket No. CP13-492-000. FERC conducted an extensive environmental review thereunder, issuing an FEIS in September 2015. On March 11, 2016, the Commission denied the applications for certificates in Docket Nos. CP13-483-000 and CP13-492-000, without prejudice to JCEP's and PCGP's refiling of new applications.

On January 23, 2017, JCEP and PCGP requested approval to participate in FERC's Pre-Filing Review Process to assist in the identification and proper assessment of issues and to obtain input on the development of the environmental resource reports. FERC granted this request on February 10, 2017, and assigned Docket No. PF17-4-000.

1.2.2 Market Demand and Economic Support for the Project

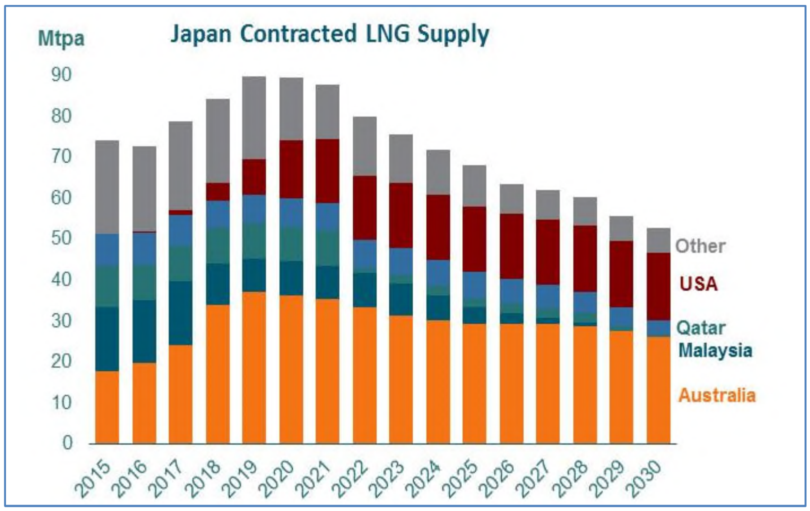
The Project would provide clean burning natural gas to Asian markets, which would reduce the amount of coal currently being burned in these markets for electric power generation and increase cleaner-burning supplies to other commercial and residential markets. The Project would also provide new market access for natural gas producers in the Rocky Mountains and Western Canada. These producers have seen their kaccess to markets in the eastern and central regions of the United States and Canada erode with the development and ramp-up of natural gas from the Marcellus and Utica shales. Two large under-utilized pipeline systems, the Ruby pipeline and the GTN pipeline, already exist to transport natural gas from these large gas supply basins to the Malin hub in southern Oregon. The Pipeline would be able to access these supplies and transport them to the LNG Terminal for export.

Global LNG Market

Demand for LNG is expected to grow 4% to 5% per year between 2015 and 2030, and LNG demand growth has exceeded expectations recently.[1] While many expected the market to be oversupplied in 2016, demand in Asia and the Middle East absorbed the increase in supply from Australia and the U.S. Chinese imports of LNG increased 33% in 2016 over the prior year, and India saw an increase of 25% over the same period. There were also six new importing countries in 2016 (Colombia, Egypt, Jamaica, Jordan, Pakistan and Poland), bringing the total number of LNG importing countries to 35. Shortages in domestic gas supplies in Egypt, Jordan and Pakistan led those countries to be among the fasting growing importers, importing a total of 13.9 million tons of LNG in 2016 during their first year of imports.

Despite the resurgent LNG demand, global LNG prices fell dramatically over the last two years following the slump in oil prices. This has led to new LNG supply projects being deferred or cancelled, and it will undoubtedly lead to a tightening of the global market post 2020. With few new supply projects and strong demand growth driven by India, China and Southeast Asia, the market is expected to recover by 2023, and LNG demand is expected to almost double by 2030, requiring an incremental 150 mtpa of new supply by the end of the next decade.

U.S. LNG exports are one of the lowest cost supply sources in the world and are expected to maintain their competitive advantage going forward due to the size and quality of the upstream natural gas resources in North America and the availability of infrastructure, including existing pipelines and road and rail infrastructure. The Project, by virtue of its West Coast location, has the further advantage of a shorter shipping distance to major Asian markets relative to other U.S. export projects. The distance from the Port of Coos Bay to Tokyo Bay requires nine days shipping as compared to 22 days from the Gulf of Mexico utilizing the recently expanded Panama Canal.



The Japanese Market

On March 22, 2016, JCEP announced that it had executed a preliminary agreement with JERA Co., Inc., the largest LNG buyer in the world, for the acquisition of at least 1.5 mtpa of LNG capacity from the Project. JERA was formed on April 1, 2015, and is a joint venture between Tokyo Electric Power Company and Chubu Electric Power Company, two of the largest Japanese power utilities. The joint venture was formed to combine the international energy assets of the two companies, including energy procurement and shipping. At formation, JERA had 40 mtpa of LNG supplies under contract. Following the announcement of the JERA agreement, JCEP announced the execution of a preliminary agreement with ITOCHU Corporation, a significant Japanese investment and trading firm, for the procurement of 1.5 mtpa of LNG capacity from the Project. Negotiations continue with other interested parties for the balance of the available plant capacity.

Demand in Japan is not dependent upon demand growth but is driven by the re-balancing of the supply portfolios held by Japanese companies. Twenty-five percent of Japan’s long term contracts expire between 2020 and 2025. U.S. LNG exports to Japan are positive from a number of standpoints. Japan is the most important U.S. ally in Asia, and increased U.S. imports will strengthen this alliance and improve the balance of trade between our two countries.

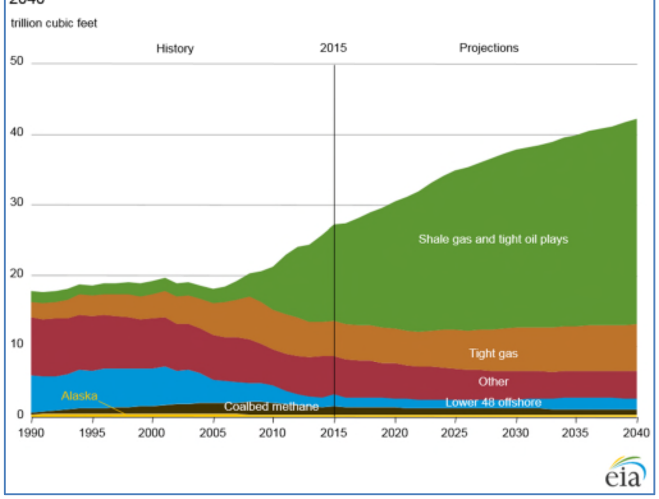
U.S. Market

The development of ultra tight shales and siltstones through horizontal drilling and hydraulic fracking has revolutionized the U.S. and Canadian long-term natural gas outlook. Resource estimates continue to climb as new and advanced exploration, well drilling, completion and stimulation technologies allow access to and delineation of more technically recoverable natural gas resources. The U.S. Energy Information Agency ("EIA") is an independent agency of the U.S. Federal Statistical System responsible for collecting, analyzing, and disseminating energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. As of January 1, 2014, the EIA estimated there was 2,136 trillion cubic feet ("Tcf") of technically recoverable natural gas resources yet to be delineated in the U.S., with natural gas from shale plays an increasingly large part of the mix. The Potential Gas Committee sponsored by the Colorado School of Mines in its biennial resource assessment estimated that at the end of 2014 technically recoverable resources were 2,515 Tcf. When combined with EIA's estimate of proved natural gas reserves of 308 Tcf of dry gas at the end of 2015, total U.S. natural gas resources are estimated at 2,444 Tcf to 2,823 Tcf, or approximately 100 years of natural gas supply at current rates of consumption.

Of particular importance to the Project, the U.S. Geological Society ("USGS") upgraded its assessment of technically recoverable natural gas resources in the Mancos Shale in the Piceance Basin of Colorado to 66 Tcf as compared to the USGS' 2003 assessment of 1.6 Tcf. The Piceance Basin is a key natural gas province that can be sourced by the Project through the Ruby pipeline for delivery to the Malin, Oregon gas hub.

None of these figures include technically recoverable natural gas resources from the Western Canadian Sedimentary Basin ("WCSB"), which can also access the Project by the GTN pipeline system. The current estimate of recoverable resources in the WCSB exceeds 1,000 Tcf with 449 Tcf of this from the Montney Formation as estimated in a joint report by the Canadian National Energy Board, the British Columbia Oil and Gas Commission, the Alberta Energy Regulator and the British Columbia Ministry of Natural Gas Development published in November 2013.

Figure MT-46. U.S. dry natural gas production by source in the Reference case, 1990–2040



One concern with U.S. LNG exports is the possible impact exports could have on natural gas availability and price in the U.S. market. In May 2014, the U.S. Department of Energy Office of Fossil Energy ("DOE/FE") announced its intention to undertake an updated economic study in order to gain a better understanding of how potential U.S. LNG exports between 12 and 20 Bcf/d could affect the public interest. Specifically, DOE/FE commissioned the EIA to update its 2012 LNG Export Study. This document is titled Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets, dated October 2014 (USEIA 2014). Further, DOE/FE determined that it would follow the EIA Study with an additional study that would evaluate the macroeconomic impacts of the exports evaluated in the EIA Study and directed the National Energy Technology Laboratory to facilitate this additional analysis. To carry out this task, The Center for Energy Studies at Rice University's Baker Institute and Oxford Economics were commissioned on behalf of the DOE/FE to undertake a scenario-based assessment of the macroeconomic impact of alternative levels of U.S. LNG exports under different assumptions for U.S. resource endowment, U.S. gas demand, and the international market environment. This document is titled The Macroeconomic Impact of Increasing U.S. LNG Exports ("Economic Study"), dated October 29, 2015 (USDOE 2015).

As related by the Economic Study, the outlook on North American gas supplies has undergone a dramatic reversal since 2008, when the general consensus was that supplies would be insufficient to keep pace with growing demand and that foreign-sourced LNG would need to be imported. As discussed above, the Economic Study identifies shale gas production growth as the biggest contributor to overall gas supply abundance due to the ramp-up in production of natural gas extracted from ultralow permeability and ultralow porosity shale formations in the U.S. The development and continuing improvement of hydraulic fracturing technology have led to increasingly efficient shale gas production, and shale gas production "has grown in less than a decade to comprise about one-half of U.S. domestic production" (USDOE 2015). Estimates of dry natural gas resources in the U.S. have likewise grown, reflecting significantly increased estimates of shale gas resources. The EIA's Annual Energy Outlook 2016 ("AEO 2016") (USEIA 2016) estimates that total U.S. dry natural gas production was 27.2 Tcf in 2015. Of this total amount of production for 2015, it is estimated that 13.6 Tcf, or 50 percent, came from shale gas and tight oil plays. Based on the AEO 2016 Reference Case, total U.S. dry natural gas production is projected to increase to 42.1 Tcf by 2040, of which approximately 69 percent is derived from shale gas and tight oil plays, leading the share of U.S. dry natural gas production growth (see EIA graph above).

The Economic Study also states that gas production will continue to grow steadily throughout the forecast period to 2040, as "the majority of the increase in LNG exports is accommodated by expanded production rather than reductions in domestic demand, a result that reflects the very elastic long-run supply curve in North America" (USDOE 2015). The Economic Study also states that increased production will also have a positive spillover to "key suppliers of the sector such as machinery and engineering services, and rising employment in the gas sector also leads to increased demand for goods and services more broadly" (USDOE 2015). Indeed, the growth potential is enhanced by the fact that the reduced geologic risk and resulting reliability of shale gas discovery and production make it responsive to demand and by the fact that the presence of natural gas liquids in some shale formations creates an added incentive for development.

For the demand outlook, the Economic Study projects steady growth, driven by demand in the industrial and power-generation sectors in the near term, and continued growth in power generation longer term. This projected growth is "driven by emerging environmental policies that target the use of coal" (USDOE 2015). Additionally, the AEO 2016 Reference Case estimates that total U.S. natural gas consumption will increase from 27.5 Tcf in 2015 to 34.4 Tcf in 2040. The AEO 2016 Reference Case also estimates that the U.S. will become a net exporter of natural gas in 2018 and that "growing natural gas production from shale gas and tight oil formations at relatively low prices support an increase in U.S. LNG exports of 6.7 Tcf from 2015-40" (USEIA 2016). Even as both domestic demand and net exports are projected to grow throughout the forecast period, U.S. natural gas production is sufficient to meet these increases. As technology improves in the development of shale resources, higher rates of recovery at lower costs occur.

According to both the Economic Study and the AEO 2016 report, growing natural gas demand in the industrial and electric power sectors and increasing exports of LNG place upward pressure on U.S. natural gas pricing. While this is occurring, the AEO 2016 report notes that improvements in drilling technology allow production to keep pace with demand, "resulting in relatively stable prices throughout the projection period." Examples of technology improvements include better rigs and drill bits, resulting in lower unit costs and the expansion of tight and shale gas formations. The Economic Study expects higher U.S. gas production and increased profitability of U.S. gas producers to "typically exceed the negative impacts of higher domestic natural gas prices associated with increased LNG exports" (USDOE 2015).

The Economic Study concludes that the overall macroeconomic impact of increasing U.S. LNG exports from 12 Bcf/d to 20 Bcf/d is marginally positive. "In aggregate the size of the economy is little changed in the long run, with GDP less than 0.1 percent ($7.7 billion USD annually in today's prices) higher on average over 2026-2040 than in the 12 Bcf/d export case" (USDOE 2015). While an increase in LNG exports from the U.S. will yield small declines in output for some energy-intensive industries, such as cement, concrete, and glass, "the estimated impact on sector output is very small compared to expected sector growth to 2040" (USDOE 2015). Also, since most of any U.S. LNG exports would be derived from increased extraction rather than diverted natural gas supplies, "other sectors benefit from increasing U.S. LNG exports, especially the industries that supply the natural gas sector or benefit from the capex needed to increase production. This includes some energy-intensive sectors such as cement and helps offset some of the impact of higher energy prices" (USDOE 2015). These conclusions are also consistent with the results from the EIA Study, which determined that "increasing LNG exports leads to higher economic output, as measured by real gross domestic product, as increased energy production spurs investment. This higher economic output is enough to overcome the negative impact of higher domestic energy prices over the projection period" (USEIA 2016).

In addition, the Project is capable of supplying natural gas to domestic users. Natural gas customers in Oregon situated along the route of the Pipeline, particularly those west of the Cascade Mountains, will stand to benefit from its construction in conjunction with the Project. Capacity on the Pipeline could bring additional natural gas supplies to this otherwise isolated market area, with concomitant beneficial price effects.

1.2.3 Current LNG Terminal and Pipeline Proposals

JCEP is proposing to develop an LNG facility with a nominal capacity of 7.8 mtpa of LNG. The LNG Terminal would be capable of receiving natural gas from the Pipeline, processing the gas, liquefying the gas into LNG, storing the LNG, and loading the LNG onto ocean-going carriers at its marine dock. PCGP proposes to construct and operate the Pipeline, an approximately 235-mile-long, 36-inch diameter pipeline between the Malin hub in Oregon and the LNG Terminal, crossing portions of Klamath, Jackson, Douglas, and Coos Counties, Oregon, that would be capable of providing 1,200,000 Dth/d of firm transportation service to the LNG Terminal. Attachment 1 contains location maps and plot plans to scale showing all major plant components. Also included in Attachment 1 is a diagram of the LNG Terminal and surrounding area that identifies the nomenclature for relevant land segments. The maps in Attachment 1b identify the Pipeline route, which incorporates information gathered during document reviews, field work, and consultation in Docket No. CP13-492. In accordance with the pre-filing review process, Applicants are committed to continuing the review of the Pipeline route alignment with stakeholders and working to address their concerns. Applicants will submit, in this docket, periodic updates of any changes in the Pipeline route.

The design of the proposed LNG Terminal reflects several enhancements from the prior proposal in Docket No. CP13-483. Hydrocarbon processing and combustion, including pre-treatment, will be located on Ingram Yard in an effort to create a more efficient footprint. The LNG Terminal will now utilize a direct drive configuration by relocating the gas turbines adjacent to the refrigerant compressors, thereby eliminating the need for the South Dunes Power Plant and associated transmission line, making the facility simpler, more efficient, and easier to operate. The workforce housing facility has been consolidated onto the South Dunes Site, reducing land and traffic impacts in the area of the previously proposed location at the North Point Site in North Bend adjacent to the suburb of Simpson Heights. The Southwest Oregon Regional Safety Center building has been relocated to the northeast portion of the South Dunes Site and the Fire Department has been relocated to the Utility Corridor, both further reducing land and wetland impacts while improving emergency response time.

JCEP currently anticipates that construction for the Project would begin in the first half of 2019, with a target in-service date in the first half of 2024. Major differences between the 2013 and 2017 export terminal proposals are further described below.

JCEP proposes herein a number of design enhancements to the proposal under Docket No.CP13-483-000. These changes will result in an enhanced system design and a reduction in overall environmental impacts.

The Project under Docket No. CP13-483-000 included the 420-megawatt ("MW") South Dunes Power Plant. Within the current proposal, the project proposes to use direct combustion-turbine liquefaction-drive instead of motor liquefaction-drive driven by electric power provided by the South Dunes Power Plant. A direct drive configuration is simpler, more efficient and easier to operate; and results in a number of reductions in environmental impact, including:

- Eliminates hydrocarbon processing combustion equipment from the South Dunes Site, which results in a single compact and consolidated facility process area on Ingram Yard;
- Eliminates the need for a railroad spur road overpass, reducing wetland impacts;
- Reduces combustion-turbine count from six to five, and maintains, and in some cases reduces, point source air emissions from the existing conditions permitted by the Oregon Department of Environmental Quality ("ODEQ");
- Reduces water consumption by 1 million gallons per day by eliminating the need for gas turbine water injection;
- Increases the distance from the nearest noise-sensitive receptors;
- Eliminates impacts on estuarine wetlands on the South Dunes Site;
- Allows for relocation of the workforce housing facility to the South Dunes Site addressing community concerns and significantly reducing workforce traffic movements on US Highway 101 during the working week; and,
- Allows for the relocation of the Southwest Oregon Regional Safety Center building to the northeast corner of the South Dunes Site and the elimination of 1 acre of wetland impacts.

In addition to the above enhancements, the following changes have been made to the design and construction of the LNG Terminal:

- Fire and other emergency incident response time has been improved by splitting the Fire Department building from the Southwest Oregon Regional Safety Center ("SORSC") building and relocating the Fire Department to the Utility Corridor from the South Dunes Site.
- The design now incorporates black-start capability; reducing impacts from the Project on local utilities by eliminating the need to draw and export electricity from the local grid for

operations. Limited temporary construction power within the capacity of the existing grid system will be utilized. Construction execution requires use of laydown areas at the Box Car Hill site and Roseburg Site; the Project will also be leasing portions of existing industrial facilities laydown yards within a 30-mile radius of the site to limit further the development footprint on the North Spit.

- The expansion of the Kentuck Mitigation Site from 33 acres to a more comprehensive Kentuck Project encompassing over 100 acres of wide-ranging habitat of mudflats, salt marsh, willowed scrub/shrubs and fish structures addressing a number of the key limiting factors Coho salmon face in this region; assisting in the species' removal from the endangered species list

Table 1.1-1 – Major Changes between CP13-483-000 and PF17-4-000 for the JCEP LNG Terminal Facilities

Element[i]	Proposed Size/Location	Reasons for the Changes
Elements Deleted From the Project		
Firewater Ponds	The firewater ponds have been deleted from the design and replaced with two (2) firewater tanks.	Reduces footprint, increased sanitation and fulfills multiple uses.
Gas Compressor Area	Gas compression is not included in the proposed design.	Gas compression is not required in the current design.
South Dunes Power Plant	The South Dunes Power Plant and the South Dunes Site Control Room (Control Room #2) have been eliminated.	Liquefaction will now be powered directly by gas-fired turbines, rather than by electric motors that previously would have required electricity generated at a separate, onsite power plant. Reduced footprint due to bringing development boundary south of Old Jordan Cove Road.
South Dunes Power Plant	The railroad spur bridge on the northwest corner of the South Dunes site has been eliminated.	Due to decrease in footprint size from the South Dunes Power Plant the existing rail line does not need to be shifted. Reduces wetland impacts.
Access/Utility Corridor	The 115kV overhead power transmission lines from the South Dunes Power Plant to the JCEP Facility have been deleted as the South Dunes Power Plant has been eliminated.	Transmission of electric power is no longer necessary due to direct turbine drive configuration.

Table 1.1-1 – Major Changes between CP13-483-000 and PF17-4-000 for the JCEP LNG Terminal Facilities

Element[i]	Proposed Size/Location	Reasons for the Changes
Access/Utility Corridor	The backup pilot gas line to the South Dunes Power Plant have been deleted as the South Dunes Power Plant has been eliminated.	No process fuel gas is required on South Dunes due to deletion of the South Dunes Power Plant.
Access/Utility Corridor	The access bridge from South Dunes to LNG Terminal in the Utility Access corridor east of Jordan Cove Road and the Roseburg Forest Products rail spur has been deleted.	Fire Department has been relocated to Utility and Access Corridor negating the need for an access route provided by the bridge.
North Point Workforce Housing	The Workforce Housing Facility has been moved from North Point and relocated to the South Dunes site.	Addresses community concerns and reduces workforce traffic movements on US Highway 101 during the working week.
Site F	Site F will no longer be used for construction Dredged Material Disposal; instead dredged material will be disposed on-site and off-site at the Kentuck Project.	The site has been cut and fill balanced and Site F is no longer necessary.
SORSC	The SORSC building has been relocated beside the administration building in the northeast corner of the South Dunes site. No fill will be placed on the previous site of the SORSC.	SORSC has been relocated, reduces wetland impacts.
Elements Added to the Project		
Off-site Temporary Construction Laydown and Staging Areas	Additional construction laydown area may be required off-site through selective leasing of adjacent brownfield land from the RFP property and Box Car Hill Site (that is suitably zoned for industrial purposes). The Project may also lease portions of existing industrial laydown yards within a 30 mile radius of the site to limit further development footprint on the North Spit.	Facilitation of safe and efficient construction methods.

Table 1.1-1 – Major Changes between CP13-483-000 and PF17-4-000 for the JCEP LNG Terminal Facilities		
Element[i]	**Proposed Size/Location**	**Reasons for the Changes**
Steam System	Black start capacity implemented by two (2) diesel generators.	Avoids drawing on local grid. Reduces impact on local utilities.
Slip and Access Channel– Lay Berth	An emergency lay berth for LNG carriers has been added to the west side of the marine slip. Dedicated access road on western boundary added for emergency lay berth access.	In response to USCG concerns, the emergency lay berth was added to mitigate the scenario of a disabled LNG tanker during port call.
Access/Utility Corridor	The Utility Corridor will include additional lines for the fire water supply to Admin and SORSC buildings; power to the Admin building.	Fire water protection systems and power generation on South Dunes were removed with deletion of South Dunes Power Plant.
Workforce Housing Facility	The Workforce Housing Facility has been relocated to the South Dunes site.	Addresses community concerns and reduces workforce traffic movements on US Highway 101 during the working week.
South Dunes Site	Added helicopter pad adjacent to the proposed SORSC building.	Agency requirement in ERP process.
Elements Modified in the Project		
Terminal Site Access	Previous primary site access was from Transpacific Parkway. Now, primary site access is from Jordan Cove Road with secondary access from Transpacific Parkway.	Improved access safety.
LNG Transfer Line/Loading Platform	LNG design loading rate has increased to 12,000m^3/hr. This was previously 10,000m^3/hr.	Decreased loading time. Still in compliance with PHMSA Vapor Dispersion requirements.
Liquefaction Process Area	The previous design included four (4) liquefaction trains and the current proposal includes five (5) liquefaction trains.	5 liquefactions trains efficiently match the gas turbine driver sizes selected.
Liquefaction Process Area	The nameplate liquefaction production capacity of the JCEP facility has been increased to 7.8 Mtpa. This was previously 6.8 Mtpa.	Liquefaction production capacity increased to reflect the production output expected with the site-specific ambient conditions.

Table 1.1-1 – Major Changes between CP13-483-000 and PF17-4-000 for the JCEP LNG Terminal Facilities

Element[i]	Proposed Size/Location	Reasons for the Changes
Liquefaction Process Area	Liquefaction will now be powered directly by gas-fired turbines, rather than by electric motors that required electricity generated at a separate, onsite power plant.	Reduced equipment count and increased efficiency.
Liquefaction Process Area	Reduction of the number of gas turbines from six (6) to five (5).	5 liquefactions trains efficiently match the gas turbine driver sizes selected.
Liquefaction Process Area	Water injection is no longer required on the gas turbines, saving approximately 1 million gallons of water a day.	Replaced with inlet chilling to meet same liquefaction power requirements.
On-site Laydown Areas	On-site laydown areas have been reconfigured.	Facilitation of safe and efficient construction methods.
Flare Area	There will be three (3) separate flare systems: one for warm (wet) reliefs, one for cold, cryogenic (dry) reliefs, and one marine flare for low-pressure cryogenic relief. The low-pressure cryogenic relief fully enclosed ground flare (marine flare) has been located at the southwest side of the LNG tank area. The warm and cold flare systems have been combined into one multi-point ground flare and moved to the north end of the facility. These were previously positioned north of the refrigerant storage area and in the South Dunes Power Plant area.	Evaluation of loading and LNGC requirements led to marine flare addition. Gas processing area relocation from South Dunes allowed consolidation of warm and cold flares,
Barge Berth	The barge berth has been renamed to Material Offloading Facility (MOF).	Slight reconfiguration to facilitate safer and efficient unloading.
Gas Processing Area	Gas conditioning is now located on the LNG Terminal. The Gas Processing Area was formerly located at the South Dunes site.	Consolidate all gas processing to the Liquefaction Area.

Table 1.1-1 – Major Changes between CP13-483-000 and PF17-4-000 for the JCEP LNG Terminal Facilities

Element[i]	Proposed Size/Location	Reasons for the Changes
South Dunes Site - Grading	The grading of the South Dunes Site has been modified to avoid impacts to estuarine wetlands.	Eliminates impacts on estuarine wetlands on the South Dunes Site.
Stormwater Pond/Laydown	The Stormwater Pond has been eliminated and laydown area has been expanded.	Stormwater pond not necessary due to decrease in impermeable surface area at South Dunes.
Slip and Access Channel - Access Channel	The access channel will be approximately 2,250 feet wide at the navigation channel end. This has reduced from 2,300 feet. The access channel width at the mouth of the slip is unchanged at 800 feet.	Design optimization
Slip and Access Channel - Access Channel	The access channel walls will be sloped to meet the existing bottom contours. Approximate slope of 3:1 will be used.	Increased usable footprint.
Slip and Access Channel - Marine Slip Basin	About 5.3 million cubic yards of material will be removed to create the marine slip basin. Approximately 1.23 million cubic yards will be land based excavation (dry upland material) and the remaining 4.07 million cubic yards will be wet material.	Optimized cut and fill balancing.
Slip and Access Channel - LNG Carriers	The number of ship calls at the LNG vessel berth has increased to 110 to 120. This number was previously 90 to 100.	Increase in plant capacity from 6.8 Mtpa to 7.8 Mtpa.
Preserved Sand Dune Area	A portion of this area will now be utilized for temporary construction laydown.	Facilitation of safe and efficient construction methods.
LNG Unloading Berth Dune	Previously this area was to be recontoured post-construction. Now, the area will not be recontoured post-construction.	Optimized cut and fill balancing.

Table 1.1-1 – Major Changes between CP13-483-000 and PF17-4-000 for the JCEP LNG Terminal Facilities

Element[i]	Proposed Size/Location	Reasons for the Changes
Pacific Connector Gas Pipeline Meter Station	The location has been shifted slightly northeast on the South Dunes Site.	Maximize land utilization, safe access and efficient operations.
Southwest Oregon Regional Safety Center	SORSC building has been relocated to the northeast corner of the South Dunes site and separated Fire Department to Access and Utility Corridor.	Reduces wetland impacts.
Access and Utility Corridor	The Fire Department has been relocated to the Access and Utility Corridor	Improves emergency response time. Reduces wetland impact at former location near SORSC building location.
Access and Utility Corridor	The 2-foot and 10-foot shoulders have been retained. The road itself will increase to a 36-foot-wide permanent roadway at grade.	Increase accessibility.
Control Building/Maintenance Building	Footprint has changed.	Efficient operational footprint.
Refrigerant Storage Area	Capacity and area are the same. The site has shifted to the interior of the LNG Terminal.	Increase distance to property boundary.
Site Elevations	Site elevation variances have decreased. Sight elevations are different in multiple areas.	Improved constructability and operational layout. Site elevations comply with functional and operational requirements.
Kentuck Project	Kentuck Mitigation Site expanded from 33 acres to a more comprehensive Kentuck Project encompassing over 100 acres of wide-ranging habitat.	A more comprehensive project has been developed.
Elements Unmodified in the Project		
Liquefaction Process	The liquefaction process is unchanged and still utilizes a single mixed refrigerant circuit with a two-stage compressor and a refrigerant exchanger.	

Table 1.1-1 – Major Changes between CP13-483-000 and PF17-4-000 for the JCEP LNG Terminal Facilities

Element[i]	Proposed Size/Location	Reasons for the Changes
LNG Tank Area	The construction design and storage volume of the LNG storage tanks is unchanged at 160,000m^3 each.	
Gas Processing Area	Feed gas supply remains unchanged. Pipeline quality feed gas will be supplied to the facility via the 36-inch-diameter Pacific Connector Gas Pipeline.	
Gas Processing Area	The pre-treatment of pipeline feed gas before it enters the liquefaction process is unchanged. The feed gas still undergoes Mercury (Hg) and Acid Gas (CO_2 and H_2S) removal and dehydration to remove moisture.	
Slip and Access Channel - LNG Vessel Berth	The size of LNG carrier that can be accommodated by the LNG berth is unchanged at 89,000m^3 to 217,000m^3.	
Slip and Access Channel - LNG Loading Arms	The number and size of the LNG loading arms at the LNG berth remain unchanged at three 16-inch diameter loading arms plus one 16-inch diameter vapor return arm.	
Preserved Wetlands Area	Unchanged	
Industrial Wastewater Pipeline Relocation	Unchanged	
Mill Casino Off-site Parking	Unchanged	
Myrtlewood Off-site Parking	Unchanged	
Eelgrass Mitigation Site	Unchanged	

In addition to meeting the statement of purpose and need discussed in Section 1.1, completion of the Project would result in these additional benefits:

Result in additional investment in and modernization of the Port of Coos Bay, which was once the largest timber port in the world but has seen utilization and investment steadily decline over time. JCEP and PCGP would directly invest in improving marine-related infrastructure and capability, such as the procurement of four state-of-the-art tractor tugs with firefighting, active ship escort and emergency towing and rescue capability, procurement and set up of a private vessel traffic information system, and installation of three meteorological ocean data collection buoys to measure wind speed and direction, current speed and direction and tide height in real time.

- Pipeline property tax would amount to additional contributions in excess of $20 million.
- Facilitate the re-building of the industrial and property tax base of the County of Coos and the towns of Coos Bay and North Bend. The decline in timber and wood products has had a significant negative impact on the local economy. JCEP has agreed to execute a Community Enhancement Plan (CEP) under which property tax benefits available at the site would be re-sculpted by JCEP such that the tax benefit would be returned to the County, the communities and the Port of Coos Bay under a formula that accelerates payments at the start of construction and levelizes payments from the commencement of operations for 15 years. The CEP will result in JCEP's payment of over $500 million over the first 20 years (five plus 15) to be used for capital projects for the schools, the SW Oregon Community College, and rehabilitation of the waterfront and for the Port of Coos Bay.

1.3 PROJECT LOCATION AND DESCRIPTION OF FACILITIES

JCEP proposes to construct and operate a new LNG export terminal on the bay side of the North Spit of Coos Bay in southwest Oregon. The general location of the proposed terminal is shown on Figure 1.1-1. The proposed Project will be located in unincorporated Coos County, Oregon, within land owned by Fort Chicago LNG II U.S. L.P., an affiliate of JCEP, across two contiguous parcels which are connected by an access corridor. The proposed site is about 7.5 miles up the existing Coos Bay navigation channel, approximately 1,000 feet north of the city limit of North Bend, in Coos County, Oregon, more than 1 mile away from the nearest residence.

The proposed LNG Terminal will be located near the Pacific Ocean in the coastal lowlands ecozone. The land is a combination of brownfield decommissioned industrial facilities, an existing landfill requiring closure, and some open land covered by grasslands and brush (including some wetlands), as well as an area of forested dunes. Portions of the proposed site have also previously been used for disposal of dredged material.

The zoning for the LNG Terminal site is established in the Coos County Comprehensive Plan, which includes the Coos Bay Estuary Management Plan ("CBEMP"). The current Comprehensive Plan and zoning designations allow for the development of the LNG Terminal. No zone or Comprehensive Plan map amendments will be required for the Project. The necessary land use entitlements are limited to the receipt of discretionary permits that implement the applicable Comprehensive Plan and zone map designations. On August 16, 2016, the Coos County Board of Commissioners unanimously approved JCEP's application for a conditional use permit for the LNG Terminal and associated components and mitigation.

1.3.1 Project Components and Facilities

The main components of JCEP's LNG Terminal include a connection to the Pipeline metering station, gas inlet facilities, a gas conditioning plant, a utility corridor, liquefaction facilities including five liquefaction trains, two full-containment LNG storage tanks, an LNG loading line, LNG loading facilities, a marine slip, and an access channel for LNG carriers. The main facilities at the LNG Terminal are shown on Figure 1.1-2, Plot Plan of the LNG Terminal.

Natural gas will be delivered to the LNG Terminal by the Pipeline. The interface point between the Pipeline and the JCEP facilities occurs at the flange immediately downstream of the metering station located on the South Dunes Site. Sections 1.3.3 through 1.3.9 of this document describe all of the facility components downstream of this interface point. Non-jurisdictional facilities are described in Section 1.9 of this document.

Figure 1.1-2 depicts a Plot Plan of the major components of the proposed LNG Terminal facilities.

All facilities and components will be constructed in accordance with governing regulations, including the regulations of the U.S. Coast Guard ("USCG") for Liquefied Natural Gas Waterfront Facilities, 33 CFR Part 127; the U.S. Department of Transportation ("DOT") Federal Safety Standards for Liquefied Natural Gas Facilities, 49 CFR Part 193; and the National Fire Protection Association ("NFPA") Standard 59A for LNG facilities, and the codes and standards referenced therein.

1.3.2 Site Elevations and Tsunami Protection

Site elevations (see Table 1.3-1) are selected to mitigate flooding due to storm surge, estuarine flooding, and tsunami. Tsunami hazard, because it is the most critical of these hazards, typically dictates the minimum elevation. Elevations have been selected to cater for life safety in case of an event that exceeds the design-level tsunami, and to ensure that the facility remains functional and operational in case of the design-level tsunami.

The design-level tsunami is consistent with the criteria given in Resource Report 6 – Geological Resources. Numerous hydrodynamic modelling efforts (ZHANG 2008, 2012; CHE 2017; MAN 2017) have demonstrated that the minimum elevation required to mitigate the design-level tsunami is +34.5 feet using North American Vertical Datum of 1988 ("NAVD88").

Typically, and due to the functional requirements of the facility, the facility will be at or above +46 feet. Exceptions include the LNG tanks and water-dependent facilities such as the marine terminal and Material Offloading Facility ("MOF"). The parts of the marine facilities that are normally occupied or operational will typically be at an elevation of 34.5 feet or greater, whereas normally unoccupied/non-operational parts of the marine facilities may be at a lower elevation. The LNG tanks, which are founded at approximately +27 feet, will be surrounded by a protective berm that is approximately +46 feet high. The protective berm will be designed to contain the contents of a single LNG storage tank.

Life safety is provided for by tsunami evacuation muster points at the LNG Terminal and South Dunes Site, which will be at elevations significantly greater than the design-level tsunami and consistent with the basis for current inundation (DOGAMI 2012a) and evacuation maps (DOGAMI 2012b) for the cities of Coos Bay and North Bend. Buildings, such as the SORSC building, operations building and Fire Department have been identified as "shelter-in-place" buildings for essential personnel in case of tsunami events. As such, these buildings will also be elevated to ensure they are above the design-level tsunami and consistent with the tsunami evacuation muster points discussed above.

1.3.3 Gas Inlet Facilities and Gas Conditioning

1.3.3.1 Gas Inlet Facilities and Metering

Pipeline quality feed gas will be supplied to JCEP via the 36-inch-diameter Pipeline. The interface point between the Pipeline and JCEP facilities occurs at the flange immediately downstream of the metering skid located on the South Dunes Site.

Inlet pipeline metering facilities consist of a pipeline pig receiver, inlet filter/separator, and flow meter, which are in PCGP scope. The pipe connecting the metering station to the liquefaction facilities will be buried from South Dunes through the Access Corridor, and then will resurface within the LNG Terminal facilities. Additionally, heating of the feed gas with high pipeline pressure is required on cold days to prevent formation of natural gas hydrates resulting from Joule-Thomson cooling when feed gas pressure is let down by the pressure reduction unit or units. A pressure reduction unit functions as an inlet pressure control station before the gas enters the gas conditioning unit.

1.3.3.2 Gas Conditioning Plant

The feed gas from the Pipeline will be treated before the gas enters the liquefaction trains. Mercury is first removed to prevent corrosion in downstream cryogenic aluminum equipment and to prevent the potential spread of mercury contamination to downstream equipment. The feed gas will then be treated by passing through the gas conditioning equipment to remove substances that would otherwise freeze during the liquefaction process, namely carbon dioxide (“CO_2”) and water. Trace amounts of hydrogen sulfide (“H_2S”) will also be removed.

A single gas conditioning train, common to all five liquefaction trains, will consist of three distinct processes: mercury removal via sulfur-impregnated activated carbon, CO_2 and other acid gases removal via an amine system, and dehydration via a molecular sieve adsorbent system.

Figures 1.3-3 and 1.3-4 provide simplified block flow diagrams of the major components of the proposed gas conditioning train and process. The section below describes the gas conditioning facilities in further detail.

1.3.3.2.1 Mercury Removal

Mercury is removed via adsorption onto a sulfur-impregnated carbon bed in order to prevent cold box corrosion during gas liquefaction and to minimize the exposure of other equipment and vent streams to mercury contamination. The mercury removal unit is located downstream of the inlet filter/separator and upstream of the amine contactor, and will reduce the amount of mercury in the treated pipeline gas down to less than 0.01 micrograms per Normal cubic meter (“$\mu g/Nm^3$”).

The life of the mercury removal beds is designed to be three years, assuming a mercury concentration in the feed gas of 0.05 parts per billion volume. Once the beds are near their end of life, the spent sulfur-impregnated activated carbon is removed from the carriers and shipped off-site as hazardous material to be disposed of by a licensed hazardous waste management contractor.

1.3.3.2.2 Acid Gas Removal

Acid gas removal involves a closed-loop system that circulates a promoted methyl-diethanolamine solution to absorb CO_2 and sulfur species from the feed gas. The process reduces the feed gas CO_2 concentration from a maximum of approximately 2 percent on a molar basis to less than 50 parts per million on a volumetric basis (“ppmv”).

The CO_2 removed from the feed gas is to be vented to the atmosphere, but the vent stream must first be treated for co-absorbed contaminants. To limit emissions, absorbed H_2S and other sulfur species in the vent stream will be thermally oxidized after passing through the sulfur scavenger unit. Co-absorbed hydrocarbons, including benzene, toluene, ethylbenzene, and xylenes, will also be combusted and destroyed in the thermal oxidizer.

1.3.3.2.3 Dehydration

Water is removed from the feed gas via molecular sieve adsorption beds. There are four water removal beds. At any one time, two beds are adsorbing water from the feed gas, one bed is in stand-by, and the fourth bed is regenerating. Regeneration of a bed involves passing dehydrated heated feed gas through it, in an up-flow direction, which drives the adsorbed water out of the bed. This water-loaded regeneration gas is then cooled to condense and remove the water, which is recovered back into the amine system. This regeneration gas is then compressed and recycled upstream of the dehydration units.

1.3.4 Liquefaction Facilities

1.3.4.1 Liquefaction Trains

Once the feed gas has been through the gas conditioning train, it is sent to five parallel identical liquefaction trains using the PRICO® LNG process (a Black & Veatch proprietary technology) to cool the conditioned natural gas to -260°F. The five trains have a combined LNG export capacity of 7.8 mtpa. The PRICO® LNG process utilizes a single mixed refrigerant (“SMR”) circuit with a two-stage compressor and a brazed aluminum refrigerant exchanger. The conditioned gas is divided equally among the five liquefaction trains. In each train, the conditioned gas stream flows into a refrigerant exchanger and exits the exchanger as LNG. An aerial cooling system (fin-fan) rejects heat from the mixed refrigerant that is gained from the liquefaction of feed gas and the compression stages (see Figure 1.3-5).

The refrigerant exchanger consists of multiple brazed aluminum cores arranged in parallel inside a perlite-insulated cold box. The cores are installed vertically inside the cold box. The refrigeration is supplied by a closed-loop, single mixed refrigerant cycle.

The refrigeration cycle is a closed-loop process that utilizes a single-body, two-stage refrigerant compressor. An aero-derivative combustion turbine directly provides the power to drive the refrigerant compressor. Exhaust-gas waste heat recovery in the form of steam generation maximizes the overall thermal efficiency of the LNG Terminal facility. An aerial inter-stage cooler removes the first stage heat of compression and partially condenses the mixed refrigerant. An inter-stage drum separates the resulting two-phase mixture. The vapor portion from the inter-stage drum goes to the second stage of the compressor, while the inter-stage pumps send the liquid portion to recombine with the second-stage compressor discharge. The air-cooled refrigerant condenser cools and partially condenses the recombined high-pressure, two-phased refrigerant. The refrigerant discharge drum separates the resulting high-pressure, two-phased mixture. The vapor portion from the refrigerant discharge drum goes directly to the refrigerant exchanger, while refrigerant pumps send the liquid portion to the refrigerant exchanger. Each refrigerant exchanger core in the cold box has a dedicated liquid nozzle to ensure good distribution among all of the refrigerant exchanger cores.

The high-pressure refrigerant flows downward through the refrigerant exchanger and exits each core from the bottom, totally condensed and sub-cooled. The sub-cooled, high-pressure mixed refrigerant exits the refrigerant exchanger and then the pressure of the stream is reduced. The pressure reduction causes some vaporization of the refrigerant, reducing the temperature further. The cold, two-phased mixed refrigerant then goes back into the cold box and provides the refrigeration for the high-pressure mixed refrigerant and the treated natural gas streams as it vaporizes. The vaporized mixed refrigerant exits the top of the cold box and is recycled back to the refrigerant suction drum to complete the cycle.

Treated natural gas with mercury, CO_2, and water removed enters the top of the refrigerant exchanger and distributes evenly among the multiple refrigerant exchanger cores, where it is pre-cooled in the first section of the refrigerant exchanger. The pre-cooled natural gas exits the refrigerant exchanger and goes to the heavy hydrocarbon removal unit, where components such as benzene and octane are sufficiently removed to prevent freezing in the liquefaction section of the refrigerant exchanger. The natural gas (with "heavies" removed; see the next section—Section 1.3.4.2, Heavies Removal—for explanation) goes back into the cold box and evenly distributes among the multiple refrigerant exchangers, where it is condensed and sub-cooled. The sub-cooled LNG exits the refrigerant exchanger cores and recombines into a single stream with the output of the other liquefaction trains, which then flows into the LNG expander. The LNG expander produces electrical power from the work provided from lowering the LNG stream pressure. The reduced-pressure LNG then flows through a pressure-reducing valve for further pressure reduction. The additional pressure reduction causes some vaporization, further cooling the LNG. The reduced pressure, two-phase LNG goes to the LNG flash drum. Flash gas from the LNG flash drum goes to the Boil-off Gas ("BOG") system, and LNG rundown pumps send the LNG product to the LNG storage tanks.

1.3.4.2 Heavies Removal

Heavy hydrocarbons, or "heavies" (generally referred to as C5+ components), must be removed from the feed gas before the final liquefaction step in order to meet the LNG specification and prevent possible freezing at subcooled temperatures. The system will be designed to remove the most likely-to-freeze components—benzene and octane—to less than 1 ppmv while recovering as much of the C4 and lighter molecules as economically as possible into the gas going to the final liquefaction step.

The total volume of heavies removed across the range of feed compositions is not enough to produce economically viable natural gas liquids product for sale or export; however, it will be blended into the fuel gas stream, so no tankage or disposal logistics need to be considered.

1.3.4.3 Refrigerant Makeup System

For many technologies, refrigerant losses occur from the closed-loop refrigeration loops primarily due to normal compressor seal leakage. However, the Black & Veatch patented seal gas recovery system will be utilized to minimize the refrigerant losses to flare by returning the normal leakage to the refrigerant compressor suction. Even with seal gas recovery, the refrigeration loop components must be replenished periodically. The hydrocarbons that provide make-up to the SMR circuit used in the liquefaction trains cannot be generated on-site (with the exception of methane, which comes from the treated feed gas), and are delivered to and stored in pressure carriers on-site.

1.3.5 LNG Storage and Containment

The LNG will be stored in two full-containment insulated LNG storage tanks, each of which is designed for a working capacity of 160,000 cubic meters ("m^3") (42,232,000 gallons) of LNG. Each tank will have a primary 9 percent nickel inner tank and a secondary concrete outer containment wall with a steel vapor barrier.

The two full-containment LNG storage tanks are each equipped with three fully submerged LNG in-tank pumps, each rated for approximately 2,400 cubic meters per hour ("m^3/hr"), and one spare well fully piped and instrumented within each tank. LNG is pumped, using five of the six installed pumps, to the marine berth and into an LNG carrier at a rate of 12,000 m^3/h. An LNG transfer line consisting of one 36-inch-diameter line connects the shore-based storage system with the LNG loading system.

LNG spills will be contained, and the bermed area around the LNG tanks will gravity drain to the LNG impoundment basin. An LNG spill containment trench will also collect any LNG from spills outside of the bermed area around the LNG tanks and gravity drains to the same LNG impoundment basin. A separate LNG trench and impoundment basin located near the marine loading system will also be provided to collect any LNG spills from the LNG transfer line or the "keep-cool" recirculation line that occur south of the liquefaction trains; this separate impoundment is required because of the slope requirement to allow effective gravity draining that cannot be achieved by a single impoundment system. The LNG impoundment basins will include sump pumps to pump out rain water. Per 49 CFR 193.2173, the water removal system is required to have the capacity to remove water at a rate of 25 percent of the maximum predictable collection rate from a storm of ten-year frequency and one-hour duration. The discharged rainwater will be piped to the stormwater drainage system.

There is a keep cool system that maintains the LNG loading system temperature to avoid excessive boil-off losses and potential damage from thermal cycling of the piping between carrier arrivals.

1.3.6 Marine Facilities

1.3.6.1 Overview

The marine slip is a single-use slip dedicated to supporting LNG exports from the LNG Terminal. The east side of the slip will be utilized for the LNG carrier-loading berth and LNG loading facilities. Berths for tugboats and security vessels will be located on the north side of the slip. The west side of the slip will contain an emergency lay-by berth; this is only for the short-term docking of temporarily disabled LNG carriers that require repairs before deemed to be seaworthy by the USCG to depart the port and proceed to sea. There is no capability to conduct any LNG transfer at the emergency lay-by berth.

1.3.6.2 Access Channel

Access to the marine slip will be via a newly constructed access channel that will connect the slip to the Coos Bay Navigation Channel at approximate Channel Mile 7.3 at the beginning of the confluence between the Jarvis Turn and the Upper Jarvis Range A. The access channel will flare from the narrowest portion at the mouth of the slip, with a minimum width of 800 feet, to the intersection of the existing navigation channel with an approximate width of 2,200 feet. The total access channel would cover approximately 22 acres below the Highest Measured Tide (HMT) elevation of 10.26 feet (NAVD88). The walls of the access channel would be sloped to meet the existing bottom contours at an angle of 3 feet horizontal to 1 foot vertical (3:1). The minimum water depth within the slip would be about 45 feet below the mean lower low water ("MLLW") line (-45.9 feet NAVD88 (North American Vertical Datum of 1988). Dredging of the access channel would affect about 15.2 acres of currently existing deep subtidal area below -15.3 feet in depth.

1.3.6.3 Marine Slip

The new marine slip will be constructed by excavating an existing upland area. The majority of the terminal marine slip will be excavated from existing uplands owned by JCEP. Part of the marine slip would be constructed within state waters of Coos Bay to the MLLW line, for which the Port has obtained an easement from the ODSL.

The slip will be bounded on the east and west sides by sheet pile walls, creating a vertical face to support mooring structures. The northern side of the slip will be sloped to meet the existing bottom contours at an angle of 3 feet horizontal to one foot vertical (3:1). The inside dimensions at the toe of the slope of the slip will measure a minimum of 800 feet along the east/west axis, and approximately 1,500 feet and 1,200 feet along the western and eastern boundaries, respectively. Figure 1.1-3 shows a plot plan of the marine slip. The slip is sized to provide the flexibility needed to safely maneuver an LNG carrier from the channel into the slip and for tugs to move a temporarily disabled LNG vessel away from the east side of the slip to the west side of the slip if necessary.

1.3.6.4 LNG Loading Berth

The LNG berth consists of a number of elements: the sheet pile wall, mooring structures, breasting structures, and the product load-out facility. In general, the LNG berth will be about 1,280 feet long between the centers of the end mooring structures, and 312 feet long from the center of the northernmost breasting structure to the center of the southernmost breasting structure. Figure 1.1-4 shows the elevation view of the LNG berth.

1.3.6.4.1 Sheet Pile Walls

The physical berth will be constructed of steel sheet piles to support surface structures (i.e., the loading platform) or provide the foundation for the breasting and mooring structures. Under the loading facility, the wall will extend from the bottom of the slip at elevation -45.9 to elevation +35.0. This face will extend north and south to capture the outermost breasting structures and then turn to the east, creating a setback wall for the remainder of the slip.

1.3.6.4.2 Mooring Structures

There will be six mooring structures—three positioned north of the product load-out facility and three to the south. The structures will be behind the sheet pile wall, set back approximately 150 feet from the face of LNG berth. These structures will have concrete platforms founded on steel pilings and will each have remote release mooring hooks with capstans, as well as all required equipment and instrumentation for safe mooring operations.

1.3.6.4.3 Breasting Structures

There will be four breasting structures located adjacent to the product loading facility ("PLF"). Two will be located north of the PLF and two to the south. Like the mooring structures, each breasting structure will have a concrete platform founded on steel pilings and will have remote release mooring hooks with capstans, as well as all required equipment and instrumentation for safe mooring operations. Each breasting structure will also support a fender assembly sized to absorb and distribute berthing and mooring loads for the full range of LNG carriers that the LNG Terminal berth is designed for, thus preventing damage to the LNG carriers or the LNG berth. The fender system will allow the carriers to be moored approximately 3 feet off the vertical face of the sheetpile wall at the PLF.

1.3.6.4.4 Product Loading Facility (PLF)

The product loading platform will be constructed on top of the sheet pile wall, and will be about 130 feet long and 86 feet wide with a top elevation of +35 feet. The platform will be reinforced concrete supported by steel pilings. The platform is designed to support a number of elements that facilitate the safe transfer of LNG product between the LNG plant and the LNG carriers.

The primary transfer equipment consists of four marine loading arms installed on top of the PLF platform. There will be two dedicated arms for transferring LNG to the LNG carriers: one arm will be designed for dual service capable of transferring LNG to the carriers or returning vapor to the terminal's boil-off gas, or BOG, vapor management system, and one arm will be dedicated to vapor return to the terminal's BOG system. For normal full rate loading operation, three arms will be used to transfer LNG to the carrier, and one arm will be used to return vapor to the terminal's BOG vapor management system. The loading of all LNG carriers will be carried out within a closed system.

The loading arms are designed with swivel joints to provide the required range of movement between the ship and the shore connections. Each arm would be fitted with a hydraulically interlocked double ball valve and powered emergency release coupling to isolate the arm and the ship in the event of an emergency condition in which rapid disconnection of the connected arms is required. Each arm would be fully balanced in the empty condition by a counterweight system and maneuvered by hydraulic cylinder drives. A mezzanine-type elevated steel platform above the concrete support deck will be installed for maintenance of the triple-swivel assembly of the arms.

LNG spill containment will be addressed at the main concrete lower platform level, where a concrete curbed and sloped area will contain any LNG spillage and allow the spill to safely flow away from the loading platform area. Drainage from this point will be via the LNG spill collection trough to the marine area impoundment basin.

The LNG carrier loading berth will be capable of accommodating LNG carriers with a range of 89,000 m^3 to 217,000 m^3. Although the USCG Letter of Recommendation ("LOR") and Waterway Suitability Report ("WSR") presently only allow LNG carriers up to 148,000 m^3 to dock at the LNG Terminal, the slip and LNG berth can accommodate LNG carriers up to 217,000 m^3 should the vessel size limitation be changed in the future.

Additional structures at the vessel berth and loading platform would include a ship gangway, area lighting facilities, aids to navigation, firewater monitors, and a dry chemical firefighting system.

1.3.6.5 Emergency Lay Berth

An emergency lay berth on the west side of the slip will be provided with facilities to safely moor a temporarily disabled LNG carrier. Berthing facilities will be supported by the west side sheetpile wall with a top-of-wall elevation of (+20 feet). The lay berth will have pile-supported breasting structures with fenders extending above the vertical sheet pile and mooring structures on the land side of the sheet pile. A grated platform with a gangway will be placed behind the berthing breasting structures to allow for safe access and egress from the ship at berth. Support infrastructure will include an access road down from the area of the tug berth building, duct bank with cabling for powering the mooring hooks and capstans, and limited lighting of the ship access area.

Along the western property line, but on the Project side of the Henderson Property buffer zone, a tsunami flow control wall will be constructed. The wall is designed with sufficient height and strength to keep a tsunami surge from overtopping into the Henderson Property and manage the tsunami current loads on carriers within the marine slip. The wall will run from the vapor dispersion wall on the west side of the LNG tank impoundment area down to the entrance to the slip.

1.3.6.6 Material Offloading Facility

The Material Offloading Facility ("MOF") will be constructed to deliver components of the LNG facility that are too large or heavy to be delivered by road or rail. The MOF will cover about 2.7 acres on the southeast side of the slip, adjacent to the Roseburg Forest Products Company ("RFP") property (Figure 1.1-3). The MOF will be constructed using the same sheet pile wall system as the LNG berth and the emergency lay-by berth. The top of the MOF will be at elevation 13.0 feet NAVD88, and the bottom of the exposed wall will be at the access channel elevation. The MOF will provide approximately 450 feet of dock face for the mooring and unloading of a variety of vessel types.

During construction of the Project, in addition to receiving equipment and large modules (upwards of 6,000 short tons) by break bulk cargo carriers, roll on roll off cargo carriers, and barges, the MOF will allow other bulk materials to be delivered by sea to minimize impacts on the local road network. After project construction, the MOF will be retained as a permanent feature of the LNG Terminal to support maintenance and replacement for large equipment components that are too large to be transported by rail and road.

1.3.6.7 Tug and Escort Berth

The tug and security vessel berth at the north side of the marine slip will accommodate four tugboats and up to six security escort boats dedicated to the LNG facility. For design purposes, the tugs are assumed to be 80- ton bollard pull carriers approximately 100 feet long with a beam of 40 feet. The escort vessels are assumed to be 35 feet long with a beam of 10.5 feet. The tug dock will generally be about 470 feet long and 18 feet wide; in addition, there is 360 feet of 8-foot-wide floats for mooring and accessing the security vessels.

The tug dock will be concrete supported by steel piles. The security vessel docks will be precast concrete floats anchored by steel pile. No wooden structures (treated or otherwise) will be used in the construction of the tug berth. The security boat dock will support two separate boat houses. The tug dock will be accessible from land by a pile-founded trestle, thus allowing vehicle and pedestrian access for service and support of operations. An onshore tug operations building will provide storage, meeting, and sanitary facilities for the crews of the tug and security boats.

1.3.6.8 Vessel Transit

LNG carriers would access the terminal through a waterway for LNG marine traffic, which is defined by the USCG for the Project as extending from the outer limits of the U.S. territorial waters 12 nautical miles off the coast of Oregon, and up the existing Coos Bay navigation channel about 7.5 miles to the LNG Terminal. The Project's plans for the LNG carriers calling on the LNG Terminal and their transit route in Coos Bay, as described below, are primarily within the jurisdiction of the USCG. Because the USCG has authorized carriers of approximately 950 feet length, 150 feet beam, and loaded draft of 40 feet (nominal 148,000 m^3)[2] as the size of LNG carrier for the Project, it is anticipated that approximately 110 to 120 LNG carriers per year will be required to transport the designed 7.8 mtpa output of the liquefaction facilities. A range of 110 to 120 ship calls represents an increase of 20 to 30 carriers per year from the estimated ship calls for the previously proposed export terminal. This increase in the annual number of LNG carriers is due to the increased production capacity of the LNG plant and differences in LNG carrier capacity based on the selection of the carrier's cargo containment system by JCEP's customers. The actual number of LNG carriers per year will be dependent on the capacity of the LNG carriers calling on the Project and the actual output production of the Project. The LNG carrier berth is designed so that it could accommodate LNG carriers up to 217,000 m^3 if larger-sized carriers were to be authorized by the USCG in the future. Larger capacity carriers would reduce the number of LNG carriers required each year to carry the cargo that is produced by the facility.

The time required for an LNG carrier to transit from the "K" buoy to the berth is approximately 1.5 hours. Bulk LNG loading time is approximately 15 hours (using the 12,000 m^3/hr loading rate). The entire process—transit from "K" buoy to berth, mooring, loading of cargo, cast off,

[2] Depending upon the approved LNG containment system type, carriers with these approximate dimensions may range in LNG cargo capacity from 135,000 m^3 to 170,000 m^3.

and transit back to the "K" buoy (shown on Figure 1.1-6) —is approximately 28 hours if there are no delays caused by natural environmental conditions.

The LNG carrier transit route is shown in Figure 1.1-6. An LNG ship traffic study conducted by Moffatt & Nichol International (M&N 2006) concluded that the additional LNG carrier traffic associated with the Project can be accommodated in the Port and the Coos Bay navigation channel. The ship traffic conditions in the Port that existed when the LNG carrier traffic study was conducted have not changed. To send out 7.8 mtpa, approximately 110 to 120 vessel calls would be required due to the inclusion of some smaller capacity LNG carriers.

Resources, such as high bollard pull tractor tugs and pilots, will be required to handle the planned number of LNG carriers. JCEP has committed to provide the following marine resources as identified by the USCG in the current version of the WSR:

- Four (three operation, one standby) 80-bollard-ton tractor tugs with Class 1, firefighting capability;
- A Port differential Global Positioning System navigation system for use by the Pilots and LNG carrier bridge team while transiting the channel en route to the Project;
- Physical Oceanographic Real Time System to provide real-time channel water level, current, and weather data;
- A Vessel Traffic Information System consisting of an Automatic Identification System receiver, 2 land-based radars, and 12 low light cameras (with zoom, pan, and tilt) to monitor the transit of the LNG carriers while in Coos Bay;
- Emergency response notification system;
- Installation of private navigation aids (e.g., channel centerline range markers); and
- Gas detection capability along the LNG carrier waterway transit route.

1.3.7 Terminal Support Systems

1.3.7.1 Vapor Handling System

The boil-off gas (known as BOG) is primarily generated from the LNG product stream entering the LNG flash drum, vapors from the heat leak into the LNG storage tanks, piping and pump systems, vapor displaced as the LNG storage tanks are filled, and vapor return from the LNG carrier during loading operations. The BOG will be consumed as fuel. Two BOG compressor trains are included to compress the vapor from LNG storage tank pressure to fuel gas pressure. The mode of operation of the liquefaction plant when not loading an LNG carrier is known as "holding mode." The mode of operation during LNG carrier loading is known as "loading mode." One BOG compression train will be operating continuously to handle holding mode BOG volumes; the second will be needed only during loading mode or during an off-design condition that results in increased BOG generation.

During normal operation, fuel gas will be supplied from BOG and heavy hydrocarbon streams, and supplemented with gas from the inlet pipeline upstream of the gas conditioning facility. The compressed BOG combines with the separated heavies from the liquefaction units and flows through a fuel gas superheater to completely vaporize the stream. Any remaining liquids are separated in the high-pressure fuel gas mixing drum that is downstream of the superheater. The low-pressure fuel gas is let down from the high-pressure header to the low-pressure fuel gas knockout drum before going to other smaller consumers, such as thermal oxidizer, duct burners, and flare pilots.

The combined and superheated high-pressure fuel gas stream primarily feeds the combustion gas turbines to drive the refrigerant compressors.

Normally, a small amount of makeup to the high-pressure fuel from the pipeline feed gas is required to meet demands; if the BOG/heavies mixture results in excess fuel for the demand, it can be recycled upstream of the amine unit and re-liquefied.

A start-up fuel gas heater will also be provided to ensure that there is liquid-free and properly superheated fuel gas for start-up and commissioning before steam is available for the fuel gas superheater.

1.3.7.2 Steam System

Combustion turbine exhaust is expelled through Heat Recovery Steam Generators (“HRSGs”) to generate high-pressure steam that supplies the gas conditioning train(s) and Steam Turbine Generators (“STGs”). Low-pressure steam is primarily provided from extraction out of the STGs, which let down the pressure from 725 pounds per square inch gauge (“psig”) to the 50 psig header at an intermediate stage in the turbines; any low-pressure steam requirement in excess of this can be made up by “de-superheating” a letdown of high-pressure steam. The STG exhaust steam will be condensed via an Air Cooled Condenser (“ACC”). Process condensate is de-aerated and treated, and then returned to the cycle as boiler feed-water for the HRSGs.

High-pressure steam required during facility start-ups will be provided by an auxiliary boiler that is sized to provide sufficient steam to meet the requirements for one STG and any additional steam required for when the facility is not producing LNG. For start-ups (other than initial commissioning), a refrigerant compressor can be run in full recycle to produce steam from the refrigerant compressor driver exhaust in an HRSG, with supplemental duct firing to provide the balance of steam required.

1.3.7.3 Instrument Air

Instrument air will be provided through compression and drying packages. Instrument air will be used for pneumatic control of automated instrumentation, utility air, and supply for nitrogen generation.

1.3.7.4 Utility Air

Utility air will be used for normal maintenance activities (utility stations, control panel purges, building purges, etc.). Utility air will be dried with the instrument air and be supplied from a separate header. The utility air header will be provided with a pressure regulator and on-off valve to shut off flow if the main header pressure drops to the minimum for proper functioning of actuators.

1.3.7.5 Nitrogen

Nitrogen will be provided through vaporization of liquid nitrogen and a pressure swing adsorption site generation package unit. Liquid nitrogen will be the only source of nitrogen used for refrigerant makeup, while the site-generated nitrogen will supply continuous utility users as well as intermittent users, such as LNG loading arm purges and utility stations. Nitrogen packages will be sized to fulfill peak demand and to handle the maximum expected instantaneous flow.

1.3.7.6 Utility and Potable Water System

The Coos Bay-North Bend Water Board (“CBNBWB”) potable water pipeline will be used for all normal water sources in the facility, which includes fire water makeup, utility water for plant needs such as equipment and area cleaning, and potable water for needs such as buildings and eyewash/safety shower stations. Utility water is fed to the demineralized water package, but storage of utility water will be combined with the fire water tanks.

The CBNBWB raw water pipeline (in addition to the potable water pipeline) will be used for construction water, including LNG tank hydrotesting. The pipeline tap at the LNG Terminal site will remain connected, but there are no normal users of this raw water during operation.

1.3.7.7 Fire Suppression System

Fire suppression and protection measures will be provided to ensure the safety of personnel and property. The function of the fire suppression water supply system is to provide water under pressure to the fire hydrants, monitors, and fixed water suppression systems throughout the LNG facility area. The fire water supply will also be used to provide water for on-site firefighting trucks. The fire suppression distribution piping network will comprise the following:

- Underground fire water mains
- Fire water tanks;
- Fire water and jockey pumps;
- Aboveground fire water hydrant mains;
- Fixed fire water sprinkler and spray systems;
- Fixed high-expansion foam systems;
- Portable fire suppression equipment;
- Appurtenances, including all piping and valves connecting the pumps and water supply to the plant fire suppression systems; and
- Hydrants and monitors.

1.3.7.8 Flare, Relief, and Blowdown System

Flare systems are a necessary safety feature of all LNG export facilities. The JCEP facility will have three separate flare systems for pressure relief plant-protection conditions: one for warm (wet) reliefs, one for cold, cryogenic (dry) reliefs, and one for low-pressure cryogenic reliefs from the marine loading system. The “warm” relief loads are separated to ensure that wet fluids cannot freeze in the header if there were a cryogenic relieving event. The “cold” and “marine” relief loads are separated to ensure that the relief of near-atmospheric pressure vapors is not affected by back-pressure in the header if an unrelated release were to occur.

The warm and cold flares will both be within a multi-point enclosed ground flare, while the marine flare will be an enclosed cylindrical ground flare. A small pilot with electronic ignition is provided on each flare.

The flare system will be used only during plant-protection situations, maintenance activities, cases of purging and gassing-up an LNG carrier, and initial commissioning/start-up.

1.3.7.9 Stormwater and Wastewater Systems

The LNG facility and marine LNG loading area will include various drainage elements to manage segregated networks for contaminated and uncontaminated water from designated areas. Liquid effluent from the LNG facility and marine LNG loading area consists mainly of water from rainfall, protection of equipment with fire water, processing areas, storage areas, domestic areas, and utilities units. Water from all oil-filled equipment in LNG spill impounding basins will be pumped by submersible pumps to the oily water treatment system.

Stormwater collected in areas other than LNG spill impounding basins will be allowed to flow or will be pumped to a system of stormwater swales, infiltration basins, and other treatment facilities. Stormwater facility overflow outfalls will ultimately connect to the Coos Bay. The initial runoff from all storms of a 2-year return period and 24-hour duration or less will be infiltrated.

Excess stormwater during storms of longer return periods will be allowed to discharge directly to the slip without being infiltrated or treated.

Stormwater collected in areas that are potentially contaminated with oil or grease will be pumped or will flow to the oily water collection sumps. Collected stormwater from these sumps will flow to the oily water separator package(s) before being treated and discharged to the industrial wastewater pipeline ("IWWP").

The facility will be designed to provide drainage of surface water to designated areas for disposal in accordance with 49 CFR § 193.2159. Stormwater collection and treatment facilities will be designed to meet regulatory requirement from NMFS and ODEQ.

1.3.7.10 Sewage and Sanitary Waste Treatment

Sanitary waste from the northwest guard house and tug building will be directed to a holding tank. A sanitary waste contractor will remove the contents of the tank as necessary and dispose of the contents at authorized disposal sites through the sanitary waste contractor's permits. Sanitary waste from the remainder of buildings will be treated by a packaged treatment system. The effluent will be directed to the IWWP. Solids will be removed from the packaged treatment system periodically by a sanitary waste contractor and will be disposed of at authorized disposal sites through the sanitary waste contractor's permits.

1.3.7.11 Hazard Detection and Response

Safety controls, including hazard detection and response systems, are briefly summarized below. The Project will contain "passive" and "active" hazard prevention and mitigation systems and controls.

Passive systems will generally include those that do not require human intervention, such as spill drainage and collection systems, ignition source control, and fireproofing. Thermal proofing will be considered for application to support structures, components, and equipment, as required, to maintain structural stability in a fire hazard zone, cryogenic spill zone, or area where a failure could affect a safety-related system, provide additional fuel to a fire, or cause additional damage to the unit or facility.

Active systems normally are either automatic or require some action by an operator. Active fire control systems and equipment will consist of a looped, underground fire water distribution piping system serving hydrants, fire water monitors, hose reels, water-spray, or deluge and sprinkler systems. Active spill control systems will include fixed high-expansion foam and dry chemical systems. They will also include portable and wheeled fire extinguishers that employ dry chemicals and CO_2. Fire protection in buildings will generally consist of smoke detectors, flame detectors, portable fire extinguishers, sprinkler systems, and an emergency shutdown ("ESD") system.

Process instruments will routinely monitor for potentially hazardous conditions. Specialized automatic hazard detection and alarm notification devices will be installed to provide an early warning. The Project will also contain hazard detectors designed to sense a variety of conditions, including combustible gas, low temperatures (LNG spill), smoke, heat, and flame. Each of these detector systems will trigger visual and audible alarms at specific site locations and in the control room areas to facilitate effective and immediate response.

The safety of the LNG carriers while docked and loading is a major design consideration for hazard detection and response. Safety measures include ESD spill containment and provisions to protect piping from the effects of surges. In addition, JCEP will have a Fire Department with three pumping trucks, one ladder truck, and one hazardous materials truck that can be mobilized to attend to a fire in the facility in less than 4 minutes.

1.3.7.12 Process Control System

Operators will control and monitor the facility through a distributed control system (DCS). Vendor-supplied packaged units with local control panels and numerous field-mounted instruments will be connected to remote Input/Output ("I/O") cabinets located throughout the facility. These remote I/O cabinets interface with the DCS controllers through cabling run through the plant to the control room. The DCS also includes a local historian that historicizes all process data on-site. Overall plant process control and monitoring will be performed at consoles located in the central control room, with monitoring capabilities from the remote I/O rooms.

Integrated into the DCS will be the Safety Instrumented Systems ("SIS"), Fire and Gas Systems ("FGS"), process analyzers, and other machine monitoring and control systems such as those used for the refrigerant compressors. The SIS will utilize separate, dedicated controllers to control safety functions such as those that are required for emergency shutdown safety functions. DCS controllers will monitor the present value of a designated process parameter and adjust actuated control valves to maintain the process setpoint. Limits will be defined to alert operators of deviation away from setpoint, and the SIS will take action if further deviation occurs. The FGS will permit activation of critical firefighting equipment from the control room and will utilize various flame, smoke, and temperature detectors as well as sirens, beacons, and manual alarm call points.

1.3.7.13 Electrical Systems

JCEP plans to obtain limited power from the regional electric grid for the SORSC and temporary construction activities. With exception of the SORSC, the site will be black-start and will not have the means, infrastructure, or need to import or export power during operations.

Plant power required for operations is nominally 60 MW. Electrical power will be via two 30 MW steam-turbine generators and one spare 30 MW generator. The steam is efficiently generated by HRSGs using exhaust from the refrigerant compressor combustion turbine drivers. A black-start auxiliary boiler will be used to generate steam for power when gas turbines are not in operation. In addition, there are two standby diesel generators for the LNG facility and one for the SORSC. The facility will not be connected to the local grid, and will not import or export power. Two switchgear buses, in a main-tie-main configuration, will be connected to the STGs (minimum of one turbine to each bus). These switchgear buses will feed the plant distribution 13.8 kilovolt ("kV") switchgear, 6.9 kV switchgear and motor control center, and 480-volt switchgears and motor control center buses located throughout the plant. The plant distribution buses will contain two 6.9 kV essential power buses that power all of the essential plant loads. The LNG facility diesel generators have 100 percent redundancy and are connected to the 6.9 kV essential power buses.

1.3.7.14 Buildings

Buildings and structures required for the operation of the LNG Terminal facility include:

- Administration Building
- SORSC Building
- Fire Department
- Operations Building/Control Room/Laboratory/First Aid Facility
- Guard House and Security Building

- Auxiliary Guard Buildings
- Plant Warehouse/Receiving Building
- Maintenance Building
- Tugboat, Storage, and Crew Building
- Chemical Storage/Hazardous Waste Storage Shelter/Building
- Water Treatment Building
- Fire Water Pump Buildings
- Fire Water Valve Buildings
- Marine Control Building
- Electrical Powerhouses
- Equipment Shelters/Buildings
- Analyzer Buildings

The siting of occupied buildings will be evaluated for overpressure, toxic release, and fire hazards. Occupied buildings will be sited in accordance with industry standards. Loads, analysis, design, and construction will be in accordance with all statutory and regulatory requirements.

1.3.7.15 Lighting System

The lighting levels will be based on American Petroleum Institute ("API") standards. Lighting around equipment and facilities where routine maintenance activities could occur on a 24-hour basis would range from 1 to 20 foot-candles, with 20 foot-candle lighting levels within the compressor enclosures.

General process area lighting would be kept to a minimum, on the order of 2 foot-candles. Access and Utility Corridor lighting for the LNG Terminal would be 0.4 foot-candle. Perimeter security would be on the order of 1.3 foot-candles, using evenly spaced 400 watt floodlights. As a point of reference, 20 foot-candles is close to the indoor lighting in a typical home, 2 foot-candles is typical of that found in a store parking lot, and 0.4 foot-candle is typical of residential street lighting. The final lighting plan would be developed during detailed design.

Only lighting required for operation and maintenance, safety, security, and meeting Federal Aviation Administration requirements would be used on the LNG storage tanks. The light will be localized to minimize off-site effects.

1.3.7.16 Access and Utility Corridor, Haul Road, Access Roads, and Parking Lots

The Access and Utility Corridor will be constructed between Ingram Yard and the South Dunes Site. The corridor would be approximately 1 mile long. It would be located entirely on property owned by JCEP. The Access and Utility Corridor would cover about 17 acres.

The primary purpose of the Access and Utility Corridor is to provide a conduit for the underground feed gas supply to the LNG Terminal and a number of utility services required between the LNG Terminal and South Dunes. Utilities in the corridor will include underground power lines, fire water supply, communications lines, and metering skid control lines.

The full length of the corridor would be used during construction for the movement of equipment and materials. The road will be used to haul materials excavated from the LNG Terminal to South Dunes and the RFP property. Use of the corridor for mass earth moving will reduce impacts to the Trans Pacific Parkway and the existing RFP facility.

The western portion of the Access and Utility Corridor between the LNG Terminal and Jordan Cove Road will be paved and provide primary permanent access; it will include two lanes into the LNG Terminal and a single lane out. The remainder of the corridor, east of Jordan Cove

Road, will be provided with a crushed rock track for infrequent maintenance access. Paved access between the South Dunes Site and the western portion of the Access and Utility Corridor will be provided by the existing Jordan Cove Road. Bridges will be used where required to reduce impacts to wetlands and all roads and bridges will be designed to meet Oregon Department of Transportation requirements. A two-lane access road will be provided to the northwest of Ingram Yard to provide emergency, marine terminal, and occasional maintenance access from Trans Pacific Parkway.

To the west of the Access and Utility Corridor and within the secured footprint of the LNG Terminal will be the guard house, security building, firefighting facility, operations building, warehouse building, maintenance building, and parking for operations personnel. Both the South Dunes Site and Ingram Yard will be provided with sufficient parking.

1.3.8 Mitigation Measures

JCEP has worked with agencies since the inception of the Project to identify measures to enhance the environment or avoid, minimize, or mitigate for adverse environmental effects. Such measures include the Kentuck Project (that includes wetland mitigation from both JCEP and PCGP) and Eelgrass Mitigation Site within the Coos Bay.

The potential environmental impacts of the Project, along with proposed mitigation measures, are detailed in Resource Reports 2 through 12.

1.3.9 Location Maps, Detailed Route Maps, and Plot/Site Plans

Figures 1.10-1 and 1.10-2 show the regional location of the facilities on a USGS topographic map and an aerial map, respectively.

A typical cross-section diagram for the Access and Utility Corridor is illustrated in Figure 1.1-5. Additional maps, illustrations, and plans of Project components are found throughout the environmental resource reports, including the detailed design plans contained in Resource Report 13 (Engineering and Design Material).

1.4 LAND REQUIREMENTS AND LAND USE

Table 1.4-1 summarizes the land requirements for the facilities proposed as part of the Project. Land requirements for each component of the Project are described below.

1.4.1 Land Ownership, Existing Land Use, and Zoning

During construction of the LNG Terminal and related facilities, about 528 acres would be disturbed. Approximately 173 acres would be retained for operational facilities. JCEP owns about 295 acres at the LNG Terminal location, with additional temporary construction areas leased from other private landowners. Table 1.4-1 lists the land requirements for the LNG Terminal.

TABLE 1.4-1

Summary of Land Requirements for the LNG Terminal Project

Area(1)	Land Area (acres)	Comments
PROJECT FACILITIES (FIGURE 1.2-1)		
Terminal Site Access (1)	2.6	
Refrigerant Storage Area (2)	3.0	

TABLE 1.4-1

Summary of Land Requirements for the LNG Terminal Project

Area[(1)]	**Land Area (acres)**	**Comments**
Marine Area (3)	7.2	
Liquefaction Process Area (4)	12.1	
LNG Tank Area (5)	25.4	
Flare Area (6)	2.2	
MOF (7)	2.7	
Gas Processing Area (8)	5.3	
Slip and Access Channel (10)	70.4	
Steam Area (11)	5.9	
Admin Building (12)	3.7	
Access and Utility Corridor (R1)	4.5	
PCGP M&R Station	1.7	
Heavy Truck Haul Route (E4)	13.3	
Control Building/Maintenance Building (R1A)	12.7	
Project Facilities	**172.7**	
NONJURISDICTIONAL FACILITIES		
Southwest Oregon Regional Safety Center (SORSC) (13)	4.3	
Fire Department (FD)	0.6	
Nonjurisdictional Facilities	**4.9**	
TEMPORARY CONSTRUCTION AND ENVIRONMENTAL AREAS (FIGURES 1.1-1, 1.2-1 AND 1.2-2)		
Laydown (L)	21.7	Ingram Yard
Laydown (RFP)	75.5	
Laydown, Workforce Housing Facility and Parking (L,9)	71.4	South Dunes
Sand Dune Area (E2)	7.8	
TPP/101 Intersection	2.3	
Industrial Wastewater Pipeline	10.1	
Water/Raw Water Line	2.8	
Eelgrass Mitigation Area	7.5	environmental area

TABLE 1.4-1

Summary of Land Requirements for the LNG Terminal Project

Area[(1)]	Land Area (acres)	Comments
Boxcar Hill Laydown and Parking Area	4.6	
Kentuck Project	146.7	environmental area
Temporary Construction Areas	**350.4**	
TOTAL PROJECT AREA	**528.0**	

(1) Numbers or letters in brackets refer to area designations shown on Figures 1.2-1 and 1.2-2.

Virtually all of upland elements of the LNG Terminal are on privately owned lands. No federal lands would be utilized for the LNG Terminal. The majority of the waterway for LNG vessel marine traffic and the access channel to the LNG Terminal would be located in Coos Bay. The bottom of the bay is owned by the State of Oregon and managed by the ODSL.

The LNG Terminal would be located on the bay side of the North Spit, about 7.5 miles up the existing Coos Bay navigation channel, approximately 1,000 feet north of the city limit of North Bend, in Coos County, Oregon. The various elements of the Project, except for the waterway for LNG vessel traffic in Coos Bay, are illustrated on Figure 1.1-2.

The LNG Terminal would be within Section 5, Township (T.) 25 South (S.), Range (R.) 13 West (W.), shown on Coos County Assessor's map as tax lots 100/200/300. The LNG Terminal, slip, and access channel are located within the aquatic and shoreline segments of the Coos Bay Estuary Management Plan ("CBEMP"). The access channel and inter-tidal portion of the slip fall within zoning districts 5 and 6 – Development Aquatic (5-DA and 6-DA). The purpose of the 6-DA zone is to provide areas for navigation and other water-dependent uses. The upland portions of the LNG Terminal are located within the Coastal Shorelands Boundary and are designated districts 5 and 6 – Water Dependent Development Shorelands (5-WD and 6-WD). The purpose of zoning district 6-WD is to protect the shoreline and provide areas suitable for water-dependent industrial uses. On August 30, 2016, the Coos County Board of County Commissioners approved JCEP's request for a conditional use permit to site and construct an LNG Terminal. The Port obtained a removal-fill permit from ODSL to dredge an access channel that will connect the LNG Terminal slip to the federally authorized deep draft navigation channel within Coos Bay.

Historically, the LNG Terminal tract was once part of the Henderson Ranch, which dates back to the 1860s. In the 1880s, the Henderson Ranch was acquired by the Luse family, who later sold it to the Southern Oregon Improvement Company. William Luse was the son of H.H. Luse, who founded the first sawmill at Empire in 1856 (Dodge 1898). William Luse, John Henderson, Henry Barrett, Sam Crawford, and James Jordan were all acquaintances who married native Coos women, sought refuge on the North Spit, and were tangentially involved in the operation of the stage line from Jarvis Landing north along the beach to the Umpqua River. The Peterson family operated a dairy farm in the area in the early twentieth century, and continued to run cattle on the North Spit until the late 1950s (Byram 2006a). The terminal tract, then referred to as the Ingram Yard, was acquired by the Menasha Wood Ware Corporation and sold to

Weyerhaeuser in 1981. The Ingram Yard was used for log sorting and disposal of debris from operation of the mill. In the early 1970s, the USACE deposited materials dredged during maintenance of the Coos Bay navigation channel at the Ingram Yard.

JCEP proposes to construct and operate an approximately 1-mile access and utility corridor between the LNG Terminal and the South Dunes Site, in the Northeast (NE) Quarter of Section 5, T.25S., R.13W., and Northwest (NW) Quarter of Section 4. This corridor would be north of the existing RFP property, on land JCEP acquired from Weyerhaeuser. On the south side of the Access and Utility Corridor, adjacent to the eastern boundary of the LNG Terminal tract, JCEP would install support buildings, including the terminal control building, and a warehouse and maintenance building. Combined, the Access and Utility Corridor and LNG support buildings area encompass about 17 acres. Table 1.1-3 shows the support buildings proposed for the JCEP LNG Terminal. Historically, this parcel was once part of the Henry Barrett and Sam Crawford Ranch and the James Jordan Ranch, which were established in the 1860s and consolidated by the Luse family in the 1880s.

TABLE 1.1-3

Support Buildings for the JCEP LNG Terminal Project

Building Location / Function	Approx. Floor Area (ft²) / Eaves Height (ft.)	Form of Construction	Other Additional Elements
South Dunes / Southwest Oregon Regional Safety Center	26,110 / 15	Type1 – Engineered stick built building with interior finishes.	One story, architect designed.
South Dunes / Administration Building	24,769 / 15	Type 2 – Pre-engineered metal building with interior finishes.	One story.
Access Corridor / Firefighting Facility	21,560 / 14-28	Type 2 – Pre-engineered metal building with interior finishes.	Two story.
Access Corridor / Operation Building	41,590 / 18-36	Type 2 – Pre-engineered metal building with interior finishes.	Two story building will include the Control Room, Laboratory and First Aid Facility.
Access Corridor / Plant Warehouse/Receiving Building	30,000 / 28	Type 2 – Pre-engineered metal building with interior finishes.	One story with mezzanine.
Access Corridor / Maintenance Building	30,000 / 28	Type 2 – Pre-engineered metal building with interior finishes.	One story with mezzanine.
LNG Terminal / Tugboat,	2,664 / 17	Type 2 – Pre-engineered	One story.

TABLE 1.1-3

Support Buildings for the JCEP LNG Terminal Project

Building Location / Function	Approx. Floor Area (ft²) / Eaves Height (ft.)	Form of Construction	Other Additional Elements
Storage and Crew Building		metal building with interior finishes.	
Access Corridor / Inspection Station Shelter	4,950 / 23	Type 3 – Pre-engineered metal building without finishes.	One story, roof only.
Access Corridor / Chemical Storage and Hazardous Waste Storage Building	1,050 / 23	Type 3 – Pre-engineered metal building without finishes.	One story storage facility with air exchange handling units and wet sprinkler system to store hazardous materials such as paints, oils, greases, etc. for the facility
LNG Terminal / Water Treatment Building	9,188 / 23	Type 3 – Pre-engineered metal building without finishes.	One story.
Access Corridor / Guard House and Security Building	960 / 12	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal & South Dunes / Auxiliary Guard Buildings	360 / 12	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal / Marine Control Building	2,030 / 12	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal / Firewater	104 / 9 (x10)	Type 4 – Pre-manufactured metal	One story.

TABLE 1.1-3

Support Buildings for the JCEP LNG Terminal Project

Building Location / Function	Approx. Floor Area (ft²) / Eaves Height (ft.)	Form of Construction	Other Additional Elements
Valve Housing (x22).	372 / 10 (x10) 787 / 14 (x2)	building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	
LNG Terminal / Firewater Pump Housing (x1).	1,328 / 9 (x1)	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story, Two Buildings.
LNG Terminal / Powerhouse Housing (x12)	3,600 / 12 (x5) 4,284 / 12 (x1) 1,689 / 12 (x1) 4,480 / 12 (x1) 3,500 / 12 (x1) 2,000 / 12 (x3)	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal / Continuous Emissions Monitoring Systems Housing (x7)	120 / 8	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal / Backup Generator Housing (x2)	188 / 9	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal / VFD Housing (x2)	1,800 / 12	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	Single story, one each for the BOG and the LNG Tank Expander. Currently area of VFD for LNG Tank Expander is unknown.
LNG Terminal / Analyzer	120 / 8	Type 4 – Pre-	One story.

TABLE 1.1-3

Support Buildings for the JCEP LNG Terminal Project

Building Location / Function	Approx. Floor Area (ft²) / Eaves Height (ft.)	Form of Construction	Other Additional Elements
Housing (x1)		manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	
LNG Terminal – BOG Compressor Shelter (x1)	7,225 / 45	Type 5 – Pre-engineered metal building with roof and partial side panels only.	One story shelter will provide weather protection for compressor, lube oil consoles and maintenance cranes.
LNG Terminal – Refrigerant Compressor Shelters (x5)	3,233 / 64	Type 5 – Pre-engineered metal building with roof and partial side panels only.	One story shelter will provide weather protection for compressor, lube oil consoles and maintenance cranes.
LNG Terminal – Air Compressor Shelter (x1)	1,800 / 30	Type 5 – Pre-engineered metal building with roof and partial side panels only.	One story shelter will provide weather protection for compressor, lube oil consoles and maintenance cranes.
LNG Terminal / Steam Turbine Generator Shelter (x3)	3,150 / 45	Type 5 – Pre-engineered metal building with roof and partial side panels only.	One story.
LNG Terminal / Boiler Feed Water Pump Shelter (x1)	1,800 / 30	Type 5 – Pre-engineered metal building with roof and partial side panels only.	One story.

The eastern portion of the LNG Terminal on South Dunes is the site of the former linerboard mill property. This location is primarily zoned industrial and would include administration buildings, a workforce housing facility, and the metering station.

JCEP would also lease about 75 acres of industrial land within the existing 229-acre RFP property for temporary construction staging activities. The haul road and dredge slurry and return water lines from the slip, to be used temporarily during construction of the terminal, would also cross RFP industrial land. The proposed relocations of the IWWP and the raw water pipeline would be routed along the existing Trans Pacific Parkway (the road on the north side of the LNG Terminal). The relocations of the water lines would impact about 14 acres of industrial land and less than half an acre of forest land during construction.

JCEP has proposed mitigating the loss of wetlands within the design of the Kentuck Project.

The Kentuck Project would cover about 100 acres of uplands, some of which will constitute JCEP and PCGP wetland mitigation, on the western shore of Coos Bay at the mouth of Kentuck Slough Kentuck Project is to the west of North Cardinal Mark 11 along the Coos Bay navigation channel, including parts of Sections 6 and 7, T.25S, R.12W, tax lots 100/799 and Sections 1 and 12, T.25S, R.13W tax lots 400/100. Formerly, this was the Kentuck Golf Course, zoned for Recreation (REC) and Forest (F). However, on September 23, 2009, the Coos County Board of Commissioners rezoned this land to Exclusive Farm Use (EFU), and amended the Coos County Comprehensive Plan for this tract from Recreation and Forest use to Agriculture. On August 30, 2016, the Coos County Board of County Commissioners granted JCEP's request for a conditional use permit to allow for mitigation and restoration within Segment 15-RS of Rural Shore lands identified in the CBEMP. This property is currently owned by JCEP.

The waterway for LNG vessel marine traffic would traverse 7.5 miles of the existing navigation channel within Coos Bay. The navigation channel is zoned "Deep-Draft Navigation Channel" in the CBEMP. The navigation channel, which is generally 300 feet wide and 37 feet deep, is maintained by the USACE on behalf of the Port. It is used by deep-draft commercial ships and barges, a commercial fishing fleet, and recreational boats. The Coos Bay navigation channel does not need to be improved for the Project. Also within Coos Bay, adjacent to the Southwest Oregon Regional Airport, would be the Eelgrass Mitigation Site, which would cover approximately 7.5 acres of open water and bay bottom.

On the north side of the McCullough Bridge, the Project would make improvements to the intersection of US 101 with the Trans Pacific Parkway, in accordance with its Transportation Impact Analysis (DEA 2012).

JCEP proposes to use two temporary off-site parking lots during terminal construction for commuting workers not residing at the worker housing at the South Dunes Site. One lot, approximately 15 acres, would be at the Mill Casino in the city of North Bend and is zoned Heavy Industrial (M-H). A parking lot likely is permitted outright, although the use is not specifically listed (North Bend City Code Chapter 18.44010). The other lot, approximately 6 acres, would be at the Myrtlewood Facility along US 101 near the community of Hauser. It is in Coos County jurisdiction and zoned Industrial (IND). "Parking lot/structure" is a use that is permitted outright (Coos County Zoning and Land Development Ordinance 4.4.200 (27)).

Construction and operation of the LNG Terminal and related facilities should have no significant adverse impacts on existing land use. JCEP's facilities would be consistent and compatible with existing zoning. The LNG Terminal tract is zoned for water-dependent industrial use and the adjacent South Dunes property is zoned for industrial use. JCEP has obtained or is in the process of obtaining local and state permits necessary for use of the Project component areas (see Table 1.4-1).

1.4.2 Land Use Effects

Virtually all of the Project's upland elements are on privately owned lands. The majority of the waterway for LNG vessel marine traffic and the access channel to the LNG Terminal would be located in Coos Bay, considered to be waters of the State, with the bottom of the bay managed by ODSL. The waterway is zoned "Deep-Draft Navigation Channel," and LNG vessel traffic would be consistent with this use. The access channel and inter-tidal portion of the slip are zoned Development Aquatic; the upland portions of the LNG Terminal are zoned Water

Dependent Development Shorelands; and the South Dunes Site with administration buildings and workforce housing facility is zoned Industrial. Therefore, the LNG Terminal would be consistent with these water-dependent industrial uses. JCEP has received all of the necessary conditional use permits, and a Land Use Compatibility Statement.

Construction of the LNG Terminal, the SORSC, and associated facilities would affect a total of approximately 528 acres. The nearest residential structure to the proposed LNG Terminal is about 1.1 miles to the southeast, while the closest commercial buildings are part of the existing RFP industrial operation adjacent to the proposed LNG Terminal site.

The LNG Terminal and the western 52 miles of the pipeline route would be within Oregon's Designated Coastal Zone. JCEP and PCGP will submit an application to the Oregon Department of Land Conservation and Development ("DLCD") to obtain a coastal zone consistency determination. It is recommended that the construction not be allowed to proceed until after the Oregon DLCD makes a finding that the Project is consistent with the Coastal Zone Management Act.

The LNG Terminal and the South Dunes Site will be located on the bay side of the North Spit of Coos Bay, Oregon, located in unincorporated Coos County and to the north of the Cities of North Bend and Coos Bay, Oregon. A plot plan of the construction facilities is shown in Figure 1.2-1; a plot plan of the temporary construction facilities is shown in Figure 1.2-2. A summary of the land areas affected by the construction and operation of the LNG Terminal is provided in Table 1.2-1 and shown on Figures 1.2-1 and 1.2-2.

During construction, approximately 528 acres will be disturbed. Of the approximately 528 acres, 295 acres will be within the land owned by Fort Chicago LNG II U.S. L.P., an affiliate of JCEP. The remaining 233 acres outside of the land owned by Fort Chicago LNG II U.S. L.P. will be used for temporary construction areas and will be leased from private owners. Specifically, an additional area of about 75acres will be leased on the RFP property and used for temporary construction areas including office, laydown, fabrication, craft break/lunchroom, parking, a heavy equipment truck haul route, and a slurry/decant water pipeline route. In addition, approximately 14 acres for the industrial wastewater line and raw water/water line relocation (Figure 1.3-1) will be in an existing utility easement on land owned by the Port.

Following construction, approximately 173 acres on the LNG Terminal and South Dunes Site will be required for the permanent facilities.

The slip will be constructed on land owned by Fort Chicago LNG II U.S. L.P. JCEP will construct the slip and the LNG carrier and tug berths.

The access channel will be on land owned by the State of Oregon. JCEP will obtain an easement from the State of Oregon for the use and maintenance of the access channel. JCEP will construct the access channel.

1.5 CONSTRUCTION METHODS AND RESTORATION

1.5.1 Schedule

To meet an in-service date of the first half of 2024, construction activities for the Project are expected to begin in the first half of 2019. Construction of the LNG Terminal and slip is expected to take five years. All in-water work, including placement of material to construct the MOF, dredging, and specifically that required to remove the berm separating the slip and the access channel will occur during the allowable in-water work window (October 1 through February 15).

1.5.2 Construction Procedures

This section describes the general procedures proposed by JCEP for construction of the LNG Terminal facilities.

Under the provisions of the Natural Gas Pipeline Safety Act of 1968, as amended, JCEP would design, construct, operate, and maintain the LNG Terminal facilities in accordance with the U.S. DOT's/Pipeline and Hazardous Materials Safety Administration's ("PHMSA") Liquefied Natural Gas Facilities: Federal Safety Standards (49 CFR Part 193). The loading facilities and any appurtenances located between the LNG carriers and the last valve immediately before the LNG storage tank would be required to comply with applicable sections of the USCG regulations in Waterfront Facilities Handling Liquefied Natural Gas (33 CFR Part 127).

JCEP would construct the LNG Terminal facilities in accordance with its project-specific Erosion and Sediment Control Plan; its Upland Erosion Control, Revegetation, and Maintenance Plan ("JCEP's Plan"); and its Wetland and Waterbody Construction and Mitigation Procedures ("JCEP's Procedures"). JCEP has adopted the FERC's Plan and Procedures (May 2013 versions), as modified for the Project, into JCEP's Plan and Procedures as modified for this Project; therefore, there are no differences between JCEP's and FERC's Plan and Procedures. In addition, JCEP has prepared a Construction Spill Plan and Operations Spill Prevention Control and Countermeasures Plan.

JCEP's proposed LNG Terminal and associated aboveground facilities would be constructed in various phases. A description of the key elements of construction are provided below.

1.5.2.1 Site Preparation – Demolition and Clearing

Site preparation will commence with demolition, clearing and removal and relocation of existing functional and redundant infrastructure to enable earthworks to progress. There are several elements to this work including the following:

- <u>Industrial Wastewater Pipeline Relocation</u> The existing industrial wastewater pipeline will be relocated (Figure 1.3-1) in order to construct the marine facilities. Currently, the pipeline carries water from the two existing bio-solids ponds to the existing ocean outfall via the Lagoon site that is northwest of the proposed LNG Terminal site. Occasionally the water passing through the industrial wastewater pipeline is supplemented by water purchased from CBNBWB to maintain permitted pH levels in the Lagoon system and ensure the ocean outfall remains open. The new line will be installed in an easement along Trans Pacific Parkway to connect the lagoon site to both Ingram Yard and South Dunes Site.
- <u>Hydrocarbon contaminated soils</u> - The South Dunes Site contains small areas of hydrocarbon contaminated soils remaining after the decommissioning of the former Weyerhaeuser paper mill. The contamination is located in the vicinity of the proposed site for the permanent buildings and would likely be disturbed during possible soil

improvement activities. Following further delineation work, JCEP will develop a disposal plan for the approval of ODEQ and will dispose of the contaminated soils.

- Existing Utility Service Relocations - The LNG Terminal site currently has a CBNWB supply line and a Frontier telecommunications cable. These services will be relocated to easements on the Trans Pacific Parkway for subsequent tie-in to the LNG Terminal facilities. An existing communication cable that is currently aboveground on Trans Pacific Parkway will be relocated underground within an easement on Trans Pacific Parkway to provide additional security of service.
- Clearing - The dune areas at the LNG Terminal site currently contain low-grade timber. Before mobilizing earthmoving equipment, the trees will be felled and selectively processed for commercial timber. Scrub and stumps from across the site will be processed into mulch for use during construction operations. Wildlife monitoring will be undertaken before and during tree felling and site clearing activities according to the relevant regulations and permitting requirements.

1.5.2.2 Site Preparation – MOF Construction and Material Deliveries

Final transportation of materials, supplies, and staff to the Project site will be undertaken by a combination of road, marine transport, and rail. The kinds of materials and the mode of delivery to the site will depend on the origin, size, and weight of the material. The larger and heavier pieces of equipment can be delivered only by marine transport, and for that reason, JCEP will be constructing the MOF (Material Offloading Facility).

Until the MOF is constructed, the logistical difficulties presented within southwestern Oregon will mean that the majority of equipment will need to be delivered to the Project site by road. Therefore, the MOF will be completed as early as possible in order to reduce the impacts of road haulage on the local community and environment. Once constructed, the MOF will facilitate the receipt of large equipment,modules and general cargo.

The MOF will be placed at the southeastern corner of the slip, and will utilize the area dredged for the slip and access channel. The berth area behind the sheet pile walls will be used as the dock surface. Heavy equipment haul roads will be constructed from the construction dock face to the process area of the site.

Although marine transport is preferable, JCEP anticipates that some bulk materials, such as temporary buildings, construction equipment, steel reinforcement, pipe spools, cable drums, and insulation, will be delivered by road, according to the construction schedule, in order to minimize laydown requirements.

An existing rail line is located adjacent to the Project site and will be utilized where infrastructure restrictions allow. The rail line, which has been acquired by the Port, is now called the Coos Bay Rail Link and currently services the RFP facility adjacent to the proposed leased construction laydown areas.

Traffic surveys have been conducted of the anticipated construction-related traffic, and measures have been proposed to mitigate adverse effects of that traffic including upgrade of the intersection with US Highway 101. These impacts and mitigation will be discussed in detail in Resource Report 5 - Socioeconomics.

MOF construction will be sequenced as follows, and as shown in Figure 1.5-1:

- In the first available in-water work window (October 1 to February 15), earthwork consisting of a small excavator and 40-ton articulated trucks will cut soil from the southern portion of the existing dune. Clean sand will be placed within the channel and extending 30 feet outside of the MOF footprint. Rip-rap will be temporarily placed on the face of the slope to protect sandy material from tidal erosion.

- Using the placed fill to locate construction equipment, sheet piles will be driven as a land-based activity without further impact to the marine environment. Following installation of the sheet pile wall, the MOF will be filled to elevation 13 feet (NAVD88), and fender piles will be installed during the allowable in-water construction window between October 1 and February 15.
- In the next available in-water work window, a clam-shell dredge operation will remove all material from the front of the MOF to achieve operational depth requirements. After the sheet piles have relaxed, a topping-off operation behind the sheetpile wall will occur before concrete and rock are placed on top of the MOF to make it fully operational.

1.5.2.3 Site Preparation – Earthworks

Earthworks will require removal of topsoil and storage for re-use, cut (excavation and dredging), fill (placement of excavated material), and grading of approximately 9 million cubic yards (“mcy”) of material to the approximate elevations detailed in Table 1.3-1.

TABLE 1.3-1

JCEP LNG Terminal Project Elevations

Facility	Critical Minimum Elevation Required (ft)	Minimum Finished Grade Elevation (ft)	Critical Elevation
Marine Terminal (Typical)	34.5	34.5	Design Level Tsunami (L1)
LNG Tanks	34.5	27*	Design Level Tsunami (L1)
*LNG Tank Protection	34.5	46	Design Level Tsunami (L1)
Liquefaction Trains	34.5	46	Design Level Tsunami (L1)
Gas Conditioning	34.5	46	Design Level Tsunami (L1)
Corridor and Roseburg Forestry Products	34.5	46 to 62	Design Level Tsunami (L1)
South Dunes (Typical)	32	51 to 58	Design Level Tsunami (L1)
Tsunami Evacuation Muster (Terminal)	60	60	Life Safety Tsunami (XXL1)
Tsunami Evacuation Muster (South Dunes)	52	52	Life Safety Tsunami (XXL1)
Operations Building	60	60	Life Safety Tsunami (XXL1)
Firefighting Facility	60	60	Life Safety Tsunami (XXL1)
SORSC Building	52	52	Life Safety Tsunami (XXL1)

The upland earthworks phase will require the handling of large volumes of material. This phase of the works is highly mechanized and will require periods of 24-hour operation. The Project will implement specific safety measures to control person/machine interfaces, including a temporary bridge or traffic overpass that will be constructed to segregate traffic travelling to and from the RFP facility from the large, off-road haul trucks and equipment, as detailed in Figure 1.5-2. Equipment zones are shown at the LNG Terminal, Access and Utility Corridor, and South Dunes site in Figure 1.5-3.

Detailed site preparation studies have been undertaken to minimize the potential impacts caused by off-site disposal of materials such that a cut/fill balance within the site has been achieved.

Approximately half of the 4 mcy of material moved onto the South Dunes Site and RFP property areas will be moved by hydraulic means, either using an upland dredge from the future slip area or a marine dredge from the access channel, as described in more detail within Section 1.5.4.

The planned rehabilitation of the Kentuck Golf Course into Coho salmon habitat will require 300,000 cy of material to be transported from the dredge activities adjacent to the slip area to the Kentuck Project Site via marine transport barges.

Boiler ash previously disposed on the site of the LNG Terminal will be relocated to the South Dunes Site, where it will be buried within the fill.

The following erosion prevention best management practices will be employed to ensure local, state, and federal laws and regulations are met:

- Slopes stabilized by means of hydro seed, gravel, wood chips, or erosion control blankets.
- Existing vegetation preserved by limiting the amount of area disturbed during construction and maintaining existing vegetation on areas not disturbed by construction.
- Sediment protection devices set on all storm drains, catch basins, and other storm water conveyance structures that are susceptible to sediment collection.
- Temporary seeding performed to re-establish the vegetative cover on a disturbed area to prevent erosion of exposed soils.
- Compost wood chips or peat cover placed on disturbed areas to absorb wind and rain forces, and to develop an excellent growing medium for vegetation.
- Maintenance of best management practices by a dedicated crew will be ongoing through all phases of construction.

1.5.2.4 Site Preparation – Soil Improvement

The subsurface conditions at the site require soil improvement before the start of construction of the LNG facilities. These conditions include peat, clay, buried driftwood, and liquefiable soil, which could cause excessive settlement and stability concerns. Issues associated with liquefiable soils occur during seismic events.

Liquefiable soils are present throughout the LNG Terminal site, and their depths vary with the location. The liquefiable soils at Ingram Yard and along the Utility and Access Corridor have been delineated in distinct soil layers from the groundwater table to a maximum of approximately elevation -30 feet (NAVD88). At the LNG Terminal and the Utility and Access Corridor, the liquefiable layers are predicted to extend below the dunes present on the site. At the South Dunes Site, liquefaction is estimated in a soil zone that starts at the groundwater table and extends to variable depths from elevation 0 feet to approximately elevation -25 feet (NAVD88).

Peat is present under the non-dune portions of Ingram Yard (locations are detailed in Figure 1.5-4). The peat is generally understood to be located close to or just below the groundwater table at depths of about 7 to 15 feet below the existing grade, and has an estimated thickness of approximately 2 feet. At the South Dunes, the peat is generally understood to be located in the central portion of the site, as shown on Figure 1.5-5. The estimated peat thickness is generally 2 feet, except for one area where the peat is up to 4 feet thick. The level of decomposition of the material in the peat layer is variable, with wood in the form of branch-size material and wood chips dispersed throughout much of the peat layer. The long-term secondary consolidation settlement from the peat layer is estimated to be up to 7 inches.

A layer of clay has been identified in the South Dunes Site, as shown on Figure 1.5-5. The thickness of the clay layer is estimated to range from 0.3 feet up to 2.5 feet and would likely cause settlement by consolidation of up to 7 inches due to the fill placed on the South Dunes Site. Clay has not been identified at Ingram Yard or Utility and Access Corridor.

There are several areas in the South Dunes Site that are detailed on Figure 1.5-5 where accumulations of buried driftwood are estimated to be present. The driftwood will decompose over time, causing settlement of soils overlying the driftwood. Buried driftwood has not been identified at Ingram Yard or Utility and Access Corridor.

A detailed review of the potential methods of soil improvement has been undertaken, and a number of these proven methods could be employed for the Project, depending on the results of the final site investigations planned for 2018. Some of these methods are:

- Soil Densification Method 1 – Vibro-compaction will be the principal method utilized to condition soils that are believed to show potential for soil liquefaction under seismic activity. This method consists of driving a vibration device, assisted by compressed air and water, into the sand layers to compact the soils.
- Soil Densification Method 2 – Sand compaction piles are technically comparable to vibro-compaction; however, the availability of resources and resulting commercial variances will likely preclude their use.
- Organic Material Treatment Method 1 – Dry excavation and removal will be favored for larger peat deposits where localized dewatering would not impact the adjacent wetland bodies.
- Organic Material Treatment Method 2 – Adjacent to wetlands, wet excavation and removal will be tried, and based on the trials, it will be used only where a good quality result can be ensured.
- Organic Material Treatment Method 3 – Soil mixing, with pre-excavation, above organic material will be utilized in instances when the extent of the addition of binder can be minimized to achieve the necessary result, or where wet excavation does not prove acceptable.

Localized deposits of boiler ash that are on-site, which are a legacy of the Weyerhaeuser paper mill, will be hauled to the South Dunes Site and buried within the fill.

1.5.3 Anchor Bolts Down – Civil Work

Geotechnical studies have been completed to determine the properties of the existing subsurface soils and to identify the foundation design criteria and solutions (see Resource Report 13).

1.5.3.1 Piling

A number of piling solutions will be utilized on the Project, and will include driven and replacement pile systems. Typically, conventional pipe pile, sheet pile, or drilled piles will be used where required for earth retaining structures and deep foundations. It is anticipated that soil improvements will be sufficient to provide the bearing capacity for typical design loads. If additional bearing or lateral resistance is required to resist extraordinary/seismic lateral loads, it is likely that driven pipe pile foundations will be used. Driven piles will typically be driven to a depth that provides the required resistance and in some instances may require predrilling to reach the desired depth.

Given the seismic loading requirements and the height of the walls required for the marine slip, a steel sheet pile system is proposed for construction of the marine slip. The sheet pile system uses interlaced sheet piles in a U-shaped configuration to provide better overturning and sliding resistance than conventional sheet pile walls. In some instances, predrilling may be required to reach the desired depth. See Section 1.5.4 for more details.

1.5.3.2 Underground Services

Underground work consists of storm drains, gravity drains, utilities, fire water, process piping, and duct banks. The main fire water header, raw water supply, and feed gas supply will be close to the permanent roadways and temporary haul roads. Early completion of underground work will facilitate completion of site grading for stormwater control, completion of plant roadways, and installation of foundations and aboveground work.

Underground work will be closely coordinated with the mass earthwork movements to install as much of the piping and duct bank as possible while the site is still being brought to grade. Areas where piping densities are higher will be left open as fill work continues. This sequencing will minimize the amount of trenching, trenching depth, and double handling of fill material as well as the overall duration of the work.

Ground improvement operations will precede underground utility work in all cases. Work adjacent to roadways will be completed before the road base course. Installation of underground pipe in the corridor between the LNG Terminal and South Dunes will be sequenced around the construction and use of the corridor as a haul road. Underground pipe testing will be completed in segments to allow backfill operations to follow.

1.5.3.3 Foundations

The foundations for all equipment and structures, including the LNG storage tanks, process equipment, and pipe racks, will use either a shallow or deep foundation system. Typically, shallow isolated or raft foundations will be used unless the design requires the use of deep foundations. All foundation loads, analysis, design, and construction will be in accordance with statutory and regulatory requirements. Where required, foundations will be evaluated and designed to mitigate the hazards associated with settlement, bearing capacity, overturning, sliding, buoyancy, erosion, and scour.

Major foundation work will generally follow the installation of piling and underground utilities.

Formwork for foundations will comprise a mix of metal form systems and job-built wooden forms. Rebar will be fabricated off-site, delivered, and tied into place on-site. LNG containment basins will utilize sheet pile cofferdams. Seal slabs will be poured to prevent ground water infiltration. Formwork for the interior walls and shoring will be designed and stamped by a Professional Engineer. The sheet piles will serve as the outer form of the sump and remain in place (and be cut off below grade) or be pulled at a later date.

A concrete batch plant will be established to supply the LNG Terminal's needs. Local aggregate sources have been investigated and have been found to have deficiencies (chert inclusions) that preclude their use for concrete. Regional sourcing of on-spec aggregates has been confirmed. A concrete washout area will be located adjacent to the batch plant to allow for containment and disposal of waste water related to concrete batching operations. The disposal of concrete waste water will follow all necessary environmental regulations.

1.5.3.4 Restoration and Civil Finishes

Areas disturbed by construction of the LNG Terminal's facilities will be stabilized with temporary erosion controls until construction is complete, unless they are covered by equipment, gravel or other covering.

Following construction, the site will be brought up to final grade, and best management practices will be applied to prevent erosion. To minimize the potential for erosion, JCEP has modified the FERC's Upland Erosion Control, Revegetation, and Maintenance Plan (JCEP's Plan) and Wetland and Waterbody Construction and Mitigation Procedures (JCEP's Procedures), thereby creating Project-specific Plan and Procedures. A copy of JCEP's Procedures is provided in Appendix B.2 of Resource Report 2 – Water Use and Quality, and a copy of JCEP's Plan is provided in Appendix B.7 of Resource Report 7 – Soils.

After the foundations are completed, the site will be brought up to final grade. Final grading and surfacing will consist of gravel-surfaced areas, asphalt-surfaced areas, concrete-paved surfaces, grass areas, and placement of salvaged topsoil and mulch.

1.5.4 Marine Facilities

1.5.4.1 Dredging and Shore Protection

About 4.3 mcy of material will need to be removed to create the slip basin. Of this, about 2.3 mcy would be dry excavated and about 2.0 mcy would be hydraulically dredged. The excavated and dredged materials would be transported to the planned locations on Ingram Yard and the South Dunes Site, and used to raise the elevations.

During the "fresh water" construction phase of the slip (see Section 1.5.4.2, Slip Construction, below for a description of the construction of the slip), up to about 1.5 mcy of material would be dredged in the pocket behind a temporary construction berm, as shown in Figure 1.5-6. During the "salt water" construction phase of the slip, about 0.5 mcy of material would be dredged during removal of the temporary construction berm. Last, about 1.3 mcy of material would be cutter-suction dredged from the bay during construction of the access channel and MOF between the current Coos Bay navigation channel and the proposed LNG Terminal marine slip. The northern slip face would be armored after the slip is dredged but before the temporary construction berm is removed. The south slip would remain unarmored, because the temporary construction berm would be removed during the later stages of slip construction.

The estimated excavated and dredged material volumes and their proposed placement locations are summarized in Table 1.1-2.

TABLE 1.1-2

Estimated Excavated and Dredged Material Volumes for the JCEP LNG Terminal Project

Facility	Construction Phase	Volume (mcy)	Placement Location
Slip	Land Based Excavation	2.3	LNG Terminal Site and South Dunes Site
Fresh Water Phase			
Slip	Dredging in Pocket Behind Berm (Base Option)	Up to 1.5	LNG Terminal Site and South Dunes Site
Salt Water Phase			
Slip	Dredging from Bay (Option 1)	Remaining of 1.5	LNG Terminal Site and South Dunes Site
Slip	Dredging to Remove Berm	0.5	LNG Terminal Site
Access Channel	Dredging from Bay	1.3	South Dunes Site

Modelling conducted by Coast and Harbor Engineering ("CHE") (see Resource Report 2 attachments for details) of sedimentation over time in the access channel and slip estimates that the access channel would accumulate about 0.56 feet of sediment per year, equivalent to about 29,200 cy of material, while the terminal slip would accumulate about 0.16 feet per year of sediment, equivalent to about 8,500 cy of material. Approximately a total of 37,700 cy of material could be dredged for maintenance of the access channel and slip combined in year one of operation of the LNG Terminal, and 34,600 cy in year ten. In the first ten years of operation of the LNG Terminal, about 360,000 cy of material would need to be removed to maintain the proper depth of the access channel and slip, while in the next ten years about 330,000 cy would need to be removed. The recommended maintenance is to conduct dredging about every 3 years, with about 115,000 cy of material removed for the first 12 years of operation, and after that maintenance dredging could be done about every 5 years with up to 160,000 cy of materials removed.

Authorization for, and upland location of disposal of, maintenance dredge materials will be the subject of future approvals.

1.5.4.2 Construction of Sheetpile Wall

Before the excavation work for the slip begins, the sheet pile bulkhead and retaining wall will be installed. The sheetpile system will serve as a retaining wall for the shoreline on the east and west sides. The east side will support the LNG carrier loading facility and associated berthing and mooring facilities. The sheetpile system will be designed to support the dead loads of the soils and structures, and the live loads of the LNG carrier at berth and LNG transfer equipment, and is also designed to meet the seismic criteria for the facility and water-imposed loads. The west side will provide an emergency lay berth and the sheetpile system will be designed to support the dead loads of the soils and structures and the live loads of the LNG carrier at berth.

The sheetpile wall system consists of face sheet piles for retaining the soils as well as tail-walls for anchorage of the retaining wall. All sheet piles and tail-walls will be driven from the land while the slip construction activities are isolated from Coos Bay.

1.5.4.3 Slip Construction

To minimize the impacts of construction of the marine facilities on fisheries, reduce the total period of estuary turbidity, and extend the time available for construction, a two-phase construction methodology will be used to construct the slip. The basic concept of the two-phase construction methodology is to excavate (either wet or dry) the majority of the slip area and construct the structures while maintaining a natural physical barrier between the excavated/dredged slip and the water of Coos Bay (see Figure 1.5-6). This methodology will be accomplished by retaining a natural earthen berm to provide a physical partition between the water of Coos Bay and the Phase 1 (fresh water) construction activities for the marine facilities. This construction methodology will allow year-round work on the northern portion of the slip without being in contact with or causing an impact to the waters of Coos Bay. Phase 2 work will include excavating the access channel and excavation/dredging of the berm and MOF in-water construction. Phase 2 will be constructed during periods when fisheries considerations allow in-water work, between October 1 and February 15.

1.5.4.4 Slip Upland Construction Details

Details of each of the steps involved during upland construction are outlined below.

1.5.4.4.1 Dry Excavation

The existing natural ground surface is at an elevation of approximately +20 feet NAVD88. The water table across the slip occurs at an elevation of approximately +10 feet NAVD88. All excavated material above an elevation of approximately +10 feet NAVD88 will be removed by conventional earthmoving equipment such as excavators, scrapers, bulldozers, and front-end loaders. A berm will be maintained as a barrier to the bay during this construction phase. In all areas other than where the sheet pile is installed, a side slope of 2.5 Horizontal (“H”) to 1 Vertical (“V”) (2.5H:1V) will be maintained on the slip side to preserve the integrity of the berm during excavation and dredging, as shown in Figure 1.5-6. Excavation during this step will remove only material that is essential for creating the slip and constructing upland structures. Contouring of the slip perimeter above +10 feet NAVD88 will be performed during this step. Side slopes of 2.5H:1V where the sheet piling is not used will be maintained around the perimeter of the slip to maintain slope stability.

The volume of material to be excavated and dredged from the slip is 4.3 mcy (2.3 mcy excavated and 2.0 mcy dredged), and the volume to be dredged from the access channel is 1.3 mcy for a total of 5.6 mcy. Current plans for management of the material involve the placement of the 1.9 mcy of excavated material on Ingram Yard and the placement of 3.7 mcy on the South Dunes Site (see Table 1.1-2).

Excavated material will be hauled by trucks to the South Dunes Site. The excavated material truck haul route will go to the north of the slip through Ingram Yard and then follow the route of the Access and Utility Corridor to the South Dunes Site. The route will not cross the Trans Pacific Parkway at any time, and the only potential conflict will be with chip truck traffic to the RFP wood chip facility, which will be mitigated by construction of a temporary bridge or traffic overpass. The excavated material truck haul route will be on JCEP-owned land. Figure 1.3-2 shows truck haul routes.

1.5.4.4.2 Excavation of Dredge Launch Pond

Several wide-tread excavators will be used to remove material down to elevation 0.0 feet NAVD88, thereby creating a 300-foot-long by 200-foot-wide by 10-foot-deep launch pond. The launch pond preferably will be located near the slip perimeter and road access. The material will be moved to the upland disposal sites by trucks, as described in the previous section.

The dredge barge will be delivered by ocean-going barge to the channel, then pulled over the berm to facilitate hydraulic dredging of the slip. All of the material to be excavated that is located at or below the level of the water table will be removed by means of hydraulic dredging and transported to the South Dunes Site.

The slurry pipeline used for hydraulic transportation of excavated materials (including the decant water return line) will follow the shoreline of the RFP property until the point where it follows the route of the future Access and Utility Corridor. The route will be approximately 8,650 feet long and will have an approximate construction right-of-way width of 8 feet. This pipeline will not result in additional land disturbance. From the slip site across the RFP property, the pipes will be placed directly on the ground surface. From the point where they follow the route of the Access and Utility Corridor, the pipeline will be covered with the fill used to develop the Access and Utility Corridor. No excavation of the existing ground surface will occur to install the slurry pipeline, because the pipeline will be placed on fill material and temporarily covered by additional fill material. Where not covered, the pipeline will be held in place by cross bracing anchored into the soil. In the area of the RFP chip ship berth, the pipeline will be placed on the rip-rap along the shoreline, so that it does not affect the docking and loading of the chip ships. The pipeline will be able to span any affected wetlands or waterbodies without the need to place any structures in the wetlands or waterbodies. At all points along the pipeline route where the slurry pipeline could rupture and the contents could potentially enter the waters of Coos Bay, secondary containment will be provided around the slurry pipeline.

The slurry pipeline and decant water return pipelines will be made of 18- to 20-inch-diameter fused polypropylene (seamless) pipeline, and will be provided with secondary containment at any wetland and waterbody crossings to ensure that those bodies will not be affected by any breaks or leaks. The decant water return pipeline will be placed along, and directly adjacent to, the slurry pipeline (no spacing between the two pipelines). The decant water pipeline will be used to convey the decanted water from the settling areas back to the dredge pond. When the hydraulic transport has been completed, the pipelines will be drained, flushed with clean water, and cut apart only in those areas where any residual material in the pipeline could not potentially be released into the bay, wetlands, or other waterbodies. The pipeline will be removed by the contractor and taken off-site for reuse, recycling, or disposal in a permitted landfill. Since the pipelines will be on existing developed surfaces (grassed, paved, graveled, and rip-rap area of the RFP property) and areas to be developed for the Project (Access and Utility Corridor), post-construction restoration will include reseeding of grassed areas that were disturbed by the location of the pipelines on the grassed area.

1.5.4.4.3 Slip Dredging

One or more disassembled hydraulic dredge plants will be transported to the slip site by barge. The hydraulic dredge plants may be in the 18-inch to 24-inch size range, since this is the maximum size range for transportability and the minimum size range capable of dredging to an elevation of -45.9 feet NAVD88. The plants will be assembled on-site and lifted by crane into the dredge launch pond. A hydraulic transport pipeline will connect the dredge or dredges to the South Dunes Site, and a decant water return pipeline will return the water to the slip area or purpose-built decant basin.

The hydraulic dredges, which are capable of transporting a slurry of 30 percent solids by weight at a flow rate of 6,000 gallons per minute ("gpm") or greater, will create an ever-increasing dredge prism that will, in the end, create the fully defined slip within the confines of the berm. The hydraulic dredges are capable of dredging to the final slip depth of -45.9 feet NAVD88, while creating side slopes for the slip at a ratio of 3H:1V where the sheet piling is not used. Dredging of the slip prism will be conducted outside of the normal Coos Bay dredging window, because the slip will be isolated from the waters of Coos Bay by the berm.

1.5.4.4.4 Driving of Piling for Marine Structures

All of the mooring dolphins will be constructed "in-the-dry" and, as such, piles can be driven prior to or concurrent with the dredging of the slip. Land-based mobile cranes with pile-driving equipment will be located on the land-side of the sheetpile walls. All piles required for the LNG loading structure as well as for all of the mooring dolphins will be driven on dry land. Fender piles are required at the MOF, and would be installed before excavation and during the allowable in-water construction window between October 1 and February 15.

1.5.4.4.5 Slope Armoring

The northern slip face will then be armored. The south slip face created by the berm will remain unarmored, because it will be removed during the next construction step to create the final configuration of the slip and the access channel. The sequence for pile driving, slope dressing, and armoring may vary depending upon the means and methods chosen by the contractor performing the work.

1.5.4.5 Marine Construction Details

Details of each of the steps involved during Marine Construction are outlined below.

1.5.4.5.1 Breaching and Removing the Berm

Once all of the Phase 1 construction is complete, work will begin on breaching and removing the berm (500,000 cy) and the remaining area of the slip. Dredging may be conducted from both the Coos Bay side and the slip side to reduce the duration of the breaching and removal activity. Material will be removed by hydraulic dredge or clam-shell dredge. Material (approximately 300,000 cy) will be transported to the Kentuck Project to be used as fill.

1.5.4.5.2 Final Contouring and Slope Armoring

Removing the berm will open the slip to Coos Bay. Additional dredging to contour the access channel will complete the construction dredging activities. Armoring of the remaining unarmored slip side slopes will be completed. Although not anticipated at this time, any additional in-water structures required to complete the slip and associated in-water structures will be installed. In-water work will be performed during the allowable construction window between October 1 and February 15.

1.5.4.5.3 Dredging Access Channel

The access channel connecting the slip to the Coos Bay navigation channel will be dredged either before or after the berm is removed. This work, along with all in-water removal activities performed from the Coos Bay (southerly) side of the berm, will be performed during an allowable in-water construction window between October 1 and February 15.

1.5.4.5.4 Restoration

Following the excavation activities, all exposed areas, including exposed slopes, will be stabilized with an approved seed mixture specified as being capable of surviving in highly permeable, xeric regimes, binding loose sand, and withstanding burial and deflation from aeolian processes.

The slurry and decant water return pipelines will be removed as described above. Any areas that are disturbed by the haul truck or pipelines route that do not become part of the Access and Utility Corridor, will be restored to pre-construction condition.

The route of the slurry/decant water return pipelines on the developed RFP property will not require restoration, because the pipelines will be placed on areas that are graveled, concrete, or rip-rapped. If there are any areas of the route where ground disturbance occurs, these areas will be returned to pre-construction conditions.

1.5.4.6 LNG Carrier Loading Facilities

The LNG carrier loading facilities will be constructed once the installation of the eastern sheet pile wall system is complete. All of the loading facilities will be on the shore side of the slip, with no facilities located in the water of the slip. The platform with the loading arms (inclusive of the loading and vapor return arms) will be installed on a concrete pad located at the edge of the slip. The foundation of the pad will contain a number of piles to provide a stable foundation for the loading arm platform. Separate piles will be driven for the breasting dolphin and the mooring dolphin platforms. The loading arm platform will be constructed on columns raised from the concrete pad and accessed through stairways. The LNG transfer piping will be located over LNG troughs that will contain any spills and divert the LNG to a containment basin.

The LNG carrier loading facilities will be constructed using land-based equipment to install the required structural elements for the loading platform and mooring dolphins. Installation of berth piping and equipment, and hookup and commissioning of the loading system and utilities will follow.

1.5.4.7 Shoreline Protection

The LNG basin shoreline will be protected from wave action and wind erosion using stone or articulated block reinforcement. Extensive hydrodynamic modeling (by C&H) has indicated that LNG carrier and tug propeller scour protection will not be required on the east side of the slip. The north side and east side will be protected by extending from the toe trench to above the water line, where it will be tied into other slope stabilization structures using various techniques (concrete cellular mattresses (“CCMs”), grout-injected geotextile fabric mattresses (fabriform), soil improvement techniques, and/or geotextile reinforced vegetative planting). For the portion of the berth basin that is not expected to be subjected to wind, wave and water level conditions under operating conditions, alternative erosion protection means will be used. This portion of the berth basin includes the area above elevation +25 feet NAVD88. This area may be protected using CCMs, grout-injected geotextile fabric mattresses (fabriform), and/or geotextile-reinforced vegetative planting. The erosion control methods will be designed to withstand expected rainfall runoff.

1.5.5 LNG Storage Tank Construction

The description below provides an outline of the construction sequence for the erection of the seismically isolated double-containment LNG storage tanks.

1.5.5.1 Concrete Work

Foundation Slab - Before the base slab is installed, there will be a levelling pad poured to ensure a level working surface for the base slab. The slab installation will be performed in sections. The first activity will be to form, install rebar, and pour the outer sections, and then the interior sections. Forming of the pedestals for the bearings will follow the bottom slab pours. During installation of the seismic isolation bearings, the upper slab shoring and formwork will be started. The upper slab pour sequence will be the same as for the bottom slab and only occur after the bottom slab has cured enough to achieve the proper compressive strength. The same work sequence will follow for the second tank.

Formwork Fabrication - A jump-form system will be utilized for the concrete walls. The jump forms will be assembled on-site from pre-fabricated panels. The wall will be straight without any taper to minimize complexity until the top ring beam is installed. The top ring beam will require a modification to the inside formwork to allow for the installation of the compression ring.

Rebar Fabrication - The rebar will be pre-assembled into mats on-site prior to installation. There will be two assembly areas set up, each within the radius of both tower cranes. The rebar for the ring beam will be tied in place.

Wall Construction - The walls will be constructed in quarter-sections. Wall pouring will start once the outer sections of the elevated slab have cured adequately. The pre-assembled rebar mats will be flown into place. The rebar crews will be installing the post-tensioning ducts with each mat of rebar. Embeds for attachment of the vapor liner will be installed in this operation as well. The formwork will then be erected, and the concrete will be poured. To facilitate construction, tower cranes, placing booms, and pump trucks will be used.

Ring Beam - The ring beam will be partially completed before raising the roof. Mechanical couplers will be utilized to allow for an effective tie-in to the roof structure. Once the steel roof structure is air raised and welded to the compression ring, the ring beam will be finished as it is tied into the concrete on the roof. The post-tensioning ducts in the ring beam will be stressed before the roof is poured.

Concrete Roof - Once the steel roof structure is welded in place, the rebar will be installed on the structure. Concrete placing booms will be utilized for the roof pours.

1.5.5.2 Steel Plate Work

Tank Floor - The floor is the first steel plate activity (the first steel layer on the concrete) that can start without interfering with the concrete work. Once the concrete outer wall is high enough, the temporary roof supports will be installed. A freestanding support at the center of the dome roof and knee brace style supports at the perimeter of the roof will be installed high enough off the floor to allow access under the roof. The outer tank roof assembly starts once these supports are installed. The roof petals are flown into the tank using a large crawler crane and set onto their temporary supports. While the assembly of the petals is occurring, the concrete crews will continue to install rebar and formwork, and pour concrete for the outer wall, as shown in Figure 1.5-7.

Dome Roof - The dome roof is composed of pre-fabricated petals that are assembled and welded on temporary supports on the floor of the tank (Figure 1.5-7). An aluminum suspended deck forms the top of the inner tank and is installed once the temporary supports are removed. This includes all openings and nozzles between the inner and outer tanks. Insulation is placed on the suspended deck for installation later. JCEP will utilize a specialty air lift subcontractor for raising the roof. The pressure required to lift the dome roof is about 0.5 psi. Once the roof reaches the compression ring, fit-up of the roof to the compression ring is completed and welding starts. Once the roof is secured, the tank is depressurized and the door plate is removed to provide access inside the tank to complete welding of the roof to the underside of the compression ring. The safety of the workers is the number one priority. Absolutely no one will be allowed to go inside the tank until all of the required checks have been performed and the tank has been declared safe to enter. The top of the ring beam will be poured as the welding on the underside of the compression ring is being performed. Before pouring the roof, the door plate is re-installed and the pressure is re-applied. During the pour and cure, no work can be performed in the interior of the tank because it remains under pressure.

Example of Wall Liner and Floor Insulation - After the door plate is re-opened, the outer wall liner plate and floor insulation can start. The plates are double jointed lengthwise and tacked to the embedded steel that was placed in the wall forms. Plates are then seal welded together to form the vapor barrier. Similarly, plates are installed on the elevated slab that forms the bottom of the tank. Precise welding procedures are followed to ensure a quality weld and (non-destructive examination is performed as a quality check. Scissor lifts and aerial work platforms are used for access. While the wall liner plates are being installed, insulation of the floor begins. A layer of leveling concrete is placed on the floor liner plate, followed by layers of damp proofing, cellular glass block, and floor plate. Thermal corner protection will be installed to ensure that heat leakage stays within the design parameters.

Inner Tank - The inner tank will be erected using a hydraulic rough terrain crane inside the tank. The door plate design will take into consideration the width and height of the equipment that needs to access the interior of the tank. The first piece of the inner tank is the annular bottom plate. Once the annular bottom plate is welded, the inner tank shell erection can begin. Until the last course of the inner tank is installed and welded, the floor cannot be completed because of the utilization of the crane in the center of the tank. The crews will utilize a gondola for access between the wall liner and the inner tank shell for welding. After all equipment is removed, the final floor plates, inner door, and outer door are installed.

1.5.5.3 Tank Pressure Test

A hydrostatic test of the inner tank will be carried out in accordance with API 620 Section R.6 using fresh water. The outer tank will be pneumatically tested in accordance with API 620 Section R.7.

Test water will be transferred between tanks and disposed of according to the methods described in Section 1.5.6.8.

1.5.5.4 Tank Insulation

Floor – The floor will be insulated as described for the wall liner above.

Inner Wall - Once the inner wall quality check is completed, a hoist will be used to install the liner insulation on the inner tank wall. Stainless steel wire is used to tie the insulation layer along the inner tank wall.

Suspended Deck - The suspended deck is insulated with a glass fiber blanket after the installation of the perlite in between the wall liner and the inner tank wall.

Perlite - This portion of the work will be performed by a specialty perlite installation subcontractor. The perlite will be filled through the roof nozzles into the annulus between the wall liner and the inner tank plates.

1.5.5.5 Purging

Once the insulation is completed, the outer temporary construction opening will be closed, and an air compressor will introduce dry air into the inner tank and dome space. Nitrogen will then be introduced and vented through a roof nozzle.

1.5.6 Anchor Bolts Up – Mechanical, Electrical and Finishes

Construction of the pipe racks, terminal buildings, major mechanical equipment, process and utility piping, and electrical equipment and instrumentation will follow the concrete foundation work. These facilities will be completed and pre-commissioned in readiness for mechanical completion.

1.5.6.1 Module Installation

The construction of the process facilities will be composed of both modularized and stick-built structures. Because the Project site must utilize water delivery for the major equipment, large modularized structures can also be delivered, providing the Project access to overseas fabrication yards. Modularized structures allow for major portions of the work to be fabricated off-site before the civil and concrete work is completed, which will allow labor requirements to be balanced with availability and reduce overall impacts in the local community.

The modules will be delivered to the site mechanically complete, with all coatings, proofing, and insulation fully installed. The unitized design of the modules for the Project allows for the stick-built portion of the work to proceed independent of the delivery of the modules. This decoupling of the stick-built work from the modules allows the off-module work to proceed in a productive and uninterrupted manner right up to the start of testing and commissioning activities.

The work to connect the modules is minimal, because the unitized design requires a limited number of tie points.

The process equipment modules include five identical modules for the liquefaction trains, an LNG handling module, three gas conditioning modules (one each for AGRU, dehydration, and mercury removal units), and the LNG loading module. The bulk of pipe racks will also be modularized. The design of the modules allows them to be off-loaded directly from the Self-Propelled Modular Trailers to their foundations, or picked up and set by crane. The site plot plan and sequencing of the module installation has been designed to provide flexibility in the module delivery schedule while minimizing the impact of module installations to ongoing site activities. Figure 1.5-8 outlines the planned installation sequence for the modules. The delivery and installation of the first pipe rack modules will begin shortly after the completion of the MOF, where all modules will be unloaded before they are moved to the site. Before the installation of the modules, all underground and foundation construction will be complete to the furthest extent practical.

The approach of the foundation design and construction schedule is to minimize the overlapping of the civil and concrete trades with the structural, mechanical, and electrical and instrumentation trades once the modules are in position. The module installation begins with the pipe rack modules along the liquefaction trains and in the LNG tank area, and is followed by the modules in the utility and refrigerant make-up areas. The pipe rack modules at the intersection of the liquefaction and utility areas will be held out until the modules and other major equipment have passed through this area. The equipment modules, starting with the LNG handling module, will be installed next. The installation of the LNG handling module will be followed by the liquefaction modules, alternating with the gas conditioning modules until all module installations are complete. The detailed installation sequence has been coordinated between the module fabrication schedule, logistics plan, required cargo arrangement on each transportation vessel, and the site construction schedule.

1.5.6.2 Steelwork Erection

Many of the structures needed for the LNG Terminal are not suited for modularization, and will therefore be stick-built on-site. Steel shapes will be fabricated with all finish painting, galvanizing, and fire/coldproofing shop-applied. All stick-built steel will be fabricated with bolted connections to facilitate erection. Stick-built structures include:

- STG and flare area pipe racks
- STG shelters
- LNG train pipe racks
- LNG refrigerant compressor shelters
- Shelters for BOG compressors, air compressors, and boiler feed pumps
- Pre-engineered buildings
- Miscellaneous sleeper racks, equipment platforms, T-stands, and vapor barriers will make up the balance of the steel erection work at the site.

Pipe racks will be erected in levels to facilitate pipe installation. This work will be highly orchestrated between the trades. Equipment shelters over rotating equipment include a bridge crane and architectural paneling on the roof with partially enclosed walls. After shelter erection, JCEP will commission and certify the overhead cranes and place them into service for use in erecting the piping and other work inside the shelter. The cranes will be inspected and recertified by the vendor at turnover.

1.5.6.3 Mechanical Equipment Installation

Key process equipment utilized for the LNG Terminal will be installed in the modules. However, a significant element has been excluded, specifically the major rotating equipment and long-lead items. The mechanical equipment that will be installed on-site includes:

- Refrigerant compressors and combustion turbine drives
- Heat recovery steam generators
- BOG compressors
- Steam turbine generators
- Air-cooled condensers
- Thermal oxidizer
- Prefabricated equipment buildings
- Electrical powerhouses
- Fire water pumps
- Guard shacks, CEMS building, and valve houses
- Carriers and tanks
- Pumps
- Miscellaneous vendor skids
- Field-erected tanks

- Flares – warm, cold, marine

1.5.6.4 Major Stick-Built Equipment

Refrigerant Compressors and Combustion Turbine Drivers – Equipment will be skid-mounted by the vendor and fully assembled, tested, and disassembled prior to shipping. The compressor, turbine, control equipment, lube oil pumps and reservoir, and associated piping are included in this package and will be installed on-site. After the large pieces are set, the building steel will be erected. Remaining vendor piping and accessories for the compressor/combustion turbine will then be installed.

Heat Recovery Steam Generators (HRSGs) – Units will arrive with the tube bundles installed in the casing section at the shop. The casing sections will be up-righted and lifted into place on the foundation with crawler cranes. Casework splice plates and interior liner plates will be installed and seal welded. The stack will be then be installed. The steam drum, tube bundle jumpers, down-comers, and drain piping will follow.

BOG Compressors – Equipment will be skid-mounted and set using a large crawler crane. The electric drivers will be fully assembled but likely not be shipped on the skid and will require installation in the field. Installation of accessory skids, lube oil piping, and coolers will follow. After the large pieces are set, the building steel will be erected.

Steam Turbine Generators (STGs) – Each piece of equipment will have its own baseplate and foundation. The STGs will be set with a large crawler crane. After the large pieces are set, the building steel will be erected. The accessory modules sit outside the shelter and will be set by crane. Lube oil piping and remaining accessories will be installed after the steel.

Air Cooled Condensers – Equipment is fabricated as an A-frame-type steam condenser. Each STG will have its own independent ACC. The fan cells will be pre-assembled at ground level and lifted into place upon stick-built steel legs with a large crawler crane. After the cells are in place, the A-frame panels will be pre-assembled and lifted into place along with the collector pipe and steam header on top. The connecting ductwork back to the axial flow turbines will be pre-assembled and set by crane.

Thermal Oxidizer – Equipment will arrive in several pieces. The combustion chamber sections will have shop-installed refractory. The sections will be preassembled and set by crane. Combustion air ductwork and FD fan will be installed and sealed. Finally, the stack will be erected. Burners, other accessories, and joint insulation will follow.

Prefabricated Equipment Buildings – Units will arrive via truck or ship depending on the final sourcing. In general, these units will be fully completed building shells with equipment, lighting, controls, etc. fully installed and tested. These will be set by crane and secured to a concrete foundation.

Electrical Powerhouses – These units are too large to ship fully assembled and will come in two to six sections, depending on the amount of electrical equipment contained. These buildings will set directly on pipe piles that are roughly 8 feet above finished grade. After the pieces are set, the shell splice plates will be installed and sealed, and electrical jumpers installed. The HVAC systems will be installed and commissioned on temporary power to provide climate control for the electrical equipment.

Shop Fabricated Vessels and Tanks – Equipment will be set by crane. Equipment will be dressed out with insulation, platforms, pipe support and piping, cable tray, etc. at site before setting.

The amine regenerator will be lifted with a large crawler crane and will require another crawler crane for tailing.

The amine contactor and regenerator vessels will have the internal trays shop- installed. The amine contactor is too heavy to set with the cranes currently planned for the Project and instead a specialty heavy lift subcontractor and equipment will set it. Packing will be installed at site during pre-commissioning just before degreasing of the AGRU. Pumps will be installed as the piping work progresses through each area.

The pumps in the LNG impoundment basins and waste water sump will be installed and commissioned on temporary power early in the Project schedule, because they handle storm water from all of the concrete paved areas under LNG service lines. There are numerous miscellaneous vendor packages and skidded equipment that will be installed around the site as the work progresses. Setting will utilize forklifts, mobile cranes, and even permanent overhead bridge cranes.

There are two large field-erected tanks on the site for fire water service. A specialty tank erection subcontractor will be utilized for this work.

There are two ground flares on the Project: one (warm and cold flare) multipoint enclosed ground flare and one (marine flare) cylindrical enclosed ground flare. Both will be field-erected on-site.

1.5.6.5 Heavy Lifting and Heavy Transport

A Heavy Lift and Haul Plan will be prepared for safely receiving, transporting, and installing all major equipment and modules. The plan focuses on the movement and lifting of major equipment and modules that require extra attention due to physical configuration, size, and weight. The plan concentrates on the movement of the major module assemblies from the MOF to the Project site. The heavy lift portion of the plan focuses on the crane equipment sizing, lift plan categorization (critical or general lifts), preliminary critical lift plans, crane pad design, and plot plan locations for major crane operations. Each type of heavy haul or lifting operation will require a specific level of planning, coordination, and approval prior to field execution.

1.5.6.6 Piping

While piping will be a major component of off-site modules, there remains a significant amount of stick-built piping work on-site, including:

- Low-density pipe racks and sleeper racks
- Piping coming-off modules to field-installed equipment
- Piping in field-erected buildings
- Module-to-module interconnections
- Module ship loose spools
- Piping associated with site-erected tanks, mechanical systems, and equipment installations,
- including vendor-supplied piping
- Inspection and testing

Early piping installation will focus on the stick-built portions in the STG rack and the LNG load-out rack. These racks will install steel and piping in alternating layers. This method allows for unencumbered access to the work and no overhead obstructions for crane-setting material.

Remaining piping work will commence as available work faces open up from equipment or module setting.

1.5.6.7 Piping Fabrication

Stick-built piping and pipe supports will be fabricated into spools and finish painted off-site to minimize the need for on-site fabrication labor and facilities. This work will be contracted to a union fabrication shop located in the U.S. in accordance with the Project Labor Agreement (PLA).

1.5.6.8 Pressure Testing

Pressure testing, wherever possible, will be hydrostatic; however, pneumatic testing of piping systems and pressure equipment will take place in cases where residual water would impact subsequent operations.

A project-specific pneumatic test procedure that adheres to all applicable jurisdictional safety, and code requirements will be developed and implemented. Pneumatic pressure testing is performed only when hydrostatic testing is not an option due to system configuration and/or potential contamination issues. Safety is of primary concern with such testing. Engineering will perform stored energy and safe distance calculations per ASME PCC-2, with exclusion zones clearly communicated and monitored to manage the potential dangers associated with pneumatic pressure testing.

Potable water will be used for pressure testing of piping systems, unless restricted by piping metallurgy. Given the climatic conditions in southern Oregon, no additives are anticipated for freeze or other protection.

Water used in pressure testing will be locally discharged, following testing and the approval of ODEQ, to the stormwater system for infiltration or discharged to the Industrial Waste Water Pipeline (IWWP) according to the applicable National Pollutant Discharge Elimination System permit requirements. To initiate this process, JCEP would submit a formal request accompanied with information on the type of testing to be conducted, the source of the water, the chemicals to be added to the hydrotest water (if any), the potential for the test water to acquire contaminants during the hydrotest, and the types of chemical analyses to be conducted on the hydrotest water prior to discharge to ensure that JCEP meets ODEQ's discharge requirements.

1.5.6.9 Closure Welds

All welds will be subject to pressure testing unless that testing will put personnel or equipment in danger of injury or damage. In these circumstances a closure weld will be approved, and the requirements of ASME B31.3-2014 345.2.3 will apply. A Project-specific procedure will be developed to describe the controls that will be implemented for closure welds.

1.5.6.10 Electrical and Instrumentation

- Electrical and instrumentation work includes:
- Temporary construction power
- Underground raceway (duct bank) installation
- Grounding infrastructure installation
- Aboveground raceway (cable tray, channel tray, conduit) installation
- Wire and cable installation (cable pulling, glanding, testing, and termination)
- Equipment installation (large pre-fabricated and smaller field equipment)

- Instrumentation (instruments, instrument control and safeguarding system ("ICSS")
- Specialty systems (lighting, cathodic protection, lightning protection)
- Security and telecommunications

<u>Modules</u> - Electrical and instrumentation cabling installed on the modules will terminate in a combination of power terminal boxes, instrument junction boxes and remote I/O cabinets for the ICSS scope. These terminal cabinets will be the tie-in point between the modules and the site cables. At the module yard, electrical equipment and instruments will be installed along with the cabling to the terminal cabinets. Before shipment to the site, cable verification and some equipment pre-testing will be done. Pipe rack and equipment modules will have cable tray pre-installed; therefore, careful planning is needed to make sure that the module-installed tray and the field-installed tray line up properly.

<u>Underground</u> - Electrical and instrumentation underground work consists of duct bank and grounding systems. The duct bank system will provide pathways for the electrical circuits where pipe rack or structural steel is not available for use of a cable tray. Duct bank is also used to provide redundant pathways for the fiber optic networks and to connect the main process site and the South Dunes (SORSC and administration) buildings. Electrical vaults will be placed strategically to provide pull points for some of the longer cable. Site grounding will also be phased and coordinated with civil and structural scopes of work. The site grounding is generally in a grid configuration that also has ground wire ties bonded to steel and equipment above the ground.

<u>Aboveground</u> - Most of the electrical and instrumentation work will follow along in the sequence with the piping, mechanical equipment, and module installation. As mechanical equipment is set and the pipe rack is built, cable tray and channel will be installed to provide a pathway for the power, control, and instrumentation circuits. Cable tray will generally be installed on the top level of the pipe rack except where it transitions from beneath the elevated powerhouse enclosures. Cable tray cover will be provided as necessary to protect installed cables from damage. The channel tray provides a transition from the cable tray to the circuit termination point.

As the equipment and pipe rack modules are placed in the field, home run cables between the modules and the local powerhouse enclosure ("PHE") will be installed and terminated at the module terminal cabinets. The homerun cables will consist of multi-conductor power cable, instrument and control cable, and fiber optic cabling. All medium-voltage circuits are pulled from the source directly to equipment located on modules rather than to module terminal cabinets.

The medium-voltage distribution backbone will extend out from the facility auxiliary powerhouse to the PHEs and support buildings. The cabling will travel both on cable tray and through the duct bank systems. The plant fiber optic backbone will follow the same pathways except that it will originate at the operations building. Redundancy has been provided by routing the redundant fiber through a different pathway if possible. In some areas, the redundant fiber is routed in the same cable tray as the primary fiber, but the redundant fiber is installed in aluminum conduit to provide a secondary pathway. Because the PHE is the origination point for the majority of circuits, cable reels will be set up at the PHE and pulled out to the plant loads and equipment.

In addition to power, instrumentation, and fiber backbone circuits, cable through the pathways will be provided to power field-installed electrical equipment and lighting and receptacles. Process area, roadway, and general site lighting and receptacle power installation will follow the structural installations. The lighting and receptacle cable will utilize armored cable both underground and above the ground. After installation, all cable in cable tray will be secured to the tray.

Equipment - The main electrical equipment is the prefabricated electrical buildings (PHEs) that are pre-packaged with the majority of the electrical and control equipment installed at the manufacturer's facility. They will be shipped to the site in sections and installed, as discussed in the Mechanical Equipment Installation section above. Final scope to assemble the PHEs will be a composite mechanical and electrical crew. The powerhouses will be elevated and cable tray will be installed underneath the buildings to provide a route for the cabling after they are set in place. Other site-installed equipment includes large pad-mounted transformers, generators for emergency/backup power for critical systems, and miscellaneous field panels and transformers. Equipment installed in classified areas will meet the required area hazardous classification.

1.5.6.11 Instrumentation and Control

Instrumentation - The instrumentation work will include instrument installation, instrument stands, process and air tubing and supports, Continuous Emissions Monitoring System (CEMS), and sample systems. The instruments and tubing will be installed following equipment and piping installation. Factory-calibrated instruments will be procured that meet the area hazardous classification requirements. Enclosures for instruments will be provided where the anticipated operating temperature range exceeds the instrument operating range. As instruments are installed, their associated cable will be pulled and terminated.

Integrated Control and Safeguarding Systems - The ICSS will be made up of the process control systems, the safety instrumented systems, and the fire and gas systems. Each system will be independent of the others. Redundancy within these systems has been provided. The ICSS equipment will be installed within the plant control room located at the operations building. This equipment will be made up of workstations, cabinets, and consoles. In addition, Distributed Control System (DCS cabinets will be installed in the powerhouses and in the process areas as required. Fiber optic cabling will be used for the main backbone of the system as well as to field-installed remote I/O cabinets. Field devices will be hardwired back to either remote I/O cabinet or an instrument junction box. The cabinets will then be wired back to DCS cabinets located at the PHE. The integration of multiple plants systems including machine monitoring, continuous emissions monitoring, and LNG sampling will be part of the ICSS.

Specialty Systems - The electrical and instrumentation work includes the following specialty systems:

- Lightning protection system
- Heat trace system
- Cathodic protection system for buried piping
- Leak detection

Generally, the installation of these systems will follow the same sequence as the main electrical and instrumentation scope; therefore, when a particular area has electrical and instrumentation cable installed, it would also include the scope for these other specialty systems. The unique nature of these systems has special vendor technical requirements for installation and testing.

Security and Telecommunications - Security and telecommunications wire and cable and devices will be installed following the base project schedule as facilities or areas of the plant become available. Whereas outside on the site, the security and telecommunications pathways are the same as electrical (underground or in cable tray, as applicable to the plant area), inside the facilities, the cabling for the security and telecommunications systems generally will be in open pathways. The equipment will be from quality manufacturers with a proven track record. JCEP will utilize a specialty telecommunications systems integrator. This specialty subcontractor will procure the selected equipment and begin assembly and programming for a Factory Acceptance Test of the systems that will be performed off-site at the system integrator's facility before equipment is shipped to the site.

Generally, the equipment will be provided rack-mounted, and complete factory acceptance-tested racks will be shipped to the site for installation in facilities. Once the racks are installed, final device terminations can be done on-site. The performance of each device will be verified before Site Acceptance Testing begins. JCEP recognizes the importance of communication with multiple stakeholders for the security and telecommunications scope, particularly with respect to the SORSC and Fire Department, which will house facilities for JCEP as well as for other state and federal entities.

1.5.7 Temporary Workforce Housing and Bussing, and Logistics

JCEP has responded to community concerns regarding potential impacts that the influx of the temporary workforce may have on housing availability and pricing. JCEP has planned a holistic approach to workforce housing that strikes a balance between community impacts and community benefits. Measures include modularization to lower peak labor, hiring local employees who do not require temporary housing, utilizing existing hotel, motel, and RV Parks as well as potential future privately developed accommodations, and a JCEP full-service workforce housing facility located at South Dunes.

A Workforce Housing and Bussing and a Logistics Plan will be developed to address issues related to the housing and transportation of workers to and from the Project. Resource Report 5 includes additional information regarding socioeconomic impacts of the workforce housing, bussing, and logistics of the Project.

This plan will also detail steps to minimize the impact of the additional traffic from construction by utilizing off-site parking lots for worker travel by bus to and from the Project site each day.

1.5.7.1 Workforce Housing Facility

The workforce housing facility was originally planned for the North Point Site in North Bend adjacent to the suburb of Simpson Heights. After consultation with the community and further design development of the facility, an alternate site on South Dunes has been allocated.

The workforce housing facility will house Project personnel who do not live within the community or within private accommodations. The current plan is for a facility that can be built out in phases. The plan is that the facility will be built out in 100-bed phases and all common facilities will be built out in the first phase.

Parking will be provided on-site, and shuttle buses to and from local communities will reduce traffic on the road network after working hours.

Improvement to the US Highway 101 and Trans Pacific Parkway intersection will ensure that the increased traffic can be accommodated.

1.5.7.2 Off-site Parking

To further reduce the traffic along the main US 101 commuter route through local communities, park-and-ride facilities will be established to bus employees to the Project site from locations north and south of the US 101 McCullough Bridge (Mill Casino and Myrtlewood Facility). Private

RV parks that have sufficient Project personnel will also be serviced by dedicated buses subject to demand.

1.5.8 Temporary Facilities and Construction Laydown Areas

Temporary facilities and construction laydown areas will be required during construction of the Project to house construction offices, crafts lunchrooms, warehousing, equipment maintenance, and laydown of materials after delivery to the Project site. These facilities have been located to maximize use of land owned by JCEP within the overall site boundary and minimize impact on wetland environments through selective leasing of adjacent brownfield land from the RFP property and the Box Car Hill Site that is suitably zoned for industrial purposes.

A detailed land use demand plan has been developed that has identified the potential need for small quantities of additional laydown area for short-duration peak demands within a 30 mile radius of the site to limit further development footprint on the North Spit.. A number of suitable locations have been identified that are currently used for similar purposes and are suitably zoned. Until commercial arrangements are finalized, the favored locations will be communicated via confidential means.

1.5.9 Kentuck Project

Construction activities at the Kentuck Project include earthwork and civil infrastructure improvements to re-establish connection to the former golf course site.

Because the Kentuck Slough has subsided approximately two to three feet from its historical profile as a result of diking and drainage, earthwork activities will include importing approximately 300,000 cubic yards of dredge sand from the LNG Terminal site to raise the subgrade to a profile conducive to establishing appropriate estuarine and some freshwater habitats. JCLNG anticipates that imported dredge sand will be mobilized to the site either by barge and/or hydraulic dredge pipeline to minimize traffic and safety impacts to the local road system. Historical drainage patterns will be re-established to the extent practical given site constraints.

Civil infrastructure improvements include constructing a new bridge in East Bay Drive to allow tidal exchange between Kentuck Inlet and the Kentuck Project; improving the existing dike separating the site from Kentuck Slough; constructing a new muted tidal regulator (i.e., “fish friendly” tide gate) in the upper portion of the Kentuck Project to redirect a portion of Kentuck Slough flows into the Kentuck Project; and raising the profile of East Bay Drive and approximately 1,900 lineal feet of Golf Course Lane to be above the zone of tidal influence. A fish-friendly culvert or other structure will be constructed within Golf Course Lane to allow passage into the drainage above the former golf course irrigation sump pond.

Construction will require a variety of temporary structures and detour facilities to isolate work areas from aquatic resources and provide access to adjacent private property. The proposed work would also remove to the greatest extent practicable relic golf course facilities such as fencing, ditches, foot bridges, and culverts.

1.6 OPERATION AND MAINTENANCE

1.6.1 LNG Terminal Facilities

JCEP will operate and maintain its facilities in compliance with 49 CFR Part 193, 33 CFR Part 127, and other applicable federal and state regulations. Before commencing operation of the

LNG Terminal, JCEP will prepare and submit for approval the operation and maintenance manuals that address specific procedures for the safe operation and maintenance of the LNG storage and processing facilities. JCEP will also prepare an operations manual that addresses specific procedures for the safe operation of the ship unloading facilities in accordance with 33 CFR 127.305. Operating procedures would address normal operations as well as safe start-up, shutdown, and emergency conditions.

All operations and maintenance personnel at the terminal will be trained to properly and safely perform their jobs. The terminal operators would be trained in the potential hazards associated with LNG, cryogenic operations, and the proper operations of all the equipment. JCEP will ensure that the operators meet all the training requirements of the USCG, DOT, Oregon Department of Energy, Oregon State Fire Marshall, Coos Bay, Coos County Fire Department, and other regulatory entities. The SORSC would provide on-site resources and assets, including a Sherriff's office.

The LNG Terminal and related facilities will be staffed with about 180 full-time employees working three shifts, so there will be coverage 24 hours a day, 365 days a year. The LNG Terminal's full-time staff will conduct routine maintenance and minor overhauls. Major overhauls and other major maintenance would be handled by bringing in maintenance personnel specifically trained to perform the maintenance. All scheduled and unscheduled maintenance will be entered into a computerized maintenance management system.

1.7 FUTURE PLANS AND ABANDONMENT

The proposed Project does not include the abandonment of existing FERC jurisdictional facilities. Additionally, JCEP has no current plans that would result in the future expansion of its proposed LNG Terminal.

JCEP does not anticipate abandonment of the proposed LNG Terminal facility in the foreseeable future (more than 30 years). Robust construction techniques and proper maintenance and operating procedures can result in LNG facilities whose useful life surpasses their design life.

1.8 PERMITS, APPROVALS, AND CONSULTATIONS

Construction, operation, and maintenance of the Project will be executed in accordance with all applicable permits and approvals. Applicable permits and approvals for the Project are summarized in Table 1.6-1 along with the schedule and status for filing of all major applications or appropriate documentation.

Table 1.6-1

Major Permits, Approvals, and Consultations for the LNG Terminal Project

Agency	Permit/Approval	Contact	Status
FEDERAL			
U.S. Department of Energy (DOE)	Order Granting Long Term, Multi-Contract Authorization to Export Natural Gas to Free Trade Agreement Nations	Marc Talbert (202) 586-7991	Received December 7, 2011
DOE	Order Conditionally Granting Long-Term Multi-Contract Authorization To Export Liquefied Natural Gas To Non-Free Trade Agreement Nations	Marc Talbert (202) 586-7991	Conditionally received March 24, 2014
U.S. Federal Energy Regulatory Commission (FERC)	Section 3 of the Natural Gas Act	John Peconom (202) 502-6352 Paul Friedman (202) 502-8059	To be filed August 2017
U.S. Army Corps of Engineers (USACE)	Section 404 (CWA) Section 10 (Rivers and Harbors Act)	Tyler Krug (541) 756-2097	To Be Filed August 2017
USACE	Section 408	Marci Johnson (503) 808-4765	Filed May 2014
U.S. Coast Guard (USCG)	Letter of Recommendation and Analysis pursuant to 33 C.F.R. Part 127	Capt. B. C. Jones (503) 861-2606 Captain William Timmons (503) 861-6206	Ongoing
	Navigation Aids – private aids to navigation		Prior to Operation

Table 1.6-1

Major Permits, Approvals, and Consultations for the LNG Terminal Project

Agency	Permit/Approval	Contact	Status
FERC (as lead agency)	National Historic Preservation Act § 106 Review/Memorandum of Agreement among federal agencies, consulting parties, and SHPO	Paul Friedman (202) 502-8059	
U.S. Fish and Wildlife Service (USFWS)	Biological Opinion - Section 7 of Endangered Species Act Consultation	Joe Zisa (503) 231-6179	Biological Assessment To Be Filed May 2017
National Marine Fisheries Service (NMFS)	Biological Opinion - Section 7 of Endangered Species Act Consultation Magnuson-Stevens Fishery Management and Conservation Act Essential Fish Habitat (EFH) Consultation	Ken Phippin (541) 957-3385	Biological Assessment To Be Filed May 2017
	Marine Mammal Protection Act Consultation		To Be Filed May 2017
Federal Aviation Administration (FAA)	Determination of No Hazard to Air Navigation pursuant to 14 CFR Part 77.	Dan Shoemaker (425) 227-2791	
Federal Communications Commission	Radio License – for radio use during construction		Prior to Construction
STATE			
Oregon Department of Environmental Quality (DEQ) Air Quality Division	Clean Air Act, Air Contaminate Discharge Permit	Tom Peterson (541) 776-6010 Ext. 247	Filed March 2013. Issued. Applicant requesting modification, meeting on 3/13/2017.

Table 1.6-1

Major Permits, Approvals, and Consultations for the LNG Terminal Project

Agency	Permit/Approval	Contact	Status
	Title V Operating Air Permit		To Be Filed one year after operation.
Oregon Department of Environmental Quality (DEQ) Water Quality Division	Construction Storm Water Discharge Permit	Mary Camarata 541-687-7435	Prior to Construction
	Hydrostatic Test Water Disposal Permit	Mary Camarata 541-687-7435	Prior to Construction
	Operation Storm Water Discharge Permit	Steve Nichols (541) 269-2721 Ext 223	Prior to Operation
	Industrial Discharge Permit	Del Cline (541) 269-2721 Ext 221	Prior to Operation
	Industrial Landfill Closure Permit	Mary Camarata 541-687-7435	Issued. Expires Aug. 31, 2021
	401 Water Quality Certification	Mary Camarata 541-687-7435	To Be Filed May 2017; requires approved SWMP
	RCRA Site Identification Number for hazardous waste activities	Mary Camarata 541-687-7435	Prior to Operation
	Solid Waste Disposal – for ash removal prior to NTP	Mary Camarata 541-687-7435	Prior to Construction
	NPDES - 1200A General Permit for Concrete Batch Plant	Mary Camarata 541-687-7435	Prior to Construction

Table 1.6-1

Major Permits, Approvals, and Consultations for the LNG Terminal Project

Agency	Permit/Approval	Contact	Status
	NPDES - 1200-C General Permit for any Contiguous Sites	Mary Camarata 541-687-7435	Prior to Construction
	NPDES Wastewater Permit for current site conditions – allows discharge of treatment of leachate from landfill through the ocean outfall	Mary Camarata 541-687-7435	Renewed July 26, 2015. Expires June 30, 2020.
Oregon Department of Land Conservation and Development	Coastal Zone Management Act Compliance	Dave Perry (541) 574-1584	To Be Filed Summer 2017
Oregon Division of State Lands (DSL) Removal/Fill Program	Removal-Fill Individual Permit	Bob Lobdell (503) 986-5282	To Be Filed May 2017
DSL Removal/Fill Program	General Authorization – for tide gate cleaning to remove logs which prevent an existing tide gate flap from opening and draining Wetland J.		Prior to Construction
DSL Land Management Program	Proprietary easements and licenses for land access and gravel use.		To Be Filed May 2017
Oregon Department of Fish and Wildlife (ODFW)	Threatened and Endangered Species Consultation (State-listed species)	Mike Gray (541) 888-6860	Ongoing
ODFW	Fish Passage Approval	Greg Apke	To Be Filed May 2017
Oregon State Building Codes Division (BCD)	Building Permits – for various permanent structures.	Mark Long (503) 373-7235	Prior to Construction

Table 1.6-1

Major Permits, Approvals, and Consultations for the LNG Terminal Project

Agency	Permit/Approval	Contact	Status
BCD	Temporary Building Permit – for any temporary structures.	Mark Long (503) 373-7235	Prior to Construction
Oregon State Historic Preservation Office (SHPO)	Section 106 Consultation	Dennis Griffin (503) 986-0679	Ongoing – required prior to 404 approval
Oregon Water Resources Department (OWRD)	Limited License – for dewatering system and any other drilled wells	Greg Wacker (541) 297-6157	To Be Filed 2019-2020
Oregon Department of Transportation	Railroad Flagging Permit		Prior to Construction
	Oversize Load Permit		Prior to Construction
	Overweight Load Permit		Prior to Construction
	Street Use Permit		Prior to Construction
LOCAL			
Coos County Planning Department	Conditional Use Permit - the LNG Export Terminal, mitigation site, and associated components.	Jill Rolfe (541) 396-7772	Final Decision and Adoption by Board of County Commissioners August 30, 2016. Appeal pending at the Land Use Board of Appeals.
	Conditional Use Permit – various associated components of Project	Jill Rolfe (541) 396-7772	To Be Filed Summer 2017
Coos Bay Rail Link	Rail Road Crossing Permit		Prior to Construction

In December 2011, the U.S. Department of Energy ("DOE") authorized exports by the JCEP from the LNG Terminal to Free Trade Agreement nations. In March 2014, the DOE conditionally authorized exports by JCEP from the LNG Terminal to Non-Free Trade Agreement nations. In 2012, the Project received all local Coos County approvals for the LNG Terminal (except the building permit that will be obtained when construction is to commence), including some import facility permits that were amended for the JCEP LNG Terminal Project and permits that were obtained anew for the currently proposed Project. Coos County approvals were superseded by the LNG Export Terminal Omnibus package submitted and approved in 2016. An ODSL removal/fill permit was issued for the slip and access channel; the removal/fill permit will remain in effect through Project permitting. There is also a current ODEQ Air Contaminant Discharge Permit (ACDP) that requires modifications to reflect the optimized design. The Project will not otherwise rely on permits or approvals obtained in connection with the previously proposed import facility or export facility.

JCEP has actively participated in the Waterway Suitability Assessment ("WSA") process with the USCG to ensure that the Project is in full compliance with all safety and security regulations applicable to LNG carrier transits and the WSA will be updated via the normal annual update process to reflect the changes discussed in Section 1.3.6.8. In connection with the import facility, JCEP had submitted to the USCG a Letter of Intent ("LOI") pursuant to 33 CFR §127.007, and its preliminary WSA, as required by the Commission's regulations (18 CFR § 157.21(a)(1) and (d)(12)). The USCG issued a WSR and an LOR for the Coos Bay navigation channel, finding that the channel can be made suitable for LNG marine traffic if a number of conditions are met. In connection with the export facility proposal, JCEP notified the USCG Captain of the Port that any changes created by the Project would be addressed in the annual WSA update. The Captain of the Port affirmed this approach and requested that the LOI, the WSA, and the Emergency Response Plan be amended to reflect any design changes or updates to the Project. The WSA for the year 2012 was updated to provide for the loading of LNG at the LNG Terminal. The LOI likewise was updated. Copies of the LOI Update, and all related correspondence with USGG were filed with FERC on January 23, 2017 as part of the Request for Approval of Pre-Filing Review; however, as stated in the correspondence, the WSA and its transmittal are considered to be Security Sensitive Information and therefore have been submitted solely to the USCG.

Approved permits and related agency communications are included as appendices to Resource Report 8 – Land Use, Recreation and Aesthetics. Moving forward, permit applications and agency correspondence will by heavily informed and influenced by past work on the export project. In some cases, agency communications have been ongoing. Specifically, communications with the National Marine Fisheries Service ("NMFS") regarding the Kentuck Project have continued, and JCEP will continue to engage with other agencies such as ODSL, USACE, NMFS, and ODEQ regarding permit applications.

Major permit and approval actions for the LNG Terminal involving multiple regulatory agencies will include environmental reviews by the FERC for authorization of the LNG Terminal under Section 3 of the NGA, the USACE for permits in or affecting navigational water, discharges of dredged or fill material, and occupation of alterations of civil works projects, the NMFS and FWS for a Biological Opinion under the Endangered Species Act, NMFS for the Marine Mammal Protection Act authorization, the Oregon DLCD for a coastal zone management consistency determination, the ODSL for an Oregon Removal/Fill Law permit, and the ODEQ for an Air Quality Permit, and Water Discharge and Water Quality Permit.

1.8.1.1 Affected Landowners

Property owners within both a one-half-mile radius and a one-mile radius of the LNG Terminal site (defined as the distance from the center of the southernmost LNG storage tank) have been notified.

All of the activities associated with the LNG Terminal will occur on land owned by Fort Chicago LNG II U.S. L.P., an affiliate of JCEP. Adjacent landowners—Oregon International Port of Coos Bay, Roseburg Forest Products Company, Weyerhaeuser NR Company, ODSL, Oregon Dunes National Recreation Area, and the U.S. Bureau of Land Management were contacted. The names and mailing addresses of landowners within both a one-half-mile and a one-mile radius of the Project site are listed in Appendix A.1 (to be submitted in a subsequent filing).

1.9 NON-JURISDICTIONAL FACILITIES

The Project involves activities and construction of facilities that do not fall under the Commission's jurisdiction. These include closure of the current industrial landfill, construction of the SORSC and Fire Department, relocation of communication lines and utility connections, and LNG vessel traffic. As discussed further in this section, the potential environmental impacts from these activities related to the Project and their construction and operation are addressed through the resource reports within this Environmental Report. Other activities that are not directly related to the Project, such as the Port's Channel Deepening Project, will only be discussed in the Cumulative Impacts section of this Resource Report 1.

Under certain circumstances, non-jurisdictional facilities may be subject to FERC's environmental review. In making this determination, FERC requires applicants to address four factors that indicate the need for FERC to do an environmental review of project-related non-jurisdictional facilities. These factors include:

1. Whether or not the regulated activity comprises "merely a link" in a corridor-type project (such as a transportation or utility transmission project);
2. Whether there are aspects of the non-jurisdictional facility in the immediate vicinity of the regulated activity that affect the location and configuration of the regulated activity;
3. The extent to which the entire project will be within FERC's jurisdiction; and
4. The extent of cumulative federal control and responsibility.

1.9.1 LNG Carriers

LNG to be exported from the LNG Terminal to overseas markets would be transported in carriers specially designed and built for that task. JCEP expects that its LNG Terminal would be visited by about 110 to 120 LNG carriers per year. These carriers, chartered by JCEP's customers, would be loaded with LNG at the terminal and would deliver the cargo, most likely around the Pacific Rim. LNG carriers would be under the ownership and control of third parties, not JCEP, and would not be regulated by the FERC. As per JCEP agreements with its customers, the third-party owners and operators of the LNG carriers calling at the LNG Terminal would have to comply with U.S. regulatory requirements governing LNG carriers and with JCEP's terminal regulations and requirements in order to be granted access to the Port and to JCEP's LNG Terminal. Although JCEP does not currently have any information about the exact carriers that would be used to transport the LNG from the LNG Terminal, the current USCG WSR and LOR limit the size of LNG carriers that would call at the LNG Terminal to carriers of approximately 950 feet in length, 150 feet in breadth, and 40 feet loaded drafts (nominal 148,000 m^3 capacity). Neither the exact destinations for the LNG cargo nor the specific routes across the Pacific Ocean to customers that would be taken by LNG carriers are known, outside of the waterway within 12 miles of the Oregon Coast.

1.9.2 Southwest Oregon Regional Safety Center

JCEP will construct a building dedicated to managing safety and security in the event of emergencies for incident management and response. This building is known as the Southwest Oregon Regional Safety Center (or SORSC). This single building will be home to:

- Jordan Cove Security Center
- Coos County Sheriff's Department Detachment
- Coos County Dispatch Center
- Coos County Emergency Operations Center
- Offices for various businesses and agencies
- Maintenance and repair facilities

The SORSC would be located adjacent to the Project administration buildings on the South Dunes Site. Although this building does not come under the jurisdiction of the FERC, this environmental report analyzes potential impacts resulting from its construction.

1.10 CUMULATIVE IMPACTS

To be provided in an attachment (Appendix B.1) to a later version of Resource Report 1.

1.11 REFERENCES

Coast and Harbor Engineering. 2017. Tsunami Hydrodynamic Modelling Coast and Harbor Engineering.

Coast and Harbor Engineering. 2011. Technical Report – DRAFT Volume 3 – Jordan Cove Terminal and Access Channel, Sedimentation and Maintenance Dredging Requirements.

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Leonardo Technologies, Inc. 2015. The Macroeconomic Impact of Increasing U.S. LNG Exports. October 29, 2015. Bannock, Ohio.

Moffat & Nichol. 2017. Tsunami Maximum Run up Modelling

U.S. Department of Energy (USDOE). 2015. The Macroeconomic Impact of Increasing U.S. LNG Exports, prepared by Leonardo Technologies, Inc., Oxford Economics, and Center for Energy Studies at Rice University's Baker Institute for Public Policy under DOE National Energy Technology Laboratory (NETL) Contract Number DE-FE0004002. October.

U.S. Energy Information Administration (USEIA). 2014. Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets. October 2014. Washington, D.C.

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U.S. Energy Information Administration (USEIA). 2016. Annual Energy Outlook 2016 with Projections to 2040. August 2016. Washington, D.C.

TABLES

FIGURES

APPENDICES

APPENDIX A.1

Landowner List

(to be provided in subsequent filing)

APPENDIX B.1

Cumulative Impacts Analysis

(to be provided in subsequent draft of this resource report)

APPENDIX C.1

Correspondence

(to be provided in subsequent draft of this resource report)