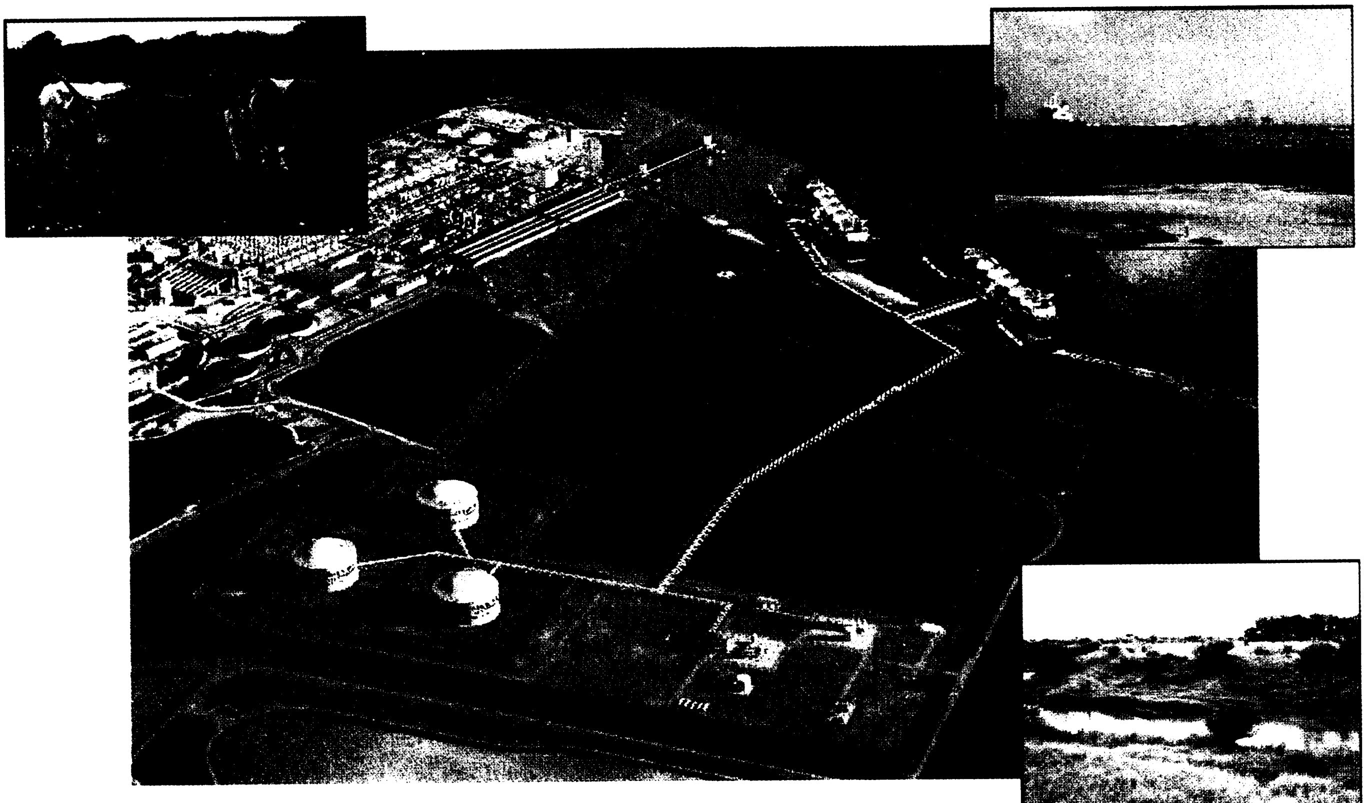
CHENIERE CORPUS CHRISTI LNG PROJECT

Draft *Environmental Impact Statement*

FERC/EIS-0174D

Corpus Christi LNG, L.P.
Cheniere Corpus Christi Pipeline Company

Docket No. CP04-37-000
Docket Nos. CP04-44-000
CP04-45-000
CP04-46-000



Federal Energy Regulatory Commission
Office of Energy Projects
Washington, DC 20426

Cooperating Agencies

US Army Corps of Engineers

November 2004

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

In Reply Refer To:
OEP/DG2E/Gas Branch 3
Corpus Christi LNG, L.P.
Cheniere Corpus Christi Pipeline Co.
Docket Nos. CP04-37-000, et al.

TO THE PARTY ADDRESSED:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared this draft environmental impact statement (draft EIS) on the liquefied natural gas (LNG) import terminal and natural gas pipeline facilities proposed by Corpus Christi LNG, L.P. and Cheniere Corpus Christi Pipeline Company (collectively Cheniere) in the above-referenced dockets.

The draft EIS was prepared to satisfy the requirements of the National Environmental Policy Act. The staff concludes that approval of the proposed project with appropriate mitigating measures as recommended, would have limited adverse environmental impact. The draft EIS also evaluates alternatives to the proposal, including system alternatives, alternative sites for the LNG import terminal, and pipeline route alternatives.

The purpose of Cheniere's Corpus Christi LNG Project is to provide facilities for the importation, storage, and vaporization of LNG, and transportation of the resulting natural gas into the existing intrastate and interstate pipeline infrastructure. Cheniere's proposed facilities would have a nominal output of about 2.6 billion cubic feet of imported natural gas per day to the U.S. market.

The draft EIS addresses the potential environmental effects of the construction and operation of the following facilities in San Patricio and Nueces Counties, Texas:

- a new marine basin and dredged maneuvering area in La Quinta Channel on the northeast shore of Corpus Christi Bay;
- two berths and unloading facilities for LNG carrier ships, and a third dock for tugs and line boats;
- three LNG storage tanks, each with a nominal working volume of approximately 160,000 cubic meters (1,006,400 barrels equivalent);

- LNG vaporization and processing equipment;
- 23 miles of 48-inch-diameter natural gas pipeline; and
- 8 interconnects with existing intrastate and interstate pipelines, and related meter stations.

Comment Procedures and Public Meetings

Any person wishing to comment on the draft EIS may do so. To ensure consideration prior to a Commission decision on the proposal, it is important that we receive your comments before the date specified below. **Please carefully follow these instructions to ensure that your comments are received and properly recorded:**

- Send an **original and two copies** of your comments to:

  Magalie R. Salas, Secretary
  Federal Energy Regulatory Commission
  888 First Street, N.E., Room 1A
  Washington, D.C. 20426

- Reference Docket Nos. CP04-37-000, et al.;
- Label one copy of the comments for the attention of the Environmental Gas Branch 3, PJ-11.3;
- **Mail your comments so that they will be received in Washington, D.C. on or before January 4, 2005.**

Please note that we are continuing to experience delays in mail deliveries from the U.S. Postal Service. As a result, we will include all comments that we receive within a reasonable timeframe in our environmental analysis of the project. **However, the Commission strongly encourages electronic filing of any comments or interventions to this proceeding.** See, 18 CFR 385.2001(a)(1)(iii) and the instructions on the Commission's web site at http://www.ferc.gov under the "e-Filing" link and the link to the User's Guide. Before you can file comments you will need to create a free account, which can be created by clicking on "Login to File" and then "New User Account."

In addition to or in lieu of sending written comments, we invite you to attend the public scoping meeting we have scheduled as follows:

December 15, 2004, 7:00 PM (CST)

Portland Community Center
2000 Billy G Webb
Portland, TX 78374
Telephone: (361) 777-3301

Interested groups and individuals are encouraged to attend and present oral comments on the environmental impact described in the draft EIS. Transcripts of the meetings will be prepared.

After these comments are reviewed, any significant new issues are investigated, and modifications are made to the draft EIS, a final EIS will be published and distributed by the staff. The final EIS will contain the staff's responses to timely comments received on the draft EIS.

Comments will be considered by the Commission but will not serve to make the commentor a party to the proceeding. Any person seeking to become a party to the proceeding must file a motion to intervene pursuant to Rule 214 of the Commission's Rules of Practice and Procedures (18 CFR 385.214).

Anyone may intervene in this proceeding based on the draft EIS. You must file your request to intervene as specified above.[1] **You do not need intervener status to have your environmental comments considered.**

The draft EIS has been placed in the public files of the FERC and is available for public inspection at:

Federal Energy Regulatory Commission
Public Reference and Files Maintenance Branch
888 First Street, N.E., Room 2A
Washington, D.C. 20426
(202) 208-1371

[1] Interventions may also be filed electronically via the Internet in lieu of paper. See the previous discussion on filing comments electronically.

A limited number of copies of the draft EIS are available from the Public Reference Room identified above. In addition, copies of the draft EIS have been mailed to federal, state, and local agencies; public interest groups; individuals and affected landowners who requested a copy of the draft EIS; libraries; newspapers, and parties to this proceedings.

Additional information about the project is available from the Commission's Office of External Affairs at 1-866-208 FERC or on the FERC Internet website (http://www.ferc.gov) using the "eLibrary" link. Click on the "eLibrary" link, click on "General Search" and enter the docket number excluding the last three digits in the Docket Number field. Be sure you have selected the appropriate date range. For assistance, please contact FERC Online Support at FercOnlineSupport@ferc.gov or toll free at 1-866-208-3676, or for TTY, contact 1-202-502-8659. The "eLibrary" link on the FERC Internet website also provides access to the texts of formal documents issued by the Commission, such as orders, notices, and rule makings.

In addition, the Commission now offers a free service called eSubscription which allows you to keep track of all formal issuances and submittals in specific dockets. This can reduce the amount of time you spend researching proceedings by automatically providing you with notification of these filings, document summaries, and direct links to the documents. Go to the "eSubscription" link on the FERC Internet website.

Magalie R. Salas
Secretary

CHENIERE CORPUS CHRISTI LNG PROJECT
DRAFT EIS
TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
µPa	micro Pascal
ABSG	ABSG Consulting Inc.
ACHP	Advisory Council on Historic Preservation
ADEIS	Administrative Draft EIS
AEP	American Electric Power, Inc.
AirData	EPA AirData database
Alcoa	Alcoa, Inc.
APE	area of potential effect
API	American Petroleum Institute
AQCR	air quality control region
ASTM	American Society of Testing Materials
BA	biological assessment
BACT	Best Available Control Technology
bcf	billion cubic feet
bcfd	billion cubic feet per day
BMP	Best Management Practice
BOG	boil-off gas
Btu	British thermal unit
BWWG	Ballast Water Working Group
CAA	Clean Air Act
Cameron	Cameron LNG L.L.C.
CBBEP	Coastal Bend, Bays, and Estuaries Program, Inc.
CCBNEP	Corpus Christi Bay National Estuary Program
CCMSA	Corpus Christi Metropolitan Statistical Area
CEII	Critical Energy Infrastructure Information
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Channel	Channel Pipeline Company
Cheniere	Corpus Christi LNG, L.P. and Cheniere Corpus Christi Pipeline Co.
CO	carbon monoxide
COE	U.S. Army Corps of Engineers
Commission	Federal Energy Regulatory Commission
Cove Point	Cove Point LNG, L.P.
CR	county road
Crosstex	Crosstex Corpus Christi Natural Gas Transmission
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dBA	decibels on the A-weighted scale
Distrigas	Distrigas of Massachusetts Corporation
DMPA	dredged material placement area
DOT	U.S. Department of Transportation

dth	dekatherms
E&E	Ecology and Environment, Inc.
EDS	environmental data search
EEA	Energy and Environmental Analysis Foundation, Inc.
EFH	essential fish habitat
EIA	Energy Information Administration
EIS	environmental impact statement
El Paso	El Paso Global LNG
ELMR	Estuarine Living Marine Resources
EPA	U.S. Environmental Protection Agency
EPEBV	El Paso Energy Bridge Vessel
ERL	Effects Range Low
ESA	Endangered Species Act
ExxonMobil	ExxonMobil Corporation
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FGT	Florida Gas Transmission Company
FIRM	Flood Insurance Rate Map
FMP	Fisheries Management Plans
FPC	Federal Power Commission
FR	Federal Register
Freeport	Freeport LNG Development, L.P.
FSRU	floating storage and regasification units
ft/sec	feet per second
FWS	U.S. Fish and Wildlife Service
Gas Tanker Code	International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
GBS	gravity-based structure
GIWW	Gulf Intracoastal Water Way
GMFMC	Gulf of Mexico Fisheries Management Council
gpm	gallons per minute
Gulf	Gulf of Mexico
Gulf South	Gulf South Pipeline Company
HAP	hazardous air pollutant
HCAs	high consequence areas
hp	Horsepower
HPA	high probability area
IMO	International Maritime Organization
INGAA	Interstate Natural Gas Association of America
ISO	International Organization for Standardization
ISPS	International Ship and Port Facility Security
kV	Kilovolt
kW	Kilowatt
LFL	lower flammability limit
LNG	liquefied natural gas
LOI	Letter of Intent

m	Meters
m/sec	meters per second
m^3	cubic meters
MACT	Maximum Achievable Control Technology
MARSEC	Maritime Security
McMoRan	Freeport-McMoRan Energy, LLC
mcy	million cubic yards
mg/kg	milligram per kilogram
MLT	mean low tide
MLV	mainline valve
MMBTU	million British thermal units
MMcfd	million cubic feet per day
MAOP	maximum allowable operating pressure
MP	Milepost
mph	miles per hour
MSA	Magnuson-Stevens Fishery Conservation and Management Act
msl	mean sea level
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFPA 59A	National Fire Protection Association, Standards for the Production, Storage, and Handling of LNG
NGA	Natural Gas Act
NGPL	Natural Gas Pipeline Company of America
NGVD	National Geodetic Vertical Datum 29
NHPA	National Historic Preservation Act
NNSR	Non-Attainment New Source Review
NO_2	nitrogen dioxide
NOAA Fisheries	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NOI	Notice of Intent
NO_x	nitrogen oxide
NPC	National Petroleum Council
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	noise sensitive area
NSPS	New Source Performance Standards
NWR	National Wildlife Refuge
O_3	Ozone
Occidental	Occidental Energy Ventures Corporation
OEP	FERC Office of Energy Projects
OPS	U.S. Department of Transportation, Office of Pipeline Safety
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
Pb	Lead

PCB	polychlorinated biphenyl
PCCA	Port of Corpus Christi Authority
PCL	protective concentration level
PERC	powered emergency release coupling
PF	FERC Pre-filing
Pilots	Aransas-Corpus Christi Pilots Association
Plan	FERC's Upland Erosion Control, Revegetation, and Maintenance Plan
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 microns
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
ppm	parts per million
ppmvb	parts per million on a volume basis
Procedures	FERC's Wetland and Waterbody Construction and Mitigation Procedures
Project	Cheniere Corpus Christi LNG Project
PSD	Prevention of Significant Deterioration
psf	per square foot
psig	pounds per quare inch gauge
Quest	Quest Consultants, Inc.
RCRA	Resource Conservation and Recovery Act
Reynolds	Reynolds Metal Company
RMP	risk management plan
Royal	Royal Production Company
RRC	Railroad Commission of Texas
SCV	submerged combustion vaporizer
SH	state highway
Sherwin	Sherwin Alumina Company
SHPO	State Historic Preservation Office
SIS	safety instrumented system
SO_2	sulfur dioxide
SOLAS	International Convention for the Safety of Life at Sea
Southern	Southern LNG Inc.
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
SR	state route
STL	submerged turret loading
TAC	Texas Administrative Code
TCAA	Texas Clean Air Act
TCEQ	Texas Commission on Environmental Quality
tcf	trillion cubic feet
tcf/yr	trillion cubic feet per year
TDOT	Texas Department of Transportation
Tennessee Gas	Tennessee Gas Company
TGLO	Texas General Land Office
TPWD	Texas Parks and Wildlife Department
Tpy	tons per year

Transco	Transcontinental Gas Pipe Line Company
TRRP	Texas Risk Reduction Program
Trunkline	Trunkline LNG Company, L.L.C.
U.S.	United States
US	U.S. highway
USC	United States Code
USCG	U.S. Coast Guard
UTMSI	University of Texas Marine Science Institute
VOC	volatile organic compound
vpd	vehicles per day

EXECUTIVE SUMMARY

This draft environmental impact statement (EIS) for the Corpus Christi LNG, L.P. and Cheniere Corpus Christi Pipeline Company (collectively Cheniere) Corpus Christi liquefied natural gas (LNG) Project (Cheniere Corpus Christi LNG Project or Project) has been prepared by the staff of the Federal Energy Regulatory Commission (FERC or Commission) to fulfill the requirements of the National Environmental Policy Act (NEPA) and the Commission's implementing regulations under Title 18, Code of Federal Regulations, Part 380. Cheniere filed applications with the FERC in Docket Nos. CP04-37-000, et al., on December 22, 2003, seeking Commission approvals under Sections 3 and 7 of the Natural Gas Act. The purpose of this document is to inform the public and the permitting agencies about the potential environmental impacts of the proposed Project and reasonable alternatives; and to recommend mitigation measures that would avoid or reduce significant adverse impacts.

The purpose of the Cheniere Corpus Christi LNG Project is to provide the facilities necessary to import, store, and vaporize LNG and deliver the resulting natural gas into existing interstate and intrastate natural gas pipelines in the Corpus Christi, Texas area. The Project was conceived to meet anticipated future national demands for increasing imported natural gas supplies. In order to accomplish this purpose, Cheniere proposes to construct and operate a new LNG import terminal including LNG ship docks and unloading facilities next to the existing Sherwin Alumina Company (Sherwin) plant on the northern shoreline of Corpus Christi Bay, east of Portland, in Nueces and San Patricio Counties, Texas. In addition, Cheniere would construct and operate a new natural gas pipeline and ancillary facilities, extending from the LNG terminal to north of Sinton, in San Patricio County, Texas.

In order to provide these services, Cheniere requests Commission authorization to construct and operate the following LNG terminal facilities:

- new marine basin including maneuvering area and two berths for LNG ships, and a dock for tugs and line-handling boats;
- three liquid unloading arms, one vapor return arm, and two LNG transfer lines for each LNG ship dock;
- three all-metal, double-walled single-containment LNG storage tanks, each with a nominal working volume of approximately 160,000 cubic meters (1,006,400 barrels equivalent), three vertical submerged pumps within each tank, and individual earthen dikes surrounding each storage tank;
- LNG vaporization and processing system consisting of 16 sendout pumps, 16 submerged combustion vaporizers (SCVs), 3 boil-off gas (BOG) compressors and a BOG condensing system, 2 vapor-return blowers, and on-site natural gas metering facilities;
- various support buildings at the LNG terminal site to house administrative offices, warehouse/maintenance, safety and control systems, fire response systems, utilities, customs, and a gatehouse.

Cheniere also requests authorization to construct, own, and operate the following facilities for the proposed natural gas sendout pipeline:

- 23 miles of 48-inch-diameter natural gas pipeline;
- eight metering stations/delivery points and pipeline interconnections with the following existing natural gas pipeline systems: Texas Eastern Transmission Company, Gulf South Pipeline Company (Gulf South), Channel Pipeline Company (Channel), Florida Gas Transmission Company (FGT), Kinder Morgan Texas Pipeline Company, Transcontinental Gas Pipeline Corporation, Natural Gas Pipeline Company of America, and Tennessee Gas Company;
- three 30-inch-diameter lateral pipelines, totaling 0.8 mile, connecting the main pipeline with the Gulf South, Channel, and FGT meter stations; and
- a pig launcher facility and mainline valve at the LNG terminal, a mainline valve near the middle of the pipeline, and a pig receiver facility and mainline valve at the northern pipeline terminus.

PROJECT IMPACTS

Construction of the Cheniere Corpus Christi LNG Project would affect a total of about 1,177 acres of land and water. The LNG terminal would be built west of an existing alumina plant, on mostly industrial land that was formerly used for bauxite ore storage and disposal of processed bauxite residue. Construction of the LNG terminal would require about 772 acres, including about 78 acres offshore for the maneuvering area and marine basin, and about 458 acres onshore for dredged material placement areas (DMPA).

Cheniere's proposed pipeline route would mostly cross agricultural land, following existing easements, such as roads and other pipelines. Construction of the proposed pipeline and related facilities would disturb about 406 acres, including the construction rights-of-way for the 48-inch-diameter main pipeline and 30-inch-diameter lateral pipelines, additional temporary workspaces, contractor and pipe yards, metering stations/interconnects, pig launchers and receivers, and access roads. About 152 acres would be required for permanent easement along the 48-inch-diameter pipeline and laterals and for new permanent access roads, and about 4 acres would be required for operation of new aboveground facilities.

Construction and operation of the Project would have minimal impact on geological resources. Four plugged and abandoned wells are located within the LNG terminal and marine basin site. Cheniere is in the process of determining whether any of these would interfere with construction of the Project, and will file its determination with the Commission and identify future action. The pipeline would be within 150 feet of 12 existing oil and gas wells, of which 4 would be within the construction right-of-way. Cheniere would conduct preconstruction surveys to ground-truth the location of these wells, and avoid them through minor route realignments. A site-specific seismic hazard analysis conducted by Cheniere indicates that due to very low level of ground motion predicted at the site, earthquake hazards were not considered a controlling factor in the LNG terminal design. No geologic hazards would be expected to affect the proposed facilities.

Construction of the LNG terminal would permanently affect only about 2 acres of soils classified as either hydric or prime farmland. Cheniere would cover existing processed bauxite residue beds with about 4.4 million cubic yards of sediments dredged during creation of its marine basin. The dredged sediments would be uncontaminated clays, and the DMPAs would eventually be revegetated.

The majority of the pipeline would cross prime farmland soils that would be temporarily affected during construction. After consulting with the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), Cheniere agreed not to segregate topsoil deeper than 18 inches in Victoria clay and Raymondville clay loam soils, along about 12.8 miles of the pipeline route. For about 18.7 miles of the route, where agricultural lands are deep plowed, Cheniere would bury the pipeline at least four feet below the surface. After construction, agricultural lands would be restored to their previous condition and use, and we[1] believe impacts on soils would be minimized because Cheniere would implement the FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures). About 4 acres of prime farmland would be permanently lost due to operation of the aboveground facilities along the pipeline. However, the NRCS does not consider this a significant loss, and we agree.

Construction and operation of the Project would not have a significant impact on groundwater resources in the Project areas. There are no public or private water supply wells located within 150 feet of the proposed Project. The greatest potential for impact on groundwater would be from spills, leaks, or other releases of hazardous substances during construction or operation. Cheniere has agreed to implement the FERC's Procedures, which includes use of Spill Prevention and Response Procedures that meet state and Federal requirements. Cheniere has filed a Spill Prevention, Control, and Countermeasure Plan and has stated it will file a revised plan to include additional Project-specific measures.

Construction of the terminal's new marine basin would impact about 78 acres of shallow bay habitat, and result in the transformation of shallow water in the La Quinta Channel into deeper water habitat. Water quality in the area being dredged would be temporarily affected by increased turbidity during dredging, but would return to preconstruction conditions following completion of dredging. During operation of the LNG terminal, the SCVs would produce fresh water that would be pumped into Sherwin's raw water reservoir north of the processing area. Hydrostatic test water would also be discharged into the reservoir. However, on rare occasions when the reservoir may be full (due to excessive rain events or other factors), water may be released into the bay through the drainage ditch on the west side of Cheniere's tract. Cheniere would obtain the necessary permits regulating dredging, return water from the DMPAs, hydrostatic test water, and release of stormwater and wastewater from the LNG terminal into the bay.

[1] "We," "us," and "our" refer to the environmental staff of the FERC's Office of Energy Projects (OEP).

The proposed pipeline would cross two perennial streams and eight intermittent-flowing waterbodies. Most of the waterbodies would be crossed using the open cut method. One drain would be bored. To minimize impact on surface waters, Cheniere would implement the protective measures in the FERC's Procedures. We have accepted Cheniere's requested variance from our Procedures to cross waterbodies between March 1 and August 31 when the region experiences its least rainfall and stream levels should be at their lowest.

Construction of the Cheniere Corpus Christi LNG Project would affect a total of 13.7 acres of wetlands, including 12.4 acres at the LNG terminal site and 1.3 acres along the pipeline route. During construction, Cheniere would minimize impact on wetlands by implementing measures in the FERC's Procedures. Cheniere has requested a variance from the Procedures to allow an extra 25 feet of temporary pipeline construction right-of-way width across three wetlands, and we have reviewed site-specific justification for this request and find it acceptable. Operation of the LNG terminal would permanently affect 10.7 acres of wetlands, including 5.4 acres of seagrass beds, 1.3 acres of tidal flat, and 4.0 acres of coastal marsh. Cheniere has prepared, in consultation with a number of resource agencies, an Aquatic Resources Mitigation Plan that includes a conceptual wetlands mitigation plan which provides for the creation of new wetlands and seagrass beds off-site at Shamrock Island in Corpus Christi Bay. Wetland mitigation ultimately implemented by Cheniere to compensate for unavoidable impacts would be determined during the U.S. Army Corps of Engineers (COE) Section 404/10 permit review.

The primary impact on terrestrial wildlife associated with the Project would be due to the clearing of vegetation. Construction and operation of Cheniere's LNG terminal would result in the clearing of about 1.5 acres of coastal grasslands and 3.3 acres of scrub/shrub vegetation. The remainder of the upland portions of the tract is industrial land. Construction of the pipeline would affect about 320 acres of agricultural land and about 55 acres of open land, including grasslands and scrub/shrub vegetation. Some shrubland habitat would be permanently converted to grassland habitat as a result of vegetation maintenance during operation of the pipeline. Because Cheniere would implement the FERC's Plan and Procedures, we do not believe the Project would have significant impacts on vegetation and wildlife.

The National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) identified essential fish habitat (EFH) for postlarval, juvenile and subadult white shrimp, brown shrimp, red drum, postlarval and juvenile pink shrimp, and subadult Spanish mackerel in the Project area. An EFH assessment is included in appendix E of this EIS. Our EFH assessment concludes that temporary impacts, such as dredging the new marine basin, would not have significant long-term impacts. The permanent loss of EFH at the LNG terminal, totaling about 12 acres combined of seagrass, coastal marsh, and tidal flats, would be mitigated by Cheniere implementing its Aquatic Resources Mitigation Plan, and whatever other mitigation measures are required by the COE and NOAA Fisheries. We are requesting that NOAA Fisheries consider this draft EIS as notification of initiation of EFH consultation.

The U.S. Fish and Wildlife Service (FWS) and NOAA Fisheries have identified a total of 23 federally listed endangered or threatened species that could potentially occur in the Project area. Based on our analysis of habitat that would be affected and other information, we conclude that the Project would not affect or not adversely affect any of these species. In comments to Cheniere, the FWS indicated that the Project would have no effect on federally listed threatened, endangered, candidate, or proposed species.

The nearest residences to the property boundary of the proposed LNG terminal are about 1.6 miles west. No residences are located within 50 feet of the proposed pipeline workspace. No public lands, developed recreational facilities, or special interest areas would be affected by the Project.

The most prominent visual features of the proposed LNG terminal would be three LNG storage tanks, each 175 feet above the current grade and 145 feet in diameter. However, the height of the LNG storage tanks would be 22 feet lower than the tallest structure on the adjacent Sherwin plant. We evaluated estimated views of the storage tanks from four surrounding observation points using visual simulations prepared by Cheniere. While the LNG storage tanks would be visible from surrounding locations, they would not dominate the landscape, would be consistent with existing views of adjacent industrial facilities, and would not represent a significant visual impact.

Cheniere has requested but has not yet received its Texas Coastal Zone Management Program (CZMP) consistency determination from the Texas General Land Office, Coastal Coordination Council (TGLO) for its LNG terminal. We have recommended that Cheniere not be allowed to begin construction of the LNG terminal until it has received a determination that the Project is consistent with the Texas CZMP. The TGLO did make a finding of consistency for the proposed pipeline.

During construction of the LNG terminal, Cheniere would employ an average of about 330 workers. Construction of the pipeline and meter station would employ an average of 325 workers. About 75 full-time employees would be needed for operation of the LNG terminal. About 61 percent of the construction workforce would reside within 50 miles of the jobsite. The addition of non-local workers would not represent a significant increase in the population of San Patricio and Nueces Counties. The two counties combined also have adequate housing available for Project employees and their families, and an established infrastructure capable of handling Project demands for public services. The Project would benefit the local economy through expenditures of wages, purchases of materials, and taxes.

Traffic generated during construction of the LNG terminal would increase by an estimated 2 to 3 percent over existing daily traffic volume on State Highway 35, the primary access route to the proposed terminal. While this would not be a significant impact on traffic flow on State Highway 35, there could be significant impacts on interchanges and intersections leading to the LNG terminal site. We have recommended that Cheniere consult with appropriate transportation authorities to determine the need for a Project-specific construction transportation management plan.

During its operation, the LNG terminal would receive up to 300 LNG ships per year, resulting in an average of an additional one vessel movement inward and one vessel movement outward per day through the Corpus Christi and La Quinta Ship Channels. The LNG ship traffic for the Project would represent less than a 1 percent increase in total ship traffic, and a 5 percent increase in large vessel traffic in Corpus Christi Bay.

Cheniere has conducted cultural resource surveys and filed with FERC and the State Historic Preservation Office (SHPO) survey reports for the LNG terminal site and all but 2.1 miles of the proposed pipeline route. The SHPO has accepted the survey reports and indicated that no historic properties would be affected within the areas inventoried. We have recommended that Cheniere not be allowed to construct any facilities or use any staging, storage, temporary work areas, or access roads until Cheniere files with the FERC all remaining cultural resources reports and SHPO review comments.

Although a slight degradation of the air quality due to pollutant emissions would occur, air emissions resulting from construction of the Project would not significantly affect ambient air quality in the Corpus Christi region. Cheniere would use dust control measures during construction of the LNG terminal and pipeline to minimize the generation of fugitive dust during construction. Air emissions from operation of the LNG terminal would be minimal because the equipment would burn natural gas as opposed to more polluting coal or oil. Cheniere has applied to the Texas Commission on Environmental Quality (TCEQ) for a state air quality permit. The TCEQ has preliminarily reviewed and approved the air quality modeling analysis that shows that the National Ambient Air Quality Standards would not be violated and emissions of designated "criteria pollutants" would not increase above the regulatory limit for prevention of significant air quality deterioration. Since the Project area is classified as in attainment for all criteria pollutants, a General Conformity Determination is not required.

Noise quality at the nearest Noise Sensitive Areas (residences) would not be significantly affected by operation of the LNG facility. Although background noise may be heard by residents, the facility would not exceed the 55 decibel limit recommended for the protection of public health and welfare. To further ensure that noise from operation of the facility would not impact residences, we have recommended that after the LNG terminal is in operation Cheniere conduct noise measurements to confirm that predicted noise impacts are not exceeded, and that Cheniere implement additional mitigation if necessary.

We evaluated the safety of both the proposed LNG import terminal facility and the related LNG vessel transit through the Corpus Christi and La Quinta Channels. With respect to the onshore facility, we completed a cryogenic design and technical review of the proposed terminal design and safety systems, and have identified specific areas of concern and included recommendations to address theses concerns. We also calculated thermal radiation and flammable vapor hazard distances for an accident or an attack on an LNG vessel. Based on the extensive operational experience of LNG shipping, the structural design of an LNG vessel, and the operational controls imposed by the U.S. Coast Guard (USCG) and the local pilots, the likelihood of a cargo containment failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision – is highly unlikely. For similar reasons, an accident involving the onshore LNG import terminal is unlikely to affect the public. As a result, the risk to the public from accidental causes should be considered negligible.

Although the Letter of Recommendation has not been issued, the USCG has indicated that there do not appear to be any significant issues that would preclude the use of the waterways for LNG carrier transit. The Letter of Recommendation would address the suitability of the Corpus Christi and La Quinta Ship Channels for LNG marine traffic, but it would not in itself represent final authority to commence LNG marine transport operations. Issues related to the public impact of safety and security or exclusion zones would be addressed in the *LNG Vessel Management and Emergency Plan* to be developed by Cheniere and approved by the USCG.

ALTERNATIVES CONSIDERED

We considered the alternatives of no action or postponed action. While the no action or postponed action alternatives would eliminate or postpone the environmental impacts identified in this EIS, the objectives of the proposed Project would not be met.

Our analysis of system alternatives included an evaluation of the use of existing LNG import and storage systems. None of the existing facilities has the capacity or space to add the capacity proposed in this Project. We also looked at the construction of an offshore terminal to meet the objectives of the proposed Cheniere Corpus Christi LNG Project. Our review indicates that construction of an offshore alternative would involve a longer pipeline, the construction of a graving dock that would impact the shoreline, and a permanent onshore facility for terminal support activities. Therefore, we do not consider construction of an offshore facility a reasonable alternative to the proposed Project. We also looked at alternative port sites, none of which would provide significant environmental advantages over the proposed site.

Our alternatives analysis included the evaluation of a pipeline route alternative that was the route originally proposed by Cheniere. We also evaluated two alternative routes that would originate from points east of Cheniere's proposed LNG terminal. None of the route alternatives would provide significant environmental advantages over the proposed pipeline route.

PUBLIC INVOLVEMENT

On February 20, 2004, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Proposed Cheniere Corpus Christi LNG Terminal and Pipeline Project, and Request for Comments on Environmental Issues, and Notice of Public Scoping Meetings and Site Visit* (NOI). The NOI was sent to 300 interested parties, including Federal, state, and local officials; agency representatives; conservation organizations; local libraries and newspapers; property owners for the LNG terminal tract and along the proposed pipeline route; and intervenors in the proceeding; and published in the *Federal Register* (FR).

On March 24, 2004, the FERC conducted a public scoping meeting in Portland, Texas to provide an opportunity for the public to learn more about the proposed Project and to provide comments on environmental issues to be addressed in the EIS. Twenty-two people spoke at the meeting, and 10 agencies and individuals submitted written comments in lieu of oral comments. A transcript of the scoping meeting and all written comments provided at the meeting have been entered into the public record for the Cheniere Corpus Christi LNG Project. On March 24 and 25, 2004, the FERC also conducted a site visit, open to the public, of the LNG terminal site and the pipeline route.

Issuance of the NOI opened the public comment period, with a closing date of March 26, 2004 originally established for receiving written comments. On February 25, 2004, the FERC issued a *Notice of Extension of Time* that extended the closing date for receiving comments to March 31, 2004. In total, 10 letters were received in response to the NOI, and 18 parties submitted motions to intervene. Intervenors receive all documentation filed in a proceeding, and have the right to seek rehearing of the Commission's decision. No protests to this Project were filed.

This draft EIS was filed with the U. S. Environmental Protection Agency (EPA) and a formal notice was published in the FR indicating that the draft EIS is available. The draft EIS was mailed to the agencies, individuals, and organizations on the mailing list prepared for the Project (appendix A). In accordance with Council on Environmental Quality regulations implementing the NEPA, the public has 45 days (until January 4, 2005), to provide written comments on the draft EIS. Additionally, a public meeting to receive comments on the draft EIS will be held on December 15, 2004 in Portland, Texas. All timely comments on the draft EIS will be addressed in the final.

MAJOR CONCLUSIONS

We conclude that, with the use of Cheniere's proposed mitigation and adoption of our recommended mitigation measures, construction and operation of the proposed facilities would have limited adverse environmental impact. As part of our analysis, we have developed specific mitigation measures that we believe to be appropriate and reasonable for construction and operation of the Project. We believe these measures would substantially reduce the environmental impact of the Project.

The primary reasons for our decision are:

- the LNG terminal would be located on an existing industrial site, with no residences within 1.6 miles;
- the LNG terminal would use an existing deep water port and ship channel capable of handling LNG ship traffic;
- sediments dredged during creation of the new marine basin for the LNG terminal would be used to cap existing processed bauxite residue beds;
- Cheniere would implement the FERC's Plan and Procedures, and its own Project-specific SPCC Plan, to minimize impacts on soils, wetlands, and waterbodies;
- Cheniere developed a Project-specific Aquatic Resources Mitigation Plan including a conceptual wetland mitigation plan to mitigate impacts on wetlands and seagrass;
- FWS determined the Project would have no effect on federally listed threatened and endangered species;
- our EFH assessment concludes that the Project would not significantly impact EFH, and that Cheniere would implement the requirements of its COE issued Section 404/Section 10 permit and implement its Aquatic Resources Mitigation Plan to mitigate effects on seagrass, coastal marsh, and tidal flat habitats. NOAA Fisheries, commenting on an administrative draft of this EIS, stated that our draft EFH assessment adequately described the potential adverse impacts of the Project on EFH, and proposed mitigation measures;
- SHPO commented that no historic properties would be adversely effected by the Project within the areas surveyed;
- NRCS stated that impacts on prime farmland would not be significant;

- Cheniere's proposed pipeline route would mostly cross agricultural lands and follow existing rights-of-way, with no residences within 50 feet of the pipeline construction workspace;
- safety features would be incorporated into the design and operation of the LNG import terminal and LNG vessels;
- operational controls would be imposed by the local pilots and the USCG to direct movement of LNG ships, and security provisions would be imposed to deter attacks by a potential terrorist; and
- the environmental and engineering inspection and mitigation monitoring program that would ensure compliance with all mitigation measures that become conditions of any FERC authorization.

1.0 INTRODUCTION

The staff of the Federal Energy Regulatory Commission (FERC or Commission) prepared this draft Environmental Impact Statement (EIS) to assess the potential environmental effects that may occur as a result of the proposed construction and operation of a liquefied natural gas (LNG) import terminal and associated natural gas pipeline in Nueces and San Patricio Counties, Texas (collectively referred to as the Cheniere Corpus Christi LNG Project or Project). This document is a draft EIS that has been prepared for public review and comment. A final EIS will be subsequently prepared to respond to the comments received on this draft EIS. The FERC will use the EIS in its decision-making process to decide whether or not to authorize the Project.

On December 22, 2003, Corpus Christi LNG, L.P. filed an application with the FERC, in Docket No. CP04-37-000, under Section 3(a) of the Natural Gas Act (NGA) and Part 153 of the Commission's regulations. Also on December 22, 2003, Cheniere Corpus Christi Pipeline Company filed an application, in Docket Nos. CP04-44-000, CP04-45-000, and CP04-46-000, under Section 7(c) of the NGA and Parts 157 and 284 of the Commission's regulations. These applications were noticed in the *Federal Register* (FR) on January 2, 2004. Both Corpus Christi LNG, L.P. and Cheniere Corpus Christi Pipeline Company are subsidiaries of Cheniere Energy Inc. (hereafter collectively referred to as Cheniere).[1]

In Docket No. CP04-37-000, Cheniere proposes to import, store, and vaporize on average about 2,600 million cubic feet per day (MMcfd) of LNG at a terminal facility to be built next to the Sherwin Alumina Company (Sherwin) plant on the northeastern shoreline of Corpus Christi Bay, east of Portland, Texas. Cheniere seeks authority to construct and operate:

- new marine basin and dredged maneuvering area at the western end of La Quinta Channel, with two berths for LNG ships, and a dock for tugs and line-handling boats;
- three liquid unloading arms, one vapor return arm, and two LNG transfer lines for each LNG ship dock;
- three all-metal, double-walled single-containment LNG storage tanks, each with a nominal working volume of approximately 160,000 cubic meters (m^3) (1,006,400 barrels equivalent), three submerged vertical LNG pumps within each storage tank, and individual earthen dikes surrounding each storage tank;
- LNG vaporization and processing system consisting of 16 sendout pumps, 16 submerged combustion vaporizers (SCV), 3 boil-off gas (BOG) compressors and a BOG condensing system, 2 vapor-return blowers, and on-site natural gas metering facilities; and
- various support buildings at the LNG terminal site to house administrative offices, warehouse/maintenance, safety and control systems, fire response systems, utilities, customs, and a gatehouse.

[1] Corpus Christi LNG, L.P. is a Delaware limited partnership, with Cheniere LNG, Inc. (a wholly owned subsidiary of Cheniere Energy Inc.) holding 66.7 percent interest, and BPU LNG, Inc. (an affiliate of Sherwin Alumina Company) holding 33.3 percent. Cheniere Corpus Christi Pipeline Company is a wholly owned subsidiary of Cheniere Pipeline Company, a Delaware corporation that is wholly owned by Cheniere LNG, Inc.

In Docket No. CP04-44-000, Cheniere seeks authority to construct and operate a pipeline extending from the LNG terminal to north of Sinton, Texas, capable of transporting up to about 2,700 MMcfd of imported natural gas to markets throughout the United States (U.S.), via interconnections with a number of existing interstate pipeline systems. Cheniere's proposed pipeline facilities would consist of:

- 23 miles of 48-inch-diameter natural gas pipeline;
- *eight metering stations/delivery points and pipeline interconnections with the following* existing natural gas pipeline systems: Texas Eastern Transmission Company, Gulf South Pipeline Company (Gulf South), Channel Pipeline Company (Channel), Florida Gas Transmission Company (FGT), Kinder Morgan Texas Pipeline Company, Transcontinental Gas Pipeline Corporation (Transco), Natural Gas Pipeline Company of America (NGPL), and Tennessee Gas Company (Tennessee Gas);
- three 30-inch-diameter lateral pipelines, totaling 0.8 mile, connecting the main pipeline with the Gulf South, Channel, and FGT meter stations; and
- pig launcher and mainline valve (MLV) at the LNG terminal, MLV near the middle of the pipeline, and pig receiver and MLV at the northern pipeline terminus.

Figure 1.1-1 shows the general location of the proposed facilities.

In Docket No. CP04-45-000, Cheniere seeks a blanket certificate allowing for construction and operation of certain unspecified future facilities under Part 157, Subpart F of the Commission's regulations. In Docket No. CP04-46-000, Cheniere requests a blanket certificate under Part 284, Subpart G of the Commission's regulations, allowing for transportation of natural gas on an open-access and self-implementing basis. We[2] analyzed the blanket certificate applications and found they were categorically excluded from environmental review under the Commission's regulations at Title 18 Code of Federal Regulations (CFR) Sections 380.4(21) and (22).

1.1 PROJECT PURPOSE AND NEED

The purpose of the Cheniere Corpus Christi LNG Project is to provide facilities necessary to import, store, and vaporize LNG and deliver the resulting natural gas into existing interstate and intrastate natural gas pipelines in the Corpus Christi area. Cheniere stated that the Project was conceived in response to the growing national demand for new sources of natural gas. Cheniere indicated that it would provide services to shippers who desire access to new competitively priced LNG supplies. The Project would contribute to the diversification of the nation's energy resources, and help ameliorate the projected future natural gas shortage in the U.S.

At the public scoping meeting for this Project, a Cheniere representative stated that the presence of a deep-water port, the existing natural gas pipeline infrastructure, and access to both the interstate and intrastate pipeline grid influenced the location of its proposed LNG terminal in the Corpus Christi, Texas area. Also, industries in the region are potential markets for natural gas.

[2] "We," "us," and "our" refer to the environmental staff of the FERC's Office of Energy Projects (OEP).

Non-Internet Public

Page 1-3
Map

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

According to Cheniere, Texas and Louisiana combined account for 25 percent of all the natural gas consumed in the nation. During a March 24, 2004 site visit, Cheniere representatives explained that the LNG terminal could also be a potential source of natural gas for the adjacent Sherwin plant, which was another factor influencing their choice of the proposed site, and a reason why Sherwin is a partner in the Project.

Cheniere has not yet filed any precedent agreements from shippers for the imported LNG. Under the FERC's regulations for Section 3 applications, Cheniere is not required to reveal market data about its LNG import terminal. Cheniere's pipeline application (CP04-44-000) indicated that it would hold an open season beginning in January 2004 to obtain binding commitments for firm transportation capacity. The open season ended April 16, 2004, and Cheniere Resources, Inc. was awarded the full pipeline capacity of 2,700 MMcfd.

1.1.1 Projected Domestic Supplies and Demand for Natural Gas

Speaking at a conference in April 2004, U.S. Federal Reserve Board Chairman Alan Greenspan pointed out that use of natural gas has increased over time while its availability has recently stagnated. Domestic natural gas prices are on the rise because of supply and demand issues. Chairman Greenspan stated that the U.S. needs to import more natural gas, including the expansion of LNG import terminals (Schneider, 2004).

The Energy Information Administration of the U.S. Department of Energy (EIA) predicted that U.S. natural gas supplies would rise from about 19 trillion cubic feet (tcf) produced in 2002 to almost 24 tcf by 2025. However, during that same timeframe, domestic consumption of natural gas is projected to increase from a total of about 22 tcf in 2002 to about 31 tcf in 2025. To make up the difference between future domestic supplies and demand, the U.S. would have to increase imports of natural gas. The EIA indicated that in 2002, the U.S. imported about 3.5 tcf of natural gas, combining imports from Canada, Mexico, and LNG. In 2025, imports are predicted to increase to about 7 tcf, with LNG's portion growing from almost 0.2 tcf in 2002 to about 4.8 tcf in 2025 (EIA, 2004).

1.1.2 Potential of LNG Imports

LNG is natural gas that has been cooled to about minus 260 degrees Fahrenheit (°F) for shipment and storage as a liquid. LNG is more compact than the gaseous equivalent, with a volumetric difference of approximately 610 to 1. LNG can be transported long distances across oceans using specially designed ships. There are currently four existing marine LNG import terminals in the U.S. (at Everett, Massachusetts; Cove Point, Maryland; Elba Island, Georgia; and Lake Charles, Louisiana), built between 1971 and 1982. In 2001, LNG imports into the U.S. totaled about 238 billion cubic feet (bcf). A number of factors are contributing to interest in increasing the level of U.S. imports of LNG, including higher domestic natural gas costs; the leveling-off of domestic gas supplies; and technological advances in liquefying, shipping, storing, and regasification, which have reduced the cost of transporting and importing LNG (Gaul and Young, 2003).

There are currently 12 LNG exporting countries, which combined represent 28 percent of the world's natural gas reserves. The EIA estimated there is up to 3,350 tcf of stranded natural gas worldwide that is seeking markets. The existing LNG import terminals in the U.S. have a combined peak capacity of about 1.2 tcf. To address projected future domestic natural gas demands, up to 40 new LNG import facilities in North America are in the planning stages (Dismukes et al., 2004). (Some of these proposed facilities are discussed in the Alternatives section of this EIS.) The EIA predicts that at least four new LNG import terminals would be built on the Atlantic and Gulf Coasts between 2007 and 2010 to meet the 58 percent projected increase in LNG imports over that timeframe. By 2010, those new terminals may be importing up to 812 bcf of LNG annually. By that date, LNG could account for about 39 percent of all natural gas imported into the U.S. (EIA, 2003).

1.2 PURPOSE AND SCOPE OF THE EIS

The FERC is the Federal agency responsible for authorizing onshore LNG import facilities. As such, the FERC is the lead Federal agency for the preparation of this EIS in compliance with the requirements of the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality (CEQ) regulations for implementing the NEPA (40 CFR 1500-1508), and the FERC's regulations for implementing NEPA (18 CFR 380). The FERC will use the EIS as an element in its review of Cheniere's applications to determine whether to authorize the Project. The Commission will consider the environmental issues, including our recommended mitigation measures, as well as non-environmental issues. Final authorization will be granted only if the Commission finds that the proposed Project is in the public interest. The environmental impact assessment and mitigation discussed in this EIS are important factors in this final determination.

The U.S. Army Corps of Engineers (COE); U.S. Department of Homeland Security, U.S. Coast Guard (USCG); U.S. Department of the Interior, Fish and Wildlife Service (FWS); U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries); and the U.S. Department of Transportation (DOT) are cooperating agencies for the development of this EIS. A cooperating Federal agency has jurisdiction by law or special expertise with respect to environmental impacts involved with the proposal, and is involved in the NEPA analysis.

Our principal purposes in preparing this EIS are to:

- identify and assess potential impacts on the human environment that would result from the implementation of the proposed action;
- identify and assess reasonable alternatives to the proposed action that would avoid or minimize adverse effects on the human environment;
- identify and recommend specific mitigation measures to minimize environmental impacts; and
- facilitate public involvement in identifying significant environmental impacts on specific resources.

Our analysis in this EIS focuses on facilities that are under the FERC's jurisdiction (*i.e.*, the proposed LNG terminal and pipeline). Minor nonjurisdictional facilities would also be constructed and abandoned in association with the Project (see section 2.9 of this EIS).

The topics addressed in this EIS include alternatives; geology; soils and sediments; water resources; wetlands; vegetation; wildlife and aquatic resources; threatened, endangered, and other special status species; land use, recreation, and visual resources; socioeconomics; transportation and traffic; cultural resources; air quality and noise; reliability and safety; and cumulative impacts. The EIS describes the affected environment as it currently exists, discusses the environmental consequences of the proposed Project, and compares the Project's potential impacts to the potential impacts of other alternatives. The EIS also presents our conclusions and recommended mitigation measures.

1.3 PERMITS, APPROVALS, AND REGULATORY REQUIREMENTS

As the lead Federal agency for the Cheniere Corpus Christi LNG Project, the FERC is required to comply with various Federal environmental laws and regulations, including, but not limited to, the Endangered Species Act (ESA) of 1973, the Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1976, the National Historic Preservation Act (NHPA) of 1966, and the Coastal Zone Management Act of 1972 (CZMA). Each of these statutes has been taken into account in the preparation of this document.

1.3.1 Endangered Species Act (ESA)

Section 7 of the ESA, as amended, states that any project authorized, funded, or conducted by any Federal agency (*e.g.*, FERC) should not "...jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined...to be critical..." (16 United States Code (USC) Section 1536(a)(2)(1988)). The FERC, or Cheniere as a non-Federal party, is required to consult with the FWS and NOAA Fisheries to determine whether any federally listed or proposed endangered or threatened species or their designated critical habitat occur in the vicinity of the proposed Project. If the FERC determines that these species or habitats may be affected by the proposed Project, the FERC is required to prepare a biological assessment (BA) to identify the nature and extent of adverse impact, and to recommend measures to avoid or reduce potential impacts on habitat and/or species. If, however, the FERC determines that no federally listed or proposed endangered or threatened species or their designated critical habitat would be affected by the proposed Project, no further action is necessary under the ESA. See section 4.6 of this draft EIS for the status of our compliance with Section 7 of the ESA.

1.3.2 Magnuson-Stevens Fishery Management and Conservation Act (MSA)

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan. The MSA requires Federal agencies to consult with NOAA Fisheries on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH (MSA Section 305(b)(2)). Although absolute criteria have not been established for conducting EFH consultations, NOAA Fisheries recommends consolidating EFH consultations with interagency coordination procedures required by other statutes such as NEPA, the Fish and Wildlife Coordination Act, or the ESA (50 CFR 600.920(e)) in order to reduce duplication and improve efficiency. As part of the consultation process, the FERC has prepared an EFH Assessment included in appendix E of this EIS.

1.3.3 National Historic Preservation Act (NHPA)

Section 106 of the NHPA, as amended in 1992, requires the FERC to take into account the effects of its undertakings on properties listed in or eligible for listing in the National Register of Historic Places (NRHP), including prehistoric or historic sites, and districts, buildings, structures, objects, or properties of traditional religious or cultural importance. The NHPA also requires the FERC to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. In accordance with the ACHP's regulations for implementing Section 106, found at 36 CFR 800, the FERC is using the services of the applicant, Cheniere, and its consultants to prepare information, analyses, and recommendations to assist in meeting our obligations to comply with the NHPA. Section 4.10 of this EIS summarizes the status of our compliance with Section 106.

1.3.4 Coastal Zone Management Act (CZMA)

The CZMA calls for the "effective management, beneficial use, protection, and development" of the nation's coastal zone and promotes active state involvement in achieving those goals. As a means to reach those goals, the CZMA requires participating states to develop management programs that demonstrate how these states will meet their obligations and responsibilities in managing their coastal areas. In the state of Texas, the Texas General Land Office (TGLO) is the agency responsible for administering its Coastal Zone Management Program (CZMP). Because Section 307 of the CZMA requires Federal agency activities to be consistent to the maximum extent practicable with the enforceable policies of a management program, the FERC has requested that Cheniere seek a determination of consistency with Texas' CZMP. Section 4.7.5 of this EIS summarizes our consultations with the TGLO and actions taken to comply with the CZMA.

1.3.5 Other Permits, Approvals, and Consultations

Besides the FERC, other Federal agencies have responsibilities for issuing permits or approvals to comply with various Federal laws and regulations. For example, the COE would issue permits under the Clean Water Act (CWA), and the Rivers and Harbors Act; the U.S. Environmental Protection Agency (EPA) issues permits under the CWA and the Clean Air Act (CAA); and the USCG has responsibilities relating to LNG waterfront facilities under 33 CFR 127. Several Texas state agencies have delegated responsibilities under the CZMA, CWA, and CAA. Major permits, approvals, and consultations required for the Cheniere Corpus Christi LNG Project are identified in table 1.3.5-1. The FERC encourages cooperation between applicants and state and local authorities, but this does not mean that state and local agencies, through applications of state and local laws, may prohibit or unreasonably delay the construction or operation of facilities approved by the FERC. Any state or local permits issued with respect to jurisdictional facilities must be consistent with the conditions of any authorization issued by the FERC.[3]

[3] See, *e.g.*, Schneidewind v. ANR Pipeline Co., 485 U.S. 293 (1988); National Fuel Gas Supply v. Public Service Commission, 894 F.2d 571 (2n Cir. 1990); and Iroquois Gas Transmission System, L.P., *et al.*, 52 FERC 61,091 (1990) and 59 FERC 61,094 (1992).

TABLE 1.3.5-1

Environmental Permits and Agency Reviews for the Cheniere Corpus Christi LNG Project

Regulation/ Permit/Approval	Agency (Location)	Agency Actions	Submission Date/Status
FEDERAL ACTIONS			
Sections 3 and 7 of the NGA	FERC (Washington DC)	Pending – preparing EIS, prior to decision on Certificate of Public Convenience and Necessity.	Cheniere filed applications 12/22/03.
Section 106 of the NHPA	ACHP (Washington DC)	No comment may be necessary, as the FERC made the preliminary determination that no historic properties would be adversely affected.	
Farmland Protection Policy Act	U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS, Temple, TX)	NRCS made a determination that construction of the pipeline would not be a permanent conversion of Important Farmland on 12/9/03 and made a determination for the meter stations on 5/24/04.	Cheniere initiated consultation for the LNG terminal on 6/23/03 and for the pipeline on 11/19/03. Cheniere requested comments on its Dredged Material Placement Area (DMPA) Plan on 5/13/04, and requested comments on its Aquatic Resources Mitigation Plan on 9/10/04.
Section 404 of the CWA; Section 10 of the Rivers and Harbors Act	COE (Galveston, TX)	Pending – review of permit application. COE agreed to be a cooperating agency for EIS preparation 3/8/04 and provided the FERC with comments on the administrative draft EIS (ADEIS) on 9/7/04. COE made jurisdictional determinations for the LNG terminal on 12/11/03 and 7/15/04, and for the pipeline on 7/28/04.	Cheniere submitted wetland delineation reports for the LNG terminal on 10/24/03 and 6/7/04, and for the pipeline on 5/11/04. Cheniere requested comments on its DMPA Plan on 5/13/04, and requested comments on its Aquatic Resources Mitigation Plan on 9/10/04. Cheniere submitted its permit application to the COE on 9/9/04.
Section 7 of the ESA; Section 305 of the MSA; Marine Mammal Protection Act	NOAA Fisheries (Galveston, TX; and St. Petersburg, FL)	Pending – consultations on threatened and endangered aquatic species; and EFH Conservation Recommendations. NOAA Fisheries agreed to be a cooperating agency for EIS preparation on 2/26/04, and commented to the FERC on the ADEIS on 9/9/04. NOAA Fisheries commented to Cheniere on EFH on 9/3/03, and commented to Cheniere on 6/14/04 that the DMPA Plan would not adversely impact living marine resources or EFH.	Cheniere initiated consultation for LNG terminal on 6/23/03. Cheniere requested comments on its DMPA Plan on 5/13/04, and requested comments on its Aquatic Resources Mitigation Plan on 9/10/04.
33 CFR 127; Notice to Mariners; Marine Transportation Security Act	USCG (Corpus Christi, TX)	Pending – review of waterfront LNG facilities, Letter of Recommendation regarding suitability of waterway; risk assessment and safety zones. USCG commented to the FERC on the ADEIS on 9/8/04.	Cheniere submitted a Letter of Intent to USCG on 6/10/03 and revised it on 9/15/03.
Section 7, ESA	FWS (Corpus Christi, TX)	FWS provided species list to Cheniere on 6/26/03. FWS agreed to be cooperating agency on 5/12/04 and provided the FERC with comments on the ADEIS on 9/8/04. FWS made "no effect" determinations for the pipeline on 11/26/03 and 5/13/04, and a finding of "no effect" for the LNG terminal on 5/13/04. FWS commented to Cheniere on its DMPA Plan on 6/3/04.	Cheniere initiated consultation for the LNG terminal on 6/23/03 and the pipeline on 11/7/03, and submitted biological survey reports on 5/11/04. Cheniere requested comments on its DMPA Plan on 5/13/04, and requested comments on its Aquatic Resources Mitigation Plan on 9/10/04.

TABLE 1.3.5-1

Environmental Permits and Agency Reviews for the Cheniere Corpus Christi LNG Project

Regulation/ Permit/Approval	Agency (Location)	Agency Actions	Submission Date/Status
49 CFR 192; 49 CFR 193	U.S. Department of Transportation, Office of Pipeline Safety (DOT, Houston, TX)	Pending – evaluations of compliance with Federal safety standards; encroachment permits for crossing of Federal highways. DOT commented to the FERC on the ADEIS on 8/20/04.	
Section 402 of the CWA; 44 CFR 9; CAA	EPA (Region 6, Denton, TX)	Pending – National Pollutant Discharge Elimination System (NPDES) permit; review of construction within floodplain; review of air quality permit application.	Cheniere initiated consultation on 6/23/03. Cheniere requested comments on its DMPA Plan on 5/13/04, and requested comments on its Aquatic Resources Mitigation Plan on 9/10/04.
STATE ACTIONS			
Texas Clean Air Act; CAA; 40 CFR 50-99	Commission for Environmental Quality (TCEQ, Austin, TX)	TCEQ accepted Cheniere's air permit application for LNG terminal on 1/20/04. Pending – final air quality permit.	Cheniere initiated consultation on 6/23/03. Cheniere requested comments on its Aquatic Resources Mitigation Plan on 9/10/04.
Section 307 of the CZMA	General Land Office (TGLO, Austin, TX; Coastal Coordination Council, Corpus Christi, TX)	Coastal Coordination Council – pending action on LNG terminal until after COE permit is submitted. Made determination of consistency for the pipeline on 11/19/03.	Cheniere initiated consultation for the LNG terminal on 6/23/03 and the pipeline on 11/7/03. Cheniere included in its Section 404/10 application to the COE a definitive statement of consistency with CZMA.
Section 106 of the NHPA	Historic Commission (State Historic Preservation Office [SHPO], Austin, TX)	SHPO accepted pipeline overview report on 1/15/04. SHPO accepted first pipeline survey report on 3/25/04 and second report on 7/8/04. SHPO on 8/10/04 determined that no underwater survey would be required. SHPO made a finding of no historic properties/no effect on 8/24/04 for the LNG terminal.	Cheniere submitted its first pipeline survey report to the SHPO on 1/19/04, and submitted an addendum report on the revised pipeline route on 5/11/04. Cheniere submitted its second survey of the LNG terminal to the SHPO 5/14/04, and an addendum to the LNG terminal survey report was submitted on 7/27/04.
	Parks and Wildlife Department (TPWD, Austin, TX)	Pending – review of biological survey reports. TPWD provided species list to Cheniere for LNG terminal on 11/9/03 and the pipeline on 1/2/04.	Cheniere initiated consultation for LNG terminal on 6/23/03 and the pipeline on 11/7/03, and submitted biological survey reports on 5/11/04.
TAC Title 16 Part 1 Chapter 3	Railroad Commission (RRC, Austin, TX)	Pending – NPDES storm water permit, and pipeline construction permit.	Cheniere initiated consultation for the LNG terminal on 6/23/03, and for pipeline 11/13/03. Cheniere requested comments on its Aquatic Resources Mitigation Plan on 9/10/04. Cheniere filed its State Water Quality Certificate application 9/9/04.
	Department of Transportation (TDOT, Corpus Christi, TX)	Pending – permit for crossing state highways. TDOT commented on 3/24/04 that all state highways must be bored.	
LOCAL ACTIONS			
44 CFR 60	San Patricio County Floodplain Mgmt Program	Pending – permit review for construction in a floodplain.	Cheniere filed its application for a Floodplain Development permit 9/9/04.
	San Patricio Highway Department	Pending – permit to cross county roads.	
	Port of Corpus Christi Authority		Cheniere consulted on pipeline route on 5/24/04.

1.4 PUBLIC REVIEW AND COMMENT

On February 20, 2004, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Proposed Cheniere Corpus Christi LNG Terminal and Pipeline Project, and Request for Comments on Environmental Issues, and Notice of Public Scoping Meetings and Site Visit* (NOI). The NOI was sent to 300 interested parties including Federal, state, and local officials; agency representatives; conservation organizations; local libraries and newspapers; property owners along the proposed pipeline route, and intervenors in the proceeding.

On March 24, 2004, the FERC conducted a public scoping meeting in Portland, Texas to provide an opportunity for the public to learn more about the proposed Project and to provide comments on environmental issues to be addressed in the EIS. Twenty-two people spoke at the meeting, and 10 agencies and individuals submitted written comments in lieu of oral comments. A transcript of the scoping meeting and all written comments provided at the meeting have been entered into the public record for the Cheniere Corpus Christi LNG Project. On March 24 and 25, 2004, the FERC also conducted a site visit, open to the public, of the LNG terminal site and the pipeline route.

Issuance of the NOI opened the public comment period, with a closing date of March 26, 2004 originally established for receiving written comments. On February 25, 2004, the FERC issued a *Notice of Extension of Time* that extended the closing date for receiving comments to March 31, 2004. In total, ten letters were received in response to the NOI. Issues identified and comments received are summarized in table 1.4-1.

In response to the FERC's Notice of Application and our NOI for this Project, a total of 18 parties submitted motions to intervene. Intervenors receive all documentation filed in a proceeding, and have the right to seek rehearing of the Commission's decision. The intervening parties and issues raised are listed on table 1.4-2. No protests were filed in this proceeding.

This draft EIS was filed with the EPA. A formal notice indicating that the draft EIS is available was published in the FR, and the document has been mailed to approximately 325 individuals and organizations on the mailing list prepared for the Project (see appendix A). In accordance with the CEQ regulations implementing the NEPA, the public has the opportunity to comment on the draft EIS in the form of written comments or at the public comment meeting that will be held in the Project area. We will review and use the comments to prepare the final EIS for the Cheniere Corpus Christi LNG Project. All timely comments and letters received on this draft EIS will be addressed in the final EIS.

TABLE 1.4-1

Written Comments Received in Response to the Cheniere Corpus Christi LNG Project NOI

Party	Date Comments Filed	Issues Raised/Comment
COE	March 15, 2004	Agrees to be a cooperating agency
Walter and Linda Pitre	March 15, 2004	Approves of the Project
U.S. Department of Agriculture, Natural Resources Conservation Service	March 16, 2004	Pipeline would not permanently convert Important Farmland to another use
Rick Perry, Governor of Texas	March 24, 2004	Supports the Project
Chitimacha Tribe of Louisiana	March 25, 2004	Project is not part of the Chitimacha Tribe of Louisiana's aboriginal homelands
Texas Department of Transportation	March 30, 2004	No state highways crossed may be open cut, all must be bored
U.S. Department of Health and Human Services, Centers for Disease Control and Prevention	March 31, 2004	No specific comments, but generally the EIS should address air and water quality, wetlands, hazardous materials, noise, occupational health and safety, land use and housing, and environmental justice
Portland Chamber of Commerce	March 31, 2004	Supports the Project
NOAA Fisheries	February 26, 2004	Agrees to be a cooperating agency
	March 24, 2004	The FERC should consult with NOAA Fisheries and prepare an EFH assessment
EPA	April 7, 2004	EIS should address potential effects on wetlands, consider an off-shore terminal location, and examine cumulative impacts

TABLE 1.4-2

Intervenors in the Cheniere Corpus Christi LNG Project

Intervening Party	Date Intervention Was Filed	Basis for Seeking Intervenor Status
Calpine Corporation	January 7, 2004	Independent power producer and natural gas consumer, who is a potential LNG customer
ConocoPhillips Company	January 9, 2004	Producer and marketer of natural gas, partner in the Freeport LNG import terminal proposal, and potential LNG customer
Total Gas and Power North America, Inc.	January, 2004	Natural gas producer, and LNG importer
Trunkline LNG Company, LLC	January 16, 2004	Owner and operator of an existing LNG import facility at Lake Charles, Louisiana
BP Energy Company	January 16, 2004	Company liquefies gas into LNG, and imports LNG into the U.S.
Southern LNG Inc.	January 16, 2004	Owner and operator of an existing LNG import facility at Elba Island, Georgia
Crosstex Energy Services, L.P.	January 22, 2004	Existing intrastate pipeline company, would transport gas from Cheniere Corpus Christi LNG terminal, and may be a potential customer
Transcontinental Gas Pipeline Corporation	January 23, 2004	Company would interconnect with Cheniere Corpus Christi pipeline
ExxonMobil Gas Marketing Company	January 23, 2004	Producer and marketer of natural gas, and subsidiary of sponsor of a proposed LNG terminal also to be sited in Corpus Christi Bay area
Freeport LNG Development	January 23, 2004	Sponsor of a proposed LNG import terminal in Freeport, Texas, partly owned by Cheniere
FPL Group Resources LLC	January 23, 2004	Natural gas marketer, potential LNG customer
Occidental Energy Ventures Corporation	January 23, 2004	Sponsor of a proposed LNG import terminal also located in the Corpus Christi Bay area
Occidental Chemical Corporation	January 23, 2004	Owner of manufacturing facility at Ingleside, Texas, and affiliate of sponsor of another proposed LNG import terminal in the Corpus Christi Bay area
Reynolds Metal Company	January 23, 2004	Affiliate of Alcoa Inc. which owns land at the site of Cheniere's proposed Corpus Christi LNG terminal
Weavers Cove Energy LLC	January 23, 2004	Sponsor of a proposed LNG import facility in Fall River, Massachusetts
Statoil ASA and Statoil Natural Gas LLC	February 4, 2004	Oil and gas company, shipper of LNG to the existing Cove Point LNG import terminal in Maryland
Natural Gas Pipeline Company of America	February 20, 2004	Existing interstate natural gas company, would interconnect with Cheniere Corpus Christi pipeline
Sempra Energy LNG	April 5, 2004	Owner and developer of LNG facilities

2.0 DESCRIPTION OF THE PROPOSED ACTION

2.1 PROPOSED FACILITIES

Cheniere proposes to construct and operate a new LNG import, storage, and vaporization terminal on the northeastern shoreline of Corpus Christi Bay, east of Portland, in San Patricio and Nueces Counties, Texas. In addition, Cheniere proposes to construct and operate a new natural gas pipeline extending from the LNG terminal to north of Sinton to transfer the imported natural gas to markets throughout Texas and the U.S. via interconnections with a number of existing intrastate and interstate pipeline systems. A general LNG terminal map is provided as figure 2.1-1. The proposed LNG terminal site plan is shown on figure 2.1-2. Detailed pipeline route maps are included in appendix B. The following section describes the proposed LNG terminal and pipeline facilities, land requirements, construction procedures and schedule, environmental compliance and inspection monitoring, operation and maintenance procedures, and safety controls.

2.1.1 LNG Terminal Facilities

2.1.1.1 Marine Basin and Berths

The LNG terminal would include a new marine basin and dredged maneuvering area at the present western end of the La Quinta Channel. Within the marine basin Cheniere would construct two berths for LNG ships. A third dock would be installed for tug and line-handing boats. The terminal would have the capability of unloading up to about 300 LNG ships per year.

The LNG ships would travel from the Gulf of Mexico into the Corpus Christi Ship Channel then the La Quinta Channel to the existing turning basin at the Sherwin plant. The existing authorized depth of the Corpus Christi Ship Channel and the La Quinta Channel is 45 feet. The La Quinta Channel is 5.5 miles long, and between 300 to 400 feet wide. The existing La Quinta Turning Basin is 45 feet deep and 1,200 feet across. The Corpus Christi Ship Channel and the La Quinta Channel are operated by the Port of Corpus Christi Authority (PCCA) and maintained by the COE, which completed the existing 45-foot-depth project in 1989. The COE recently did a study (COE, 2003a) to extend the La Quinta Channel an additional 7,400 feet at a depth of 39 feet to reach the proposed PCCA La Quinta Container Terminal, which would be located to the west of the Cheniere LNG terminal.

The Project would entail enlarging the existing La Quinta turning basin at the Sherwin plant to include a maneuvering area to turn and move LNG ships into berths at the LNG terminal (see figure 2.1-3). The new marine basin and berths would be oriented so that docked LNG tankers would be out of the way of other ship traffic and to allow for emergency egress. The new marine basin would be about 1,300 by 3,170 feet at its widest point, and would cover about 78 acres. To create the maneuvering area and marine basin, Cheniere would dredge about 4.4 million cubic yards (mcy) of material. The basin would be dredged to 42 feet below mean low tide (MLT), with up to an additional 2 feet of overdredge depth. The sides of the maneuvering area would be contoured at a 3:1 slope, and the sides of the maneuvering area along the shoreline would be protected using articulated block mats or rock breakwaters.

Non-Internet Public

Page 2-2
Map

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

Non-Internet Public

Pages 2-3 and 2-4
Maps

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

The COE commented that using rock for protection of sloped sides of the maneuvering area may result in the movement of rock rip-rap into dredged areas, in particular the La Quinta Channel if it is extended as proposed. We believe the chance for this would be remote since shoreline areas where protection would be used would be more than 350 feet from the edge of the La Quinta Channel extension.

The new marine basin and berths would be able to accommodate both currently operating LNG ships and future LNG ships, with capacities up to 250,000 m^3 and drafts up to 41 feet. There would be three new tractor tugs and two line-handling boats, and facilities for their permanent berthing at the marine basin, dedicated to maneuvering LNG ships into and out of the terminal. These tugs and line-handling boats would be owned and operated by Cheniere or an affiliated company.

Cheniere states that the maneuvering and docking of the LNG tankers can be accomplished under most weather and tidal conditions with no more than three Z-drive tugs. Simulation studies of maneuvering and docking of LNG ships using Cheniere's berthing design were conducted at the COE's Engineering Research and Development Center in Vicksburg, Mississippi. At the March 24, 2004 public scoping meeting for this Project, Jim Dooley, representing the Aransas-Corpus Christi Pilots Association (Pilots), confirmed that several port pilots participated in the simulation studies, and that they are satisfied with the results.

Each of the two berths would have four breasting and six mooring structures. The breasting dolphins, consisting of reinforced concrete structures on piles, would be equipped with fenders and mooring hooks for spring lines. Access bridges would be provided to connect the breasting dolphins to the docks and to the mooring dolphins. The mooring points would each consist of reinforced concrete slabs supported on piles. Mooring dolphins would be provided with access stairs and interconnecting walkways with protective handrails, except on the mooring line faces.

The two LNG ship docks would each be a one-level concrete structure supported on piles. Each dock would consist of a reinforced concrete beam and slab structure, approximately 90 feet wide by 116 feet long. The slabs would be slightly sloped to allow for water drainage. Each dock would support jetty substation and control buildings, LNG unloading and vapor return arms, gangway tower and crane, utility piping, fire suppression equipment, and elevated access platforms and firewall monitors. Figure 2.1-4 shows an artist's rendering of the proposed LNG terminal facilities, including the LNG ship docks.

2.1.1.2 LNG Ship Deliveries

The LNG terminal berths and off-loading facilities would be designed to handle LNG transport ships ranging in capacity from about 87,000 m^3 up to 250,000 m^3. Cheniere estimates that its proposed Corpus Christi LNG terminal would serve on average of about 300 LNG ships per year. However, that figure would depend upon the size of the LNG transport ships that come to dock. A simulation study conducted by Cheniere showed that its marine terminal design is capable of unloading one 138,000m^3 LNG ship a day. This is the most common size of LNG tanker currently in use. Table 2.1.1.2-1 shows how the number of ships would decline if they increase in capacity.

The ships that transport LNG are specially designed and constructed to carry LNG for long distances. Sections 4.9.2 and 4.12.5 of this EIS include detailed discussions of LNG ship design and safety.

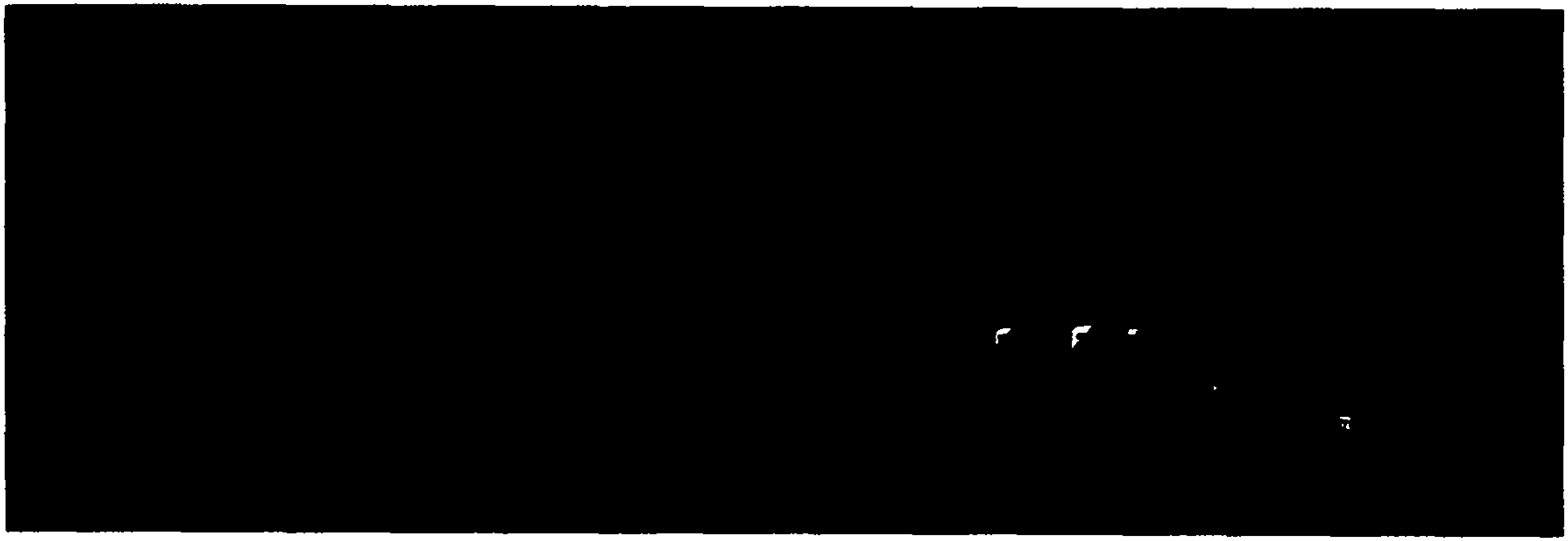


Figure 2.1-4
Cheniere Corpus Christi LNG Project
Artist's Rendering of Proposed LNG Terminal

TABLE 2.1.1.2-1

Number of LNG Tanker Deliveries Depending on the Size of the Ship

	Size of the LNG Tankers (Capacity in m³)		
	138,000	165,000	250,000
Number of Dockings at LNG Terminal Per Year	323	0	0
	300	20	0
	205	100	1
	100	100	60
	50	50	120
	0	0	180

2.1.1.3 LNG Unloading and Transfer Lines

Onboard ship pumps would deliver LNG to the on-shore storage tanks via stainless-steel unloading arms and insulated transfer pipelines. Each dock would have an unloading arm platform containing four 20-inch-diameter arms. Each arm would be designed up to a pressure of 225 pounds per square inch gauge (psig), with a capacity of 12,000 m^3 per hour. The arms could handle LNG ships ranging from 75,000 m^3 to 250,000 m^3 in size.

All the arms would be operated by a hydraulic system with counter-balance weights to reduce the deadweight of the arm on the shipside connection, and the arms would be designed with swivel joints for the required range of movement between the dock and the ships. The arms would be equipped with powered emergency release coupling (PERC) valves to prevent the spillage of LNG in case of ship movements. Three arms would be dedicated to unloading LNG from the ships, while one arm would be for vapor return.

The purpose of the vapor return arm would be to recycle LNG that has vaporized as a result of ambient heat and other factors. This is also referred to as boil-off gas or BOG. When a ship is unloading LNG, a portion of the BOG would be returned to the ship by way of the vapor return arm and a vapor return blower, which would discharge at about 10 psig. Vapor must be returned to the ship during unloading to make up for the volume of liquid being pumped from the ship to maintain ship tank pressure.

The unloading arms would be connected to two parallel 30-inch-diameter stainless-steel insulated LNG transfer lines for each dock. These four lines would then be valved together into a single pair of stainless-steel insulated lines that would run along the main pipe rack to transfer the LNG into the LNG storage tanks. Depending on the final berth and tank locations selected, the LNG transfer lines would range in length from approximately 4,300 to 6,200 feet. The transfer pipelines would be placed on aboveground structural pipe racks. The pipe racks would be constructed of reinforced concrete columns and steel cross members.

The facilities have been designed to provide safe berthing for the receipt and mooring of LNG ships and to ensure safe transfer of LNG cargoes from the ships to on-shore facilities. Design of the facilities is in accordance with applicable codes and standards, including but not limited to

Oil Companies International Marine Forum, Society of International Gas Tanker and Terminal Operators, American Petroleum Institute (API), and American Society of Civil Engineers.

2.1.1.4 LNG Storage Tanks

The transfer pipelines would transport the LNG to three all-metal, double-wall, single-containment storage tanks. Each storage tank would consist of an open-top inner container of 9 percent nickel steel, with an insulated aluminum deck over the inner container suspended from the roof, and a dome roofed outer container made of carbon steel. The space between the inner and outer containers would be insulated with expanded perlite. Beneath the inner container would be cellular glass insulation. The storage tanks would sit on reinforced concrete foundations. The nominal working volume of each storage tank would be approximately 160,000 m^3 of LNG, equivalent to about 1,006,400 barrels, at a normal operating temperature of –260 °F, and a maximum internal pressure of 1.5 psig. Each tank would be approximately 270 feet in diameter (outside dimensions) and 175 feet high (above ground level).

All connections to the LNG storage tanks would be from the top so that there would be no penetrations of the tank bottom or sides. Four in-tank pump columns would be installed within each storage tank, for three operating pumps and a spare. The in-tank LNG pumps would be submersible, vertical pumps, each designed to handle up to 4,304 gallons per minute (gpm).

2.1.1.5 LNG Vaporization System

LNG from the storage tanks would be pressurized and vaporized so that natural gas could be sent out via the proposed natural gas pipeline. The in-tank pumps would transfer LNG from the storage tanks to the sendout pumps, via the BOG compressors.

This process would be accomplished using a "vaporization train," consisting of one high-pressure LNG sendout pump and one SCV. Cheniere intends to routinely use 15 vaporization trains at its Corpus Christi LNG terminal, and keep an additional train on line as a spare. However, the number of vaporization trains placed in service at any given time would be based on customer demand.

The first part of the train would be a multi-stage vertical canned LNG sendout pump, which would deliver LNG from the BOG condenser to a LNG vaporizer. The sendout pumps would boost the pressure of the LNG from about 90 psig to 1,300 psig. Each pump would be rated up to 1,686 gpm, with a normal flow being 1,533 gpm.

LNG from the sendout pumps then enters the SCV. As the LNG passes through tubes within the SCV, it is heated by a warm water bath within a basin and turns from a liquid into a gas. Each SCV contains a separate coil to heat the water, using its own vaporized LNG for fuel. The natural gas exits the SCV at a designed outlet temperature of 40°F.

A 700-foot-long interior plant pipe would connect the vaporization trains to a metering facility that would measure the total natural gas output of the Project. A custody transfer meter would measure the natural gas leaving the facility. Under normal operations, the terminal would have an average total output of 2.6 billion cubic feet per day (bcfd).

2.1.1.6 Vapor Handling System

During normal operation, ambient heat input into the LNG storage tanks and piping system would cause a small amount of LNG to be continuously vaporized. Some vaporization of LNG would also be caused by other factors such as barometric pressure changes, heat input due to pumping, and ship flash vapor. The vapor handling system would condense BOG and allow it to re-combine with the LNG in the storage tanks. In this process, vapor from the LNG storage tanks would be compressed by the BOG compressors and then passed through the condenser. In the condenser, the vapor would be condensed prior to being pressurized in the LNG sendout pumps.

Key components of the vapor handling system include:

- three BOG compressors, about 6,500 cubic feet/minute (11,044 m^3/hour) each, and a BOG condensing system to handle the boil-off from the LNG tanks and unloading systems; and
- two vapor return blowers, approximately 2,164 cubic feet/minute (3,677 m^3/hour) each, sized to make up the LNG volume displaced from the ships.

2.1.1.7 Utilities and Support Facilities

The LNG terminal would require a new powerline and electrical substation, and a new waterline. The powerline, electrical substation, and waterline are discussed under the nonjurisdictional facilities for the Project, in section 2.9 of this EIS.

Support facilities located within the terminal would include buildings for administration, warehousing and maintenance, electrical, customs, and security.

2.1.2 Pipeline Facilities

The natural gas pipeline facilities proposed by Cheniere would consist of approximately 23 miles of steel, 48-inch-diameter high-pressure pipeline, extending underground from Cheniere's proposed LNG terminal to north of Sinton, Texas. The pipeline would be capable of transporting about 2,700 MMcfd of natural gas at a design pressure of 1,440 psig. The pipeline would allow Cheniere to transport natural gas from its Corpus Christi LNG terminal to intrastate and interstate markets, via interconnections with eight existing pipeline systems. Cheniere would construct a meter station at each of the pipeline interconnect/delivery points. In addition, Cheniere would construct three new 30-inch-diameter pipeline laterals, one each leading to Gulf South, Channel, and FGT meter stations, totaling about 0.8 mile in length combined. Table 2.1.2-1 lists each of the proposed pipeline interconnect/delivery points and the associated meter station. Detailed maps of the pipeline route and meter station locations are provided in appendix B.

In addition to the eight meter stations, Cheniere would construct aboveground facilities at the start and end points and approximate midpoint of the pipeline, as listed below:

- pig launcher facility and MLV within the proposed LNG terminal meter station at pipeline milepost (MP) 0.0;

- MLV near the mid-point of the pipeline at MP 10.2; and
- pig receiver facility and MLV co-located with the Tennessee Gas meter station at the northern pipeline terminus at MP 23.0.

TABLE 2.1.2-1

Proposed Delivery Points and Meter Station Locations

Interconnection/Delivery Points	Pipeline Milepost	Average Daily Flow Rate (bcfd)
Texas Eastern Transmission Company	7.8	0.335
Gulf South Pipeline Company, L.P.	11.2	0.100
Channel Pipeline Company	14.6	0.320
Florida Gas Transmission Company	16.5	0.165
Kinder Morgan Texas Pipeline Company, Tejas Pipeline	21.3	0.850
Natural Gas Pipeline Company of America	22.8	0.500
Transcontinental Gas Pipeline Corporation	22.8	0.265
Tennessee Gas Company	23.0	0.200

2.2 LAND REQUIREMENTS

2.2.1 LNG Terminal Facilities

Construction of the proposed LNG terminal would require about 771.5 acres of land, including about 78 acres for the maneuvering area and marine basin, and about 458 acres for dredged material placement. Table 2.2.1-1 summarizes the land requirements for the proposed LNG terminal. Access to the LNG terminal would be by way of the existing La Quinta Road. This road would be extended to the proposed location of the administrative building, then southward to the dock for the tugs and line boats.

2.2.2 Pipeline Facilities

Construction of the proposed pipeline and related facilities would disturb about 405.6 acres of land, including construction rights-of-way for the 48-inch-diameter main pipeline and 30-inch-diameter laterals, additional temporary workspaces, contractor and pipe yards, mainline valves, metering stations/interconnects, pig launchers and receivers, and access roads.

Operation of the new facilities would require about 139.4 acres for the permanent easement along the 48-inch-diameter pipeline, 1.5 acres of permanent easement along the pipeline laterals, 4.3 acres at the aboveground facilities, and 11.5 acres for new permanent access roads. After construction the temporary right-of-way would be restored to its previous condition and use. The land required for operation of aboveground facilities would be fenced and maintained by Cheniere. Table 2.2.2-1 summarizes the land requirements for proposed pipeline facilities.

TABLE 2.2.1-1

Summary of Land Requirements for Proposed LNG Terminal Facilities

Facility/Use	Land Affected During Construction (acres)	Land Affected During Operation (acres)
LNG Terminal		
Offshore maneuvering area, marine basin, and docks a/	78.0	78.0
Land-based facilities b/	287.9	287.9
Subtotal	**365.9**	**365.9**
Associated Activities/Facilities (outside terminal operating limits)		
Temporary contractor yard 1	6.0	0
Dredged material placement area 2 (Alcoa Area 200)	385.0	0
Easement for 138 kilovolt power line, transmission line and waterline	10.1 c/	4.2 d/
Easement for electric substation	4.5	2.0
Subtotal	**405.6**	**6.2**
Exclusion Zone e/		
Sherwin Alumina (west and north of terminal)	0	136.2
Reynolds/Alcoa (north of terminal)	0	117.0
Subtotal	**0**	**253.2**
Total	**771.5**	**625.3**

a/ Acreage for operation includes dredged area located within state/Federal waters.
b/ Area within terminal operating limits, including; administration building, vaporization facilities, transfer pipe, storage tanks, maintenance, warehouse, and impoundment basin (43.4 acres); dredged material placement area 1 (72.8 acres); south exclusion zone (31.9 acres); permanent facility road (15.9 acres); relatively undisturbed terminal property (109.6 acres); and *temporary contractor yards 2 and 3 (14.3 acres).*
c/ Acreage calculated based on a 120-foot-wide by 3,670-foot-long construction right-of-way. The remainder of the easement construction right-of-way is accounted for in the pipeline portion of the proposed project.
d/ Acreage calculated based on 3,670 foot-long, 10-foot-wide permanent easement for the waterline and 40-foot-wide easement for the electric line.
e/ Includes those exclusion zones located outside operating limits (fenceline) of terminal.

TABLE 2.2.2-1

Summary of Land Requirements for Proposed Pipeline Facilities

Facility	Land Affected During Construction (acres)	Land Affected During Operation (acres)
Pipeline		
Pipeline right-of-way	334.6 a/	139.4
Additional temporary extra workspaces	19.4	0
Lateral Pipelines to Meter Stations	2.3	1.5
Contractor and Pipe Yards	30.0	0
New Access Roads	14.3	11.5
Subtotal	***400.6***	**152.4**
Aboveground Facilities		
Meter stations b/	5.0	4.3
Pig launcher and MLV at MP 0.0 c/	0.0	0.0
Subtotal	**5.0**	**4.3**
Total	**405.6**	**156.7**

a/ Includes nominal 120-foot-wide construction right-of-way.
b/ *Also includes pig receiver and MLV that would be co-located with the Tennessee Gas meter station at MP 23.0.*
c/ Facilities would be within the fenceline of the LNG terminal. MLV at MP 10.2 would be within the pipeline easement.

2.2.2.1 Pipeline Rights-of-Way and Temporary Extra Workspaces

Cheniere would construct the 48-inch-diameter main pipeline within a 120-foot-wide construction right-of-way, of which 50 feet would be retained for permanent pipeline easement and 70 feet would be temporary workspace. Figure 2.2-1 shows a typical right-of-way cross-section for this pipeline. Additional temporary workspace of varying dimensions, located adjacent to the construction right-of-way, would be required at about 45 locations, primarily at crossings of existing utilities, roads, and waterbodies. Locations of additional temporary workspaces are listed in table C-1 in appendix C.

Approximately 21 miles of the route for the 48-inch-diameter main pipeline would be immediately adjacent to existing rights-of-way. Construction of the pipeline would overlap about 61.5 acres of existing easements as part of the temporary right-of-way. Table 2.2.2.1-1 lists locations where the pipeline would parallel existing rights-of-way. Where the pipeline would be directly adjacent to an existing pipeline, the new pipeline would be offset about 50 feet from the existing utility, and the temporary construction right-of-way would overlap the existing easement by about 25 feet.

Cheniere proposes to construct three new 30-inch-diameter lateral pipelines to connect with the Gulf South, Channel, and FGT meter stations. The Gulf South lateral would be about 3,100 feet long, co-located within the construction right-of-way and permanent easement for Cheniere's proposed 48-inch-diameter main pipeline between MPs 11.2 and 11.8. The Channel lateral would be about 950 feet long, and would branch out from the main pipeline at MP 14.6. The FGT lateral would be about 400 feet long, and would branch out from the main pipeline at MP 16.5. The construction rights-of-way for the Channel and FGT laterals would be about 75 feet wide; 50 feet would be incorporated into a permanent easement and 25 feet would be temporary construction right-of-way.

2.2.2.2 Aboveground Facilities

Aboveground facilities associated with the proposed pipeline would include meter stations, mainline valves, a pig launcher, and a pig receiver (see section 2.1.3 above). Table 2.2.2-1 lists land requirements for these proposed aboveground facilities. Locations of proposed aboveground facilities are shown on figure B-1 in appendix B. A typical interconnect/delivery point meter station for this Project would be about 100 feet by 200 feet in size, covering about 0.5 acre. The exceptions would be the NGPL, Transco, and Tennessee Gas meter stations. The NGPL and Transco meter stations would be adjacent and co-located at MP 22.8, and combined would require about 0.8 acre for construction and 0.6 acre for operation. The Tennessee Gas meter station, including a MLV and pig receiver, would be located at MP 23.0 at the northern terminus of the pipeline and would require about 1.6 acres for construction and about 0.6 acre for operation. The MLV at MP 10.2, and most of the meter stations, would be situated within the permanent easement for the main pipeline right-of-way, except for the Channel, FGT, NGPL, and Transco meter stations. The Channel and FGT meter stations would be located adjacent to roads, and connected to the main pipeline by 30-inch-diameter laterals. The NGPL and Transco meter stations would be adjacent to the main pipeline permanent right-of-way.

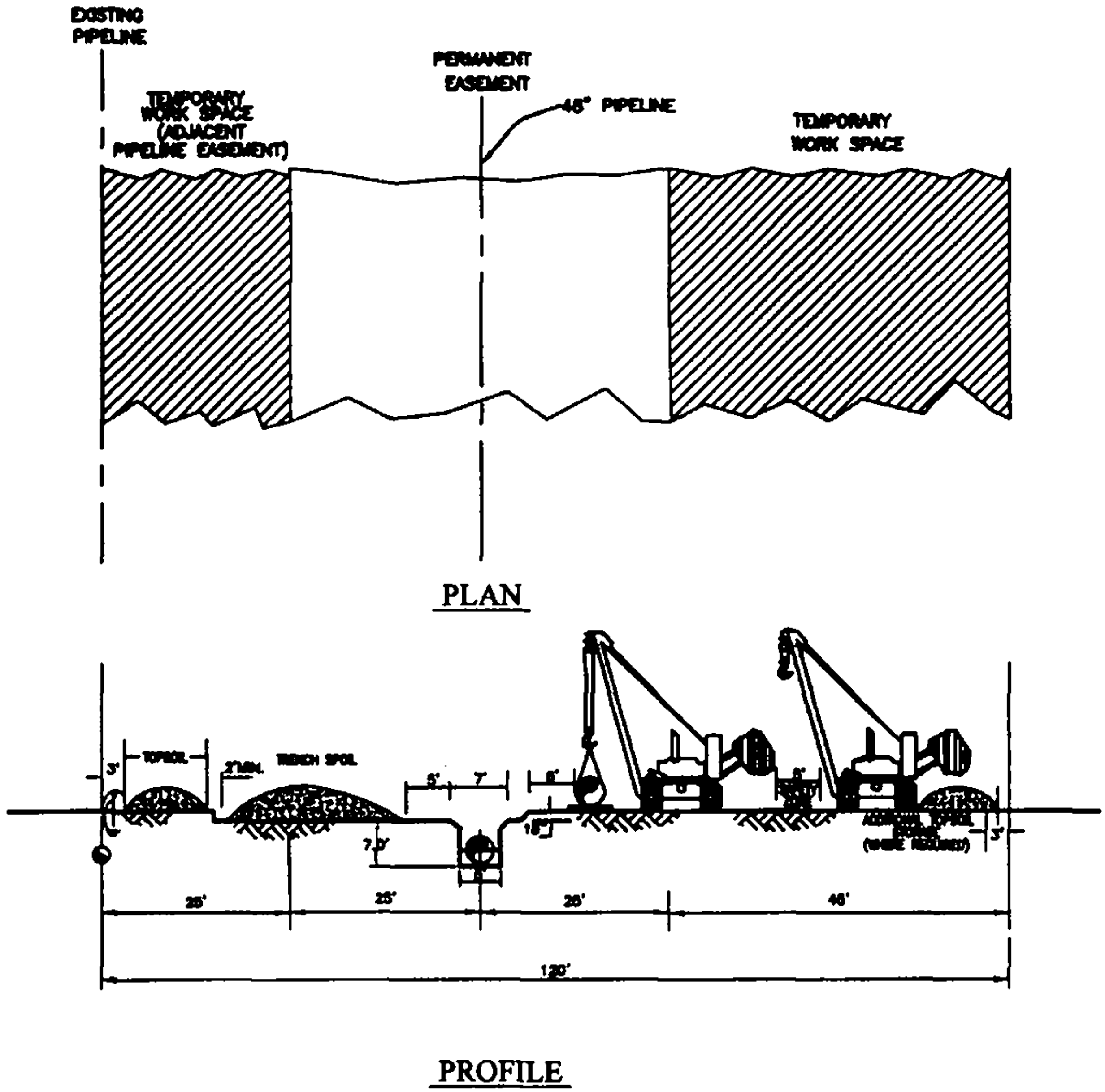


Figure 2.2-1
Cheniere Corpus Christi LNG Project
Typical Pipeline Right-of-Way Cross Section

TABLE 2.2.2.1-1

Locations Where the Cheniere Corpus Christi Pipeline Would Parallel Existing Rights-of-Way

Mileposts	Segment Length (miles)	Existing Easement	Direction from Existing Right-of-Way
0.0 – 0.7	0.7	La Quinta Road	Adjacent to the east side of the road
0.7 – 2.2	1.5	Equistar Pipeline, Koch Pipeline, Tejas Pipeline, and El Paso Pipeline	Adjacent to the north side of the Koch Pipeline
2.2 – 2.4	0.2	Kinder Morgan Pipeline and Unknown Pipeline	Adjacent to the north side of the Kinder Morgan Pipeline
2.4 – 3.1	0.5	Overhead electric powerline and water line	Adjacent to north side of the water line
3.1 – 6.7	3.6	Boykin Road, overhead electric powerline and water line	Adjacent to north side of the water line. Boykin Road would be about 300 feet south of Cheniere's pipeline to about MP 5.0 and about 150 feet south thereafter.
6.7 – 7.3	0.6	Boykin Road and overhead electric powerline	Adjacent to the north side of the powerline
7.3 – 7.8	0.5	Boykin Road, Kinder Morgan Pipeline and Koch Pipeline	Adjacent to the south side of Koch Pipeline. Boykin Road would be about 150 feet north of Cheniere's pipeline.
7.8 – 9.8	2.0	Boykin Road	Cheniere's pipeline would be about 500 feet south of Boykin Road (not adjacent)
9.8 – 10.1	0.3	Overhead electric powerline and Kinder Morgan Pipeline	Adjacent to the south side of the Kinder Morgan Pipeline and north of the powerline
10.1 – 10.5	0.4	Koch Pipeline	Adjacent to the north side of the Koch Pipeline
10.5 – 12.2	1.7	Koch Pipeline, county road, and water line	Adjacent to the north side of the water line. The county road would be about 150 feet south of Cheniere's pipeline.
12.2 – 12.5	0.3	Koch Pipeline, Valero Pipeline, county road, and water line	Adjacent to the north side of the water line
12.5 – 13.3	0.8	Water line	Adjacent to the north side of the water line
13.3 – 13.9	0.6	County road, Valero Pipeline, water line	Adjacent to the north side of the water line. The county road would be about 150 feet south of Cheniere's pipeline.
13.9 – 14.2	0.3	El Paso Pipeline	Adjacent to the north side of pipeline
14.2 – 16.2	2.0	County Road 1074, El Paso Pipeline, Valero Pipeline	Adjacent to the east side of Valero Pipeline. County Road 1074 would be about 1,000 feet west of Cheniere's pipeline.
16.2 – 23.0	6.8	El Paso Pipeline, Valero Pipeline, El Paso Pipeline	Adjacent to the east side of El Paso Pipeline

The pig launcher and MLV at MP 0.0 would be located at the meter station within the proposed LNG terminal. It would be situated adjacent to La Quinta Road, within the parcel owned by Cheniere, north of the vaporization and sendout system. Construction of the LNG terminal meter station, including the pig launcher and MLV, would require 0.7 acre, and operation of this facility would be within a 0.6-acre tract.

2.2.2.3 Access Roads and Contractor Yards

Cheniere would construct or improve five access roads related to its proposed pipeline facilities (see table 2.2.2.3-1). Four of these roads would be retained for permanent access while one road would only be temporarily used during construction of the pipeline. Three of the permanent roads would be newly constructed for this Project. The one temporary access road and one permanent access road are existing roads that would be improved. All of the roads would be 25 feet wide, and combined they would total about 4.7 miles in length. A total of about 14.3 acres would be required for the access roads.

TABLE 2.2.2.3-1

New or Improved Access Roads Associated with the Proposed Pipeline

Milepost	Road Name/ Destination	New/ Existing	Permanent/ Temporary	Length (feet)	Width (feet)	Acres Affected
0.0	Unnamed private road from La Quinta Road to LNG Meter Station	New	Permanent	130	25	0.1
10.2	Unnamed private road to MLV	New	Permanent	330	25	0.2
11.2	Unnamed private road to Gulf South Meter Station	New	Permanent	2,800	25	1.6
17.8	Unnamed private road leading to the south side of Chiltipin Creek	Existing	Temporary	4,900	25	2.8
22.5	Caliche Road	Existing	Permanent	16,790	25	9.6

Cheniere has identified one proposed pipe storage and contractor warehouse yard, a 30-acre tract in the town of Odem. This tract would only be used temporarily during construction of the Project.

2.3 CONSTRUCTION PROCEDURES

The Project facilities would be designed, constructed, operated, and maintained in accordance with Federal standards which are intended to adequately protect the public by preventing or mitigating LNG and natural gas pipeline failures or accidents, and ensure safe operation of the facilities. The LNG terminal would be constructed according to the standards outlined by the DOT's "Federal Safety Standards for Liquefied Natural Gas Facilities" at 49 CFR 193, and the National Fire Protection Association's "Standards for the Production, Storage, and Handling of LNG" (NFPA 59A). The LNG ship unloading facilities would comply with the applicable sections of the USCG regulations for "Waterfront Facilities Handling LNG" at 33 CFR 127 and Executive Order 10173.

The proposed pipeline facilities would comply with DOT regulations at 49 CFR 192, "Transportation of Natural or Other Gas by Pipeline: Minimum Federal Safety Standards." Among other items, these regulations specify material selection, design criteria, corrosion protection, and qualifications for welders and operation personnel. In addition, Cheniere would comply with the Commission's regulations at 18 CFR 380.15, regarding the siting and maintenance of pipeline rights-of-way.

Cheniere has agreed to construct Project facilities following the FERC staff's *Upland, Erosion Control, Revegetation and Maintenance Plan* (FERC Plan, January 17, 2003 version), and our *Wetland and Waterbody Construction and Mitigation Procedures* (FERC Procedures, January 17, 2003 version). (The FERC's Plan and Procedures are available for viewing on the

FERC Internet website www.ferc.gov). In addition, Cheniere has developed its own Spill Prevention, Control, and Countermeasure (SPCC) Plan for both the LNG terminal and the pipeline. We reviewed the SPCC Plan and found it generally acceptable provided Cheniere adds project-specific details. Cheniere has stated that after it selects a prime construction contractor it will file with the FERC and the Railroad Commission of Texas (RRC) a revised SPCC Plan that includes Project-specific details (see section 4.3 of this EIS).

2.3.1 LNG Terminal Facilities

Cheniere indicated that it considered the following factors during site selection and design of the LNG terminal facilities, in accordance with 49 CFR 193 Subpart B and NFPA 59A (both 1996 and 2001 versions):

- thermal radiation protection and separation of facilities;
- seismic forces and soil characteristics; and
- wind forces and other severe natural conditions.

Spill prevention and handling, fire protection, and other safety controls are discussed in section 2.7 of this EIS.

2.3.1.1 Marine Basin Dredging and Dredged Material Placement

The LNG marine basin and maneuvering area would be dredged to minus 42 feet MLT, with up to an additional 2 feet of depth for overdredge. Based on a hydrographic survey conducted by Cheniere, dredging of the new marine basin would produce approximately 4.4 mcy of material. Cheniere's dredging contractor would conduct pre- and post-dredging surveys to determine actual quantities.

Dredging would be accomplished by hydraulic means using a cutterhead pipeline dredge. Working off of a dredge barge, a rotating cutter would displace the basin sediments, which would then be suctioned into a pipeline attached to the cutterhead. The depth of the cut would be controlled by lowering the cutterhead. A centrifugal pump would move the slurry (a combination of sea water and bottom sediments sucked up from the dredge cutterhead) through the pipeline. Typically for a dredging project of the size proposed by Cheniere, a 20- to 30-inch-diameter pipeline would be used for the dredge. The slurry would be transported through a discharge pipeline to the disposal areas. Depending on the length of the discharge pipeline, a booster pump may be used. Velocities in the discharge pipeline would average about 15 feet per second. The slurry would be about 15 percent sediments and 85 percent water.

Cheniere has identified two areas where it intends to dispose of, and permanently store, dredged materials (see figure 2.3-1). These dredged material placement areas (DMPAs) were formerly used by Alcoa, Inc. (Alcoa) for the disposal of processed bauxite residue and related waste from refining activities at the alumina plant. (A more detailed discussion of the bauxite residue beds can be found in section 4.2.1 of this EIS). DMPA 1 would consist of Alcoa's Bed 22 (45 acres) and Bed 24 (28 acres), and an area known as the V-ditch (8 acres). DMPA 1 would be within the operating limits (fenceline) of Cheniere's LNG terminal. DMPA 2 consists of Alcoa's Facility 200 (385 acres), located north of the proposed LNG terminal. About 1.2 mcy and 3.2 mcy of dredged material would be placed in DMPA 1 and DMPA 2, respectively.

Non-Internet Public

Page 2-17
Map

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

Cheniere would work with Alcoa to make improvements at the DMPAs to handle the dredged material. This would include raising the height of the existing earthen levees around the residue beds to provide additional ponding depth, and installing weir boxes to control the discharge of dredge decant water. (A more detailed discussion of dredge decant water disposal can be found in section 4.3.2 of this EIS). At DMPA 2, Cheniere would need to make arrangements for reducing the existing slopes of the levees and enhancing levee stability.

In consultation with a number or resource and regulatory agencies Cheniere has prepared an Aquatic Resources Mitigation Plan that includes a Dredged Material Placement Area Plan. This plan was included as part of Cheniere's Section 404/10 application to the COE. In its comments on our administrative draft of this EIS, the COE stated that Cheniere should coordinate its proposed dredging of the marine basin with the planned Federal dredging of the La Quinta Channel extension to avoid construction conflicts. We agree, and recommend that:

- **<u>Prior to construction</u>, Cheniere should file with the Secretary of the Commission (Secretary) documentation of consultations with the COE regarding timing of the dredging for the LNG marine basin and maneuvering area. To the extent possible, Cheniere should coordinate its dredging operations with the proposed COE dredging of the La Quinta Channel extension to avoid construction conflicts.**

2.3.1.2 LNG Ship Unloading and Transfer Facilities

The primary materials that would be used in the dock construction are steel-pipe pilings, concrete, and reinforcing steel for concrete. It is expected that the steel-pipe pilings and reinforcing steel would be fabricated off site and trucked to the site. The concrete would either be produced in a batch plant located at the main terminal site or purchased from a local supplier, depending upon economics. The docks would be at an elevation of 20 feet above mean sea level (msl), and should be above the anticipated height of storm surges.

Work on the dock platform, approach, and pipe trestles would begin first so that the structures could be completed in an order that would allow installation of equipment and piping. All steel pilings would be coated with coal tar epoxy from a point 15 feet below the mudline or groundline, to the soffit of the pile cap. Concrete-filled, high-density polyethylene pipe sleeves would be required for all piling under the pipe trestle, to provide splash zone corrosion resistance.

Piered foundations for the pipe rack would be constructed of concrete. The LNG transfer pipeline would be installed after the construction of the pipe racks. Special cryogenic high-density polyurethane foam would be placed on concrete sleepers to support the piping on the racks. The LNG transfer lines would be stainless steel, provided in fully tested lengths with one longitudinal weld. All field welds would be inspected through radiography and the pipeline would be pneumatically tested when finished. The straight run pipe would be welded together on site. Pipe expansion loops would be prefabricated and trucked in. Pipe would be painted to the maximum extent possible in the shops, prior to shipment.

2.3.1.3 LNG Storage and Vaporization Facilities

The most labor-intensive and time-consuming activity would be the construction of the three LNG storage tanks. Each tank would be built on a reinforced concrete slab foundation. The LNG storage tank foundations would be elevated such that base heating would not be required to prevent frost heave from occurring during infrequent frost events.

The primary critical path activity for construction would be erection of the LNG storage tanks; therefore, site preparation would begin in the areas required for tank placement. After the tank erection area has been fully prepared, site-work activities would shift to the remaining areas of the Project. The LNG storage tanks would be hydrostatically tested before they are put into operation. More information about hydrostatic testing is discussed in section 4.3.2.3 of this EIS.

The first steps in preparing the process areas would be clearing and grading. Surface vegetation would be cut, and all stumps removed. The process areas would be finish-graded with fill of compacted crushed stone to about + 25 feet above msl, which would be above the predicted height of a 100-year flood. Prior to beginning construction of the actual project components, it would be necessary to construct access roads to the tank and process areas. Soil preparation in and around the area of the LNG storage tanks would follow the rough-grading activities. Additional activities during the site-works portion of the project would include: (1) cutting necessary drainage ditches to allow proper surface water run off; (2) cutting and backfilling for placement of any temporary construction facilities such as parking lots, office areas, and lay-down areas; (3) installing perimeter fencing and temporary construction fencing; and (4) cutting and filling any roads within the Project boundaries.

Construction of other necessary facilities and buildings, as well as foundations and major equipment such as vaporization units and other major mechanical equipment would commence once construction of the LNG storage tanks has begun. Emphasis would be placed on coordinating the arrival of the major equipment with the completion and curing of the respective foundations so that the equipment can be placed on its foundation when it arrives. This would avoid double-handling and intermediate storage on site.

Wherever practical, large equipment would arrive at site in preassembled packages that would facilitate final hook-up and testing. Some larger equipment, such as the SCVs and compressors, would come in several subassemblies that would then be brought together and interconnected on their foundations. All equipment would be designed, fabricated, and tested by highly qualified specialist suppliers at their respective facilities, and shipped to the site only after the necessary inspections have taken place. Installation of the vaporization equipment would coincide with laying the transfer pipelines on the pipe racks, so there could be a seamless tie-in of the pipelines to the processing system.

The terminal buildings would be constructed simultaneously with the vaporization facilities. These facilities would be completed and ready to be placed in service prior to completion of tank construction.

2.3.2 Pipeline and Associated Aboveground Facilities

2.3.2.1 General Pipeline Construction Procedures

Before the start of construction, Cheniere would finalize surveys, locate the centerline and construction workspace, and complete land or easement acquisition as needed. If the necessary easements cannot be obtained through good faith negotiations with property owners, and the Commission has issued a Certificate for the Project to Cheniere, it may use the right of eminent domain granted under Section 7(h) of the NGA and the Rules of Civil Procedure to obtain easements.

Figure 2.3-2 shows the typical construction sequence used for an overland pipeline construction spread as summarized below.

Clearing and Grading

Initial clearing operations would include the removal of vegetation within the construction right-of-way and temporary construction workspace either by mechanical means (using equipment such as a brush hog) or hand-cutting. The right-of-way limits would be identified and flagged in the field prior to clearing. Flat grassy areas would be mowed. In upland areas, outside of the trenchline, woody vegetation would be removed at or near ground level, leaving the root systems intact to the extent possible. Brush and timber would be disposed of in various manners, including burning if allowed by appropriate agencies, or chipping, stockpiling at the edge of the right-of-way, or hauling off site, in accordance with the property owner's wishes.

During clearing, temporary gated fences would be installed where necessary for livestock control and security. Temporary entries of clean rock over geotextile fabric would be installed for access to the right-of-way from roads.

Following clearing, the construction right-of-way and additional temporary workspace would be rough graded as necessary to allow for safe passage of equipment and to prepare a relatively level work surface for pipeline construction. Bulldozers equipped with ripper and grading blades would perform grading activities. Closely following initial disturbance of the soil, erosion controls would be installed at the required locations (see section 4.2.1.4).

Trenching

The pipeline ditch would be excavated with either a wheel-trencher or a backhoe. Typically, the trench would be about seven feet deep (for a minimum of three feet of cover over the pipe) and about five feet wide. In agricultural areas where deep tilling is practiced, Cheniere would excavate a deeper trench to allow for at least four feet of cover over the pipeline. Topsoil would be segregated from subsoil, and windrowed on the spoil side of the construction right-of-way. Topsoiling is further discussed in section 4.2.1 of this EIS. Based on available data, no bedrock would be encountered within the trench depth and no blasting would be required to excavate the trench. Temporary barriers, know as "trench plugs," would be installed at certain distances within the ditch.

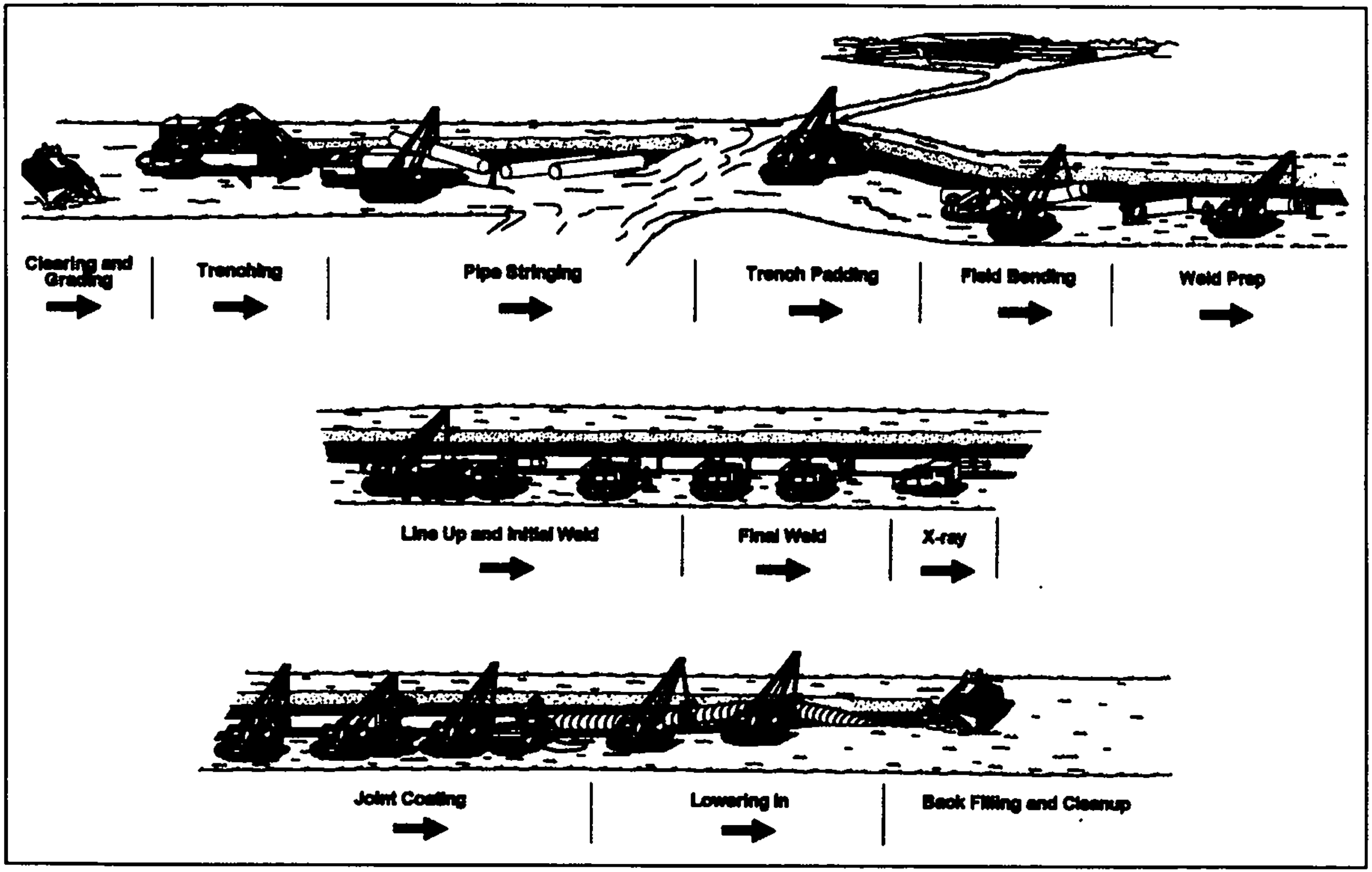


Figure 2.3-2
Cheniere Corpus Christi LNG Project
Typical Pipeline Construction Sequence

Pipe Stringing, Bending, and Welding

After trenching, the pipe would be strung along the right-of-way and placed up on wooden pedestals known as "skids." Pipe would be trucked to the right-of-way from the contractor yard at Odem, and off-loaded using side-booms. A hydraulic bending machine would be used in the field to bend individual sections of pipe where necessary to fit the contours of the trench. About 40-foot-long segments of pipe, known as "joints," would be welded together. All welds would be x-rayed to ensure structural integrity and compliance with the requirements established by the DOT and the API Standard 1104.

Lowering-In and Backfilling

The trench would be dewatered, cleaned of debris, and padded as necessary before the pipeline is lowered into the trench. Cheniere's construction contractor would use a padding machine to dump rock-free subsoil or sand (but not topsoil) into the bottom of the trench. Side-booms would be used to lower in the pipe. Permanent trench breakers would then be installed where necessary within the ditch, such as at the base of slopes. The trench would be backfilled first using stored subsoil, then the topsoil. Excess rock would be removed from the top 12 inches of topsoil. Heavy equipment would be used to compact the backfill, and a crown of soil would be left over the pipeline to account for settling. After the trench is backfilled, the pipeline would be cleaned of any internal dirt, water, or debris by pipeline "pigs"[4] that are propelled through the pipeline by air pressure.

Hydrostatic Testing

After backfill and cleaning, the pipeline would be hydrostatically tested in two segments, using approximately 11.4 million gallons of water for each segment. The water would be obtained from the San Patricio Municipal Water District, stored temporarily in tanks, and then pumped into the pipeline at a rate of approximately 5,000 gpm. After completing the hydrostatic test, the water would be discharged into the Sherwin raw water reservoir located to the north of the beginning of the pipeline at MP 0.0. Hydrostatic testing is also addressed in section 4.3.2.3 of this EIS.

Cleanup and Restoration

Following backfilling, all work areas would be final-graded and restored to preconstruction contours as closely as possible. Prior to final grading, all construction debris would be picked up along the right-of-way. Permanent erosion control structures, such as slope breakers, would be installed during final grading, in accordance with the FERC Plan. Our Plan requires that restoration be completed within 20 days after backfilling, unless prevented by inclement weather conditions. Private property such as fences, field roads, and driveways would be restored or repaired as necessary.

Revegetation would be accomplished by seeding disturbed areas in accordance with the recommendations of the local office of the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) or as requested by the landowner. Seeding would not be required

[4] Pigs are tools that are used inside the pipeline for cleaning and inspecting the pipe.

in active cultivated croplands, unless specifically requested by the landowner. Revegetation is further discussed in section 4.4.2 of this EIS.

2.3.2.2 Special Pipeline Construction Techniques

Utility, Road, and Railroad Crossings

Prior to construction, Cheniere would contact the local "One Call" or "Call Before You Dig" system to determine the location of utilities to be crossed. These utility crossings would then be marked in the field during pre-construction surveys.

Railroads and paved roads would be bored. Pits would be excavated on both sides of the road or railroad at the depth of the ditch. A boring machine uses an auger to drill a tunnel under the road or railroad, wide enough for the pipeline and casing to be pulled through. Unpaved county roads (CRs) would be open-cut. During the cut, usually one lane of traffic would be left open. Steel plates may be used to cover the open trench.

Utility, road, and railroad crossings would be done according to applicable permits. Local authorities would be kept appraised of the timing of such crossings.

Agricultural Areas

Cheniere estimates that about 83 percent of the pipeline route is agricultural land. After consulting with the NRCS, Cheniere has agreed not to segregate topsoil deeper than 18 inches in agricultural areas of Victoria clay and Raymondville clay loams, accounting for about 12.8 miles along the pipeline route, to avoid mixing in subsoil. In three agricultural areas, where the soils are deep plowed, totaling 18.7 miles, Cheniere has agreed to bury its pipeline at least 4 feet deep. Cheniere has not identified any drainage tiles that would be crossed by the pipeline. Some ditches would be crossed that are used primarily for drainage. These ditches would be open-cut, with one exception; the drainage at MP 10.1 would be bored.

Wetlands and Waterbodies

Cheniere has requested a variance from the FERC's Procedures so that it could use a 100-foot-wide construction right-of-way for its pipeline crossing of three wetlands. Cheniere has provided site-specific justification and plan drawings for the three wetlands. We have reviewed the site-specific justification for a wider construction right-of-way across these three wetlands and agree with Cheniere's variance request. Given the size of the pipeline, a minimum depth of 8.5 feet would be necessary in wetlands. A 6-inch-thick concrete coating would be applied to the pipeline for negative buoyancy. Spoil excavated from the trench would be stored inside of sediment barriers. For conventional wetland crossings, Cheniere would segregate the top 12 inches of topsoil. When crossing saturated wetlands, Cheniere may stabilize the travel lane using timber riprap, prefabricated mats, or gravel over geotextile fabric. A more detailed discussion of wetland construction can be found in section 4.4.1 of this EIS.

Cheniere also requested a variance from the FERC Procedures so that waterbodies along the pipeline route could be crossed between March 1 and August 31. According to Cheniere, March is the month with the average least rainfall in the Corpus Christi vicinity. Section 4.3.2.2 of this EIS presents more detailed information about the crossing of waterbodies.

2.3.2.3 Aboveground Facility Construction Procedures

Aboveground facilities that would be constructed as part of the project include meter stations, mainline valves, pig launcher, and pig receiver. Locations of proposed aboveground facilities are shown on figure B-1 in appendix B. Construction of the meter stations would involve clearing and grading, where necessary, for placement of the facilities, piping, and structures. The sites would be cleared of trees, brush, and debris; graded and compacted to surveyed elevations; and covered with gravel or paved. Although site-specific designs have not been finalized, the meter stations would typically include two one-story buildings, and be surrounded by a chain-link fence. Meter run piping would be located outside the buildings.

Pigging facilities would be located within the LNG meter station at the beginning of the pipeline (MP 0.0) and the Tennessee Gas meter station at the end (MP 23.0). These meter stations would also house MLVs. Another MLV would be located at MP 10.2, and would be fenced. The valves would be installed below ground, with a stem that would extend about three feet above ground. The MLVs would be remotely monitored and controlled.

2.4 CONSTRUCTION SCHEDULE

Cheniere wants to have the Project in operation by about November 2007. It should take a total of about three years to construct the entire Project. Cheniere estimates that it would take about one year for removal and relocation of the existing pipelines within the proposed LNG terminal, which would be the fist task undertaken after authorization for the Project is received. The dredging of the marine basin also would begin at that time, and is estimated to take about nine months to complete. Dock construction would begin concurrently and is estimated to take about two years to complete, including the installation of LNG unloading equipment. About nine months after construction of the Project would begin, the foundations for the LNG storage tanks would be laid over about a five-month period. Finishing tank construction would take about two additional years. At about the same time as the foundation work on the tanks begin, the foundations for the vaporization, processing, and sendout systems would be laid, requiring about 13 months. Once the foundations are finished, an additional 25 months would be necessary to complete construction of the process area. The last task for the terminal would be the installation of connecting pipelines, which would take about seven months to complete.

It would take a total of about 6 months to construct the entire 23-mile-long, 48-inch-diameter pipeline and associated aboveground facilities, from initial clearing through final restoration. Therefore, pipeline and meter station construction would not begin until about the same time as the connecting pipelines at the LNG terminal. The pipeline would be built as one spread. A separate construction crew would build the meter stations.

2.5 ENVIRONMENTAL COMPLIANCE AND MONITORING

Cheniere would implement environmental compliance and monitoring requirements from the FERC's Plan and Procedures during construction of the LNG terminal and pipeline. Cheniere would also incorporate compliance and monitoring requirements from Federal, state, and local permits obtained for the Project.

In accordance with the FERC's Plan and Procedures, Cheniere would conduct environmental training for construction and contractor personnel before construction and periodically during construction. Cheniere would employ at least one environmental inspector for construction of the LNG terminal, at least one environmental inspector for the pipeline, and another environmental inspector to monitor construction of the meter stations, which is considered a separate spread. The environmental inspectors would be responsible for monitoring construction activities for compliance with the conditions of the FERC Certificate, and all other applicable Federal, state, and local permits. The environmental inspectors would have independent status, but would report to Cheniere's Chief Inspector, and would have stop-work authority in the event of a noncompliance issue that requires corrective action.

In addition, the FERC would have its own independent environmental inspectors monitor the Project for compliance with the Commission's environmental conditions.

2.6 OPERATION AND MAINTENANCE

Cheniere would incorporate post-construction environmental requirements into an *Operation and Maintenance Plan* and an *Emergency Plan and Procedures* for the Project.

2.6.1 LNG Terminal Facilities

LNG ships would enter Corpus Christi Bay under the command of a local pilot who would decide whether the current and wind conditions allow safe entry to the Corpus Christi Ship Channel. The pilot would direct the maneuvering of the LNG ship in the bay using the Project-dedicated tugboats. The pilot would direct the securing of the lines and would turn the command back to the captain when the ship is secured at the LNG terminal docks.

The LNG unloading arms would be coupled to the ship manifolds by shore-side operators. A ship-to-shore cable would connect the ship-based and shore-based instrument control systems. The emergency shutdown system would be tested and safety checks would be performed before unloading begins. During unloading, the ship's manifold would be visually monitored from on deck and by two video cameras.

The shore-side operators would open the required valves after performing the required safety checks and procedures so that the LNG tanks are ready to receive the LNG. The ship operator would then start the in-tank pumps on the ship. The BOG blower would return cold LNG vapors created during the unloading process to the ship through the vapor return arm to maintain a vapor balance within the ship's LNG tanks. During unloading, the ship's manifold is visually monitored by a ship operator on deck and by video cameras mounted on the dock that transmit pictures to the dock and the main control rooms.

LNG vaporization is not interrupted during the unloading operation. LNG can enter an LNG tank and be withdrawn at the same time. The control room operator verifies that the planned vaporization rate is maintained. LNG stored in the tanks would be pumped to the vaporizers using a series of in-tank and sendout pumps. The LNG would be vaporized in the SCVs and the resulting natural gas discharged into an approximate 2,000-foot-long piece of interior plant pipe that would connect the vaporization trains to the metering facility that would measure the total natural gas output of the LNG terminal.

Cheniere would train all operations and maintenance personnel at the terminal to properly and safely perform their assignments. The terminal operators would be trained in LNG safety, cryogenic operations, and the proper operation of all equipment. The operators would meet all the training requirements of the DOT, USCG, and other regulatory entities, including the minimum Federal safety standards specified in 49 CFR 192 and 193, and 33 CFR 127.

In accordance with 49 CFR Parts 193.2503 and 193.2605 and Sections 11.3.1 and 11.5.2 of NFPA 59A, Cheniere is required to prepare and submit manuals that address specific procedures for the safe operation and maintenance of the LNG storage and processing facilities to DOT for approval. These manuals would address startup, shutdown, cooldown, purging, and other routine operation, maintenance, and monitoring procedures. In accordance with 33 CFR Part 127.305, Cheniere also would prepare an operation manual that addresses specific procedures for the safe operation of the ship unloading facilities. These manuals would include training requirements and programs for operations and maintenance personnel.

Cheniere predicts that from 25,000 to 40,000 cubic yards per year of shoaling may be deposited into the LNG terminal maneuvering area and berths, which would require some maintenance dredging over time. Materials excavated during maintenance dredging would be deposited in DMPA 2 (Alcoa Facility 200). The COE would be responsible for maintenance dredging along the La Quinta Channel. Cheniere indicated it would coordinate its maintenance dredging with the COE and attempt to use the same dredging contractor at the same time that work is done in the La Quinta Channel.

Facility maintenance would be conducted in accordance with 49 CFR 193 Subpart G. The full-time terminal maintenance staff, consisting of approximately six to eight employees would conduct routine maintenance and minor overhauls. Major overhauls and other major maintenance would be handled by outside specialty contractors.

2.6.2 Pipeline and Associated Aboveground Facilities

Cheniere would operate and maintain the proposed facilities in accordance with the applicable safety standards established by the DOT Minimum Federal Safety Standards as specified in 49 CFR 192 and in accordance with the NGA. The pipeline would be patrolled from the air on a periodic basis. This patrol would provide information on possible leaks, encroachment into the right-of-way, third party construction activity near the pipeline, erosion, waterbody crossings, exposed pipe, or population density changes in the vicinity of the pipeline. Operation would also include monitoring of cathodic protection units (installed for corrosion control) along the pipeline to ensure proper functioning.

Maintenance activities would include regularly scheduled gas leak surveys, and measures necessary to repair any leaks. All fence posts, signs, marker posts, aerial markers, and decals would be painted or replaced as necessary to ensure the pipeline location remains visible from the air and ground. All valves would be periodically inspected and greased. Maintenance would also include periodic seasonal mowing of the permanent right-of-way, vegetation control around aboveground facilities, and the repair of terraces as necessary. Cheniere would not use herbicides or pesticides within 100 feet of a wetland or waterbody unless approved in appropriate permits.

The proposed aboveground facilities would be fully automated and would not be manned. The mainline valves would be remotely monitored and controlled from a central control facility.

2.7 SAFETY CONTROLS

2.7.1 LNG Terminal Facilities

The LNG terminal facilities would be sited, designed, constructed, operated, and maintained in compliance with Federal safety standards. Federal siting and design requirements for LNG terminal facilities are summarized in table 2.7.1-1.

TABLE 2.7.1-1

Federal Siting and Design Requirements for LNG Facilities

Requirement	Description
Thermal Radiation Protection (49 CFR Part 193.2057 and Section 2.2.3.2 of NFPA 59A)	This requirement is designed to ensure that certain public land uses and structures outside the LNG facility boundaries are protected in the event of an LNG fire.
Flammable Vapor-Gas Dispersion Protection (49 CFR Part 193.2059 and Sections 2.2.3.3 and 2.2.3.4 of NFPA 59A)	This requirement is designed to prevent a flammable vapor cloud associated with an LNG spill from reaching a property line of a property suitable for building.
Wind Forces (49 CFR Part 193.2067)	This requirement specifies that all facilities be designed to withstand wind forces of not less than 150 miles per hour without the loss of structural integrity.
Impounded Liquid (Section 2.2.3.8 of NFPA 59A)	This requirement specifies that liquids in spill impoundment basins cannot be closer than 50 feet from a property line of a property suitable for building or a navigable waterway.
Container Spacing (Section 2.2.4.1 of NFPA 59A)	This requirement specifies that LNG containers with capacities greater than 70,000 gallons must be located a minimum distance of 0.7 times the container diameter from the property line or buildings.
Vaporizer Spacing (Section 2.2.5.2 of NFPA 59A)	This requirement specifies that integral heated vaporizers must be located at least 100 feet from a property line of a property suitable for building and at least 50 feet from other select structures and equipment.
Process Equipment Spacing (Section 2.2.6.1 of NFPA 59A)	This requirement specifies that process equipment containing LNG or flammable gases must be located at least 50 feet from sources of ignition, a property line of a property suitable for building, control rooms, offices, shops, and other occupied structures.
Marine Transfer Spacing (33 CFR Part 127.105)	This requirement specifies that each LNG unloading flange must be located at least 985 feet from any bridge crossing a navigable waterway.

2.7.1.1 Spill Containment

The unloading arm platform on the docks would have concrete curbs to collect any inadvertent LNG spills during unloading. The surface of the docks would be sloped, and drainage would be through a LNG spill collection trough to a spill impoundment basin. This basin would be located along the transfer pipelines just north of the two berths, with a capacity of 70,628 cubic feet.

Any LNG accidentally spilled along the transfer pipelines would be collected by troughs under the pipelines. These troughs would drain to the spill impoundment basins. There would be another 20-foot-deep, 60-foot-square spill impoundment basin located between the LNG storage tanks and the vaporization system, with a capacity of 2,039 m^3 (538,597 gallons). Sump pumps would remove rainwater from the basins. The impoundment basins would be equipped with automatic level control activators and low-temperature sensors and switches to prevent operation of the pumps in the event of an accidental release of LNG to the basin. The spill rate from the transfer pipelines is not expected to exceed 12,00m^3/hour (52,834 gpm). Cheniere estimates that leakage from one vaporizer inlet would produce a spill of about 347m^3/hour (1,527 gpm). LNG leaking from the BOG condenser could result in a spill of about 5,218 m^3/hour (22,973 gpm).

Each of the LNG storage tanks would be surrounded by an earthen dike sized to contain 110 percent of the tank volume. The top of the dikes would be approximately +46 feet above msl with the impoundment interior floor at +25 above msl. The impoundment dikes would each be about 520 feet square on the interior bottom edge and 604 feet square if measured from the top inside edge.

2.7.1.2 Hazard Detection System

The LNG terminal would have a monitoring system able to detect low-temperature LNG spills, release of gas, and fire. There would be both audible and visual alarms. All monitors would be hardwired into a control room. The control room would also contain closed-circuit television, providing panoramic views of the jetty and processing areas. An independent safety instrumented system (SIS) would allow for sequential shutdown and isolation of equipment.

2.7.1.3 Fire Protection System

The main components of the fire protection system at the LNG terminal include:

- two 500,000 gallon water tanks;
- two firewater pumps (one driven by an electric motor and the other driven by a diesel engine), each designed to provide 4,500 gpm at 150 psi;
- an electric motor driven jockey pump, designed to provide 10 gpm at 125 psi;
- an electric motor driven firewater booster pump;
- 37 fire monitors, of which 13 are elevated, and 6 are remote controlled;
- 18 fire hydrants;
- hose reels and firewater piping;
- nitrogen snuffing at the tailpipe of each LNG storage tank;
- a portable high expansion foam injection trailer;
- 50 hand-held portable fire extinguishers; and
- a sprinkler system for all administrative and warehouse buildings.

In addition, the two tugs at the marine terminal would contain firewater pumping equipment. Water for the firewater tanks would be obtained from the municipal water district.

Nitrogen for LNG Tank Relief Valves

Nitrogen snuffing would be provided at the tailpipe of each LNG storage tank pressure relief valve. This would enable a fire in the relief valve discharge piping to be extinguished. The nitrogen piping for the relief valve tailpipe purging would be located along the side of the tank and terminated with a valve in a safe location at grade.

High Expansion Foam System

Cheniere would provide a portable foam injection trailer for the facility. This high expansion foam system would be self powered, so no electrical power would be required. The system would have a carbon steel foam solution storage tank, two high expansion foam generators, and all other necessary accessories for proper operation. The system would have the ability to flood a 60-foot by 60-foot impoundment basin with foam to a depth of six feet within one minute. Connections would be provided to the firewater system for use with this foam system.

Vent Systems

Natural gas may be vented to the atmosphere, should a facility upset occur. Pressure relief valves located on top of the storage tanks would discharge directly to the atmosphere. Additionally, two vent stacks would be provided to vent high-pressure and low-pressure natural gas released under emergency conditions. BOG may be temporarily vented to the low-pressure vent stack when the vapor handling system capacity is exceeded during upsets such as equipment malfunction or power failure. Relief valves with a set pressure less than 75 psig and maintenance vents would discharge to this low-pressure stack. Relief valves with a set pressure greater than 75 psig would discharge to the high-pressure vent stack. Both vent systems would be swept continuously with nitrogen gas to prevent flammable conditions within the piping. The facility is designed such that no venting would occur during normal operating conditions.

Emergency Shutdown System

The emergency shutdown system would consist of separate shutdown sequences, which would either be manually initiated by push buttons or automatically initiated. The system would be designed to allow for areas of the terminal to be shut down, without necessarily shutting down the entire terminal. Three levels of shutdown would be configured for the LNG terminal.

Level 1 (LNG Ship Unloading Shutdown) – Can be initiated manually or automatically by local instrumentation, storage tank high-high liquid level, storage tank high pressure, or by the LNG ship. Level 1 shutdown would include LNG ship transfer pump stoppage in a safe and controlled manner without disconnecting the LNG transfer arms. LNG ship transfer pump stoppage can be activated by either the ship's own shutdown system or by the facility's overall SIS shutdown system.

Level 2 (LNG Ship Unloading Shutdown) – Can be initiated manually, by the LNG ship, or by unloading arm operating parameters that exceed safe operating limits. All shutdowns described for Level 1 above would occur, plus the PERCs on the unloading arms would release.

Level 3 (SCV Train Shutdown) – This shutdown may be initiated manually and initiates a shutdown and isolation of all SCV trains. LNG ship unloading is unaffected by the SCV Level 3 shutdown.

A partial facility shutdown may be initiated by activating either Level 1, 2, or 3 pushbuttons in response to a major incident such as fire, vapor, or liquid release. A total facility emergency shutdown can only be initiated in the control room by activating all three level pushbuttons. Upon activation of the total facility shutdown, the SIS would shut down sequentially and isolate the terminal equipment, including stopping LNG ship unloading and disconnecting the unloading arms from the LNG ship.

2.7.2 Pipeline and Associated Aboveground Facilities

2.7.2.1 Corrosion Protection and Detection Systems

During construction of the proposed facilities, Cheniere would install a cathodic protection system to prevent or minimize corrosion of the buried pipeline and aboveground facilities. The cathodic protection system impresses a low-voltage current on the pipeline to offset natural soil and groundwater corrosion potential. The condition of the pipe coating and the effectiveness of the cathodic protection system would be monitored during regularly scheduled cathodic protection surveys in accordance with Federal standards and regulations. Cathodic protection surveys usually require walking the pipeline right-of-way with monitoring instruments. Repairs to the pipe, the pipe coating, or the cathodic protection system would be made as appropriate.

2.7.2.2 Emergency Response Procedures

The proposed pipeline and aboveground facilities must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR 192. The regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. Part 192 specifies material selection and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion. Part 192 also prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Under Section 192.615, each pipeline operator must also establish an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. Key elements of the plan include procedures for:

- receiving, identifying, and classifying emergency events, gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- making personnel, equipment, tools, and materials available at the scene of an emergency;
- protecting people first and then property, and making them safe from actual or potential hazards; and
- emergency shutdown of system and safe restoration of service.

Part 192 also requires that each operator must establish and maintain a liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency, and to coordinate mutual assistance. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials.

2.8 FUTURE PLANS AND ABANDONMENT

The Project as proposed includes no plans for future abandonment. However, Cheniere identified one possible future expansion for the LNG terminal: the addition of a fourth LNG storage tank, if warranted by additional demand for natural gas service. Such an addition would require a separate application to the FERC. Also, Cheniere's LNG terminal design as proposed does not include control equipment to remove components with a high Btu (heating value content) (*e.g.*, ethane, propane, butane), and Cheniere has stated that Btu control may be required depending on final selection of LNG sources, composition, and pipeline markets. The addition of Btu control equipment to the proposed project would require an amendment to the LNG terminal application.

2.9 NONJURISDICTIONAL FACILITIES

Under Section 3 of the NGA, the FERC considers all relevant factors bearing on the siting of LNG import terminals. Under Section 7 of the NGA, the FERC is required to consider, as part of a decision to certificate jurisdictional facilities, all facilities that are directly related to the Project where there is sufficient Federal control and responsibility to warrant environmental analysis as part of this jurisdictional proceeding. The jurisdictional facilities for the Cheniere Corpus Christi LNG Project include the proposed LNG terminal facilities and proposed new natural gas pipeline and its associated aboveground facilities. These are discussed in detail in this EIS.

Occasionally, proposed projects have associated facilities that do not come under the jurisdiction of the Commission. The following nonjurisdictional facilities or actions would be undertaken by parties other than Cheniere but would be directly associated with the Cheniere Corpus Christi LNG Project.

2.9.1 Electrical Transmission Line and Substation

Construction and operation of the Project would require electrical service to the site. Electrical service would be provided by a 1.6-mile-long, 138-kilovolt (kV) overhead electrical transmission line and substation. The transmission line would begin near the intersection of State Highways (SH) 35 and 361 north of the site, and extend south along the eastern side of La Quinta Road to the LNG terminal site. A new substation would be constructed along the transmission line about 0.4 mile north of the LNG terminal site. The transmission line and substation would be constructed by American Electric Power, Inc. (AEP). Because Cheniere would not require electrical service at the Project site until after a FERC decision on the Project, Cheniere has indicated that AEP has not yet applied for the required environmental permits or approvals for the electrical facilities.

Cheniere has provided information to FERC on the electrical substation and the 0.4-mile of electrical transmission line south of the substation, and these facilities are addressed in this EIS. In addition, for approximately 1,000 feet north of the substation the electric transmission line would be co-located with Cheniere's proposed sendout pipeline, and for this area studies and analysis conducted for the proposed pipeline also address the electric transmission line. Therefore, approximately 0.6 mile of the electric transmission line route is addressed directly or indirectly in this EIS.

For the approximately 1.0 mile of the nonjurisdictional electric line not addressed in this EIS, construction would affect approximately 12 acres of previously disturbed land classified as "wasteland" by the NRCS (NRCS, 2003). Current land use is industrial, and vegetation consists of roadside scrub. Although this portion of the electric transmission line route was not addressed during field surveys conducted by Cheniere, literature review and historic research for the project vicinity have not revealed any cultural resources or rare species in the vicinity of the electric transmission line route. We believe that construction of the nonjurisdictional electric transmission line would have no significant environmental impacts. However, we have included a recommendation below in section 2.9.4 to ensure that the facility would be in compliance with all necessary permits.

2.9.2 Potable Waterline

Operation of the Project would require potable water service to support office facilities. Water service would originate from an existing 24-inch-diameter San Patricio Municipal Water District waterline at the intersection of SH 35 and 361, and approximately 1.6 miles of buried potable waterline would be installed along the same route as the electric transmission line (see above). Because Cheniere would not require potable water service at the Project site until after a FERC decision on the Project, Cheniere has indicated that the San Patricio Municipal Water District has not yet applied for the required environmental permits or approvals for the waterline.

The potable waterline would be co-located within the same right-of-way as the AEP electric transmission line described above. Therefore, impacts of the water line would be the same as described above for the nonjurisdictional electric transmission line.

2.9.3 Existing Natural Gas Pipelines

Three existing natural gas pipelines would have to be abandoned in place, removed, and/or relocated to allow for construction of the proposed marine basin and LNG terminal. The existing pipelines and proposed relocations are shown on figure 2.9-1. Cheniere has indicated it is still in the process of negotiating the timing and scope of the relocation, abandonment, or removal of these pipelines and therefore a proposed plan has not been finalized. The plans described below were presented in Cheniere's application as the conceptual plans for treatment of these nonjurisdictional pipelines.

Non-Internet Public

Page 2-33
Map

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

Gulf South Pipeline Company

Two segments of a 6-inch-diameter Gulf South natural gas pipeline would be affected by the Project. A 0.5-mile-long segment of the pipeline crosses the area proposed for the LNG storage tanks. This segment would be abandoned in place, and a 0.4-mile replacement segment would be relocated by Gulf South approximately 500 feet east of its current location. The rerouted pipeline would be within industrial land within the Sherwin plant property. A 0.26-mile-long segment of the pipeline crosses the area on the southern portion of the site proposed for dredged material disposal. This segment would also be abandoned in place prior to the start of LNG terminal construction. Following placement of dredged material in this area, a replacement segment of pipeline would be reinstalled by Gulf South within the same right-of-way. Cheniere stated in its application that if portions of the abandoned segments of pipeline are encountered by Cheniere's construction contractor during LNG site preparation, the contractor would remove the abandoned pipeline as needed.

Potential environmental impacts of removal, relocation, or abandonment of the segments of the Gulf South Pipeline that are within the limits of the proposed LNG terminal are addressed in this EIS as a result of our analysis of the proposed LNG terminal. About 0.4 mile of the relocated Gulf South pipeline would be outside of the area directly addressed by this EIS. We estimate that construction of the relocated pipeline would disturb about 2.5 acres, all of which would be industrial lands within the existing Sherwin plant. We believe there would be no significant environmental impact associated with the relocation of the Gulf South pipeline.

Crosstex Corpus Christi Natural Gas Transmission

Two segments of a 10-inch-diameter Crosstex Corpus Christi Natural Gas Transmission (Crosstex) natural gas pipeline would be affected by the Project. A 0.1-mile segment of the pipeline crosses the southeastern corner of the area proposed for the LNG storage tanks. Cheniere has indicated that the segment would be relocated slightly to the south and east within industrial land within the Sherwin plant property. A 0.2-mile segment of Crosstex pipeline crosses under the proposed La Quinta Channel extension and berthing area. This portion of pipeline would be removed by Crosstex prior to dredging for the marine basin, relocated to the eastern edge of the project boundary, and buried to a depth of 65 feet to provide clearance from dredging activities. Crosstex would be required to relocate this segment of pipeline for the planned La Quinta Channel extension, whether or not Cheniere's proposed project is constructed.

The affected onshore segment of the Crosstex pipeline would be within industrial land immediately adjacent to the LNG terminal site, and impacts from the relocation of this pipeline are essentially addressed within this EIS. The majority of the 0.2-mile segment of offshore pipeline overlaps the area that Cheniere would dredge for the marine basin. Relocation of this segment of pipeline would affect similar resources, but in a much smaller area, as the proposed marine basin.

Royal Production Company

The Royal Production Company (Royal) has a 6-inch-diameter natural gas pipeline that extends from an offshore well in Corpus Christi Bay to the proposed LNG terminal site, and a tank battery and processing area and a 4-inch tie-in line also on the proposed site. Royal has informed Cheniere that the cost of rerouting the pipeline and tank battery would exceed the value of the well. Royal proposes to prematurely shut-in the well and accept reimbursement from Cheniere for the premature closure. A 0.6-mile segment of the offshore pipeline that runs under the proposed marine basin and the aboveground facilities on the proposed LNG terminal site would be removed by Royal prior to the proposed terminal construction and dredging.

Nearly the entire segment of Royal pipeline that would be removed would overlap the area affected by Cheniere's proposed marine basin. Therefore, impacts from removal of the Royal pipeline are essentially addressed in this EIS.

2.9.4 Summary of Nonjurisdictional Facilities

Based on our review of information provided by Cheniere on the nonjurisdictional facilities discussed above, and our site review of the general location where these facilities would be located, we believe environmental impact associated with these nonjurisdictional facilities would be minimal. However, to ensure that potential issues are adequately addressed, we recommend that:

- **Cheniere should file with the Secretary <u>prior to construction</u> the following information on nonjurisdictional facilities, including the AEP transmission line and substation, San Patricio Municipal Water District pipeline, and three existing natural gas pipelines and associated aboveground facilities:**

    a. **documentation of consultations with the appropriate agencies and the status of Federal, state, or local permits or approvals required for their construction, abandonment, removal, or relocation. Consultations should address handling and removal of potential hazardous substances during facility removal; and**

    b. **status and copies of any surveys and reports prepared for waterbodies, wetlands, threatened and endangered species, and cultural resources.**

3.0 ALTERNATIVES

We have evaluated a number of alternatives to the Cheniere Corpus Christi LNG Project to determine if any would be reasonable and environmentally preferable to the proposed action. Alternatives discussed below include the no action or postponed action alternative, LNG terminal system and site alternatives, dredged material disposal site alternatives, and pipeline system and route alternatives.

The evaluation criteria for selecting potentially reasonable and environmentally preferable alternatives include whether they:

- are technically and economically feasible and practical;
- offer significant environmental advantage over the proposed Project or segments of it; and
- meet the project objectives of providing facilities necessary to import, store, and vaporize LNG and deliver natural gas into the existing interstate and intrastate natural gas pipeline system in the Corpus Christi, Texas area.

With respect to the first criteria, it is important to recognize that not all conceivable alternatives are technically and economically practical and feasible. Some alternatives may be impracticable because they are unavailable and/or incapable of being implemented after taking into consideration costs, existing technologies, constraints of existing system capacities, and logistics in light of the overall project objectives. In conducting a reasonable analysis, it is also important to consider the environmental advantages and disadvantages of the proposed action and to focus the analysis on those alternatives that may reduce impacts and/or offer a significant environmental advantage.

Through the application of evaluation criteria and subsequent environmental comparisons, each alternative was considered until it was clear that the alternative was not reasonable or would result in significantly greater environmental impacts that could not be readily mitigated. Those alternatives that appeared to be the most reasonable with less than or similar levels of environmental impact are reviewed below.

3.1 NO ACTION OR POSTPONED ACTION ALTERNATIVE

The Commission has three courses of action in processing an application. It may: (1) deny the proposal, (2) postpone action pending further study, or (3) authorize the proposal with or without conditions.

If the Commission denies the proposal (the no action alternative), the short- and long-term environmental impacts identified in section 4 of this EIS would not occur. If the Commission postpones action on the application, the environmental impacts identified in section 4 of this EIS would be delayed, or if the applicant decided not to pursue the project, the impacts would not occur at all. If the Commission selects the no action alternative, however, the objectives of the proposed Project would not be met and Cheniere would not be able to provide a new source of natural gas supply to markets that can be accessed through the proposed interconnections with the interstate natural gas pipeline grid. Should Cheniere's proposed Project, along with other proposed LNG projects be delayed by a period of two years, the Energy and Environmental Analysis Foundation, Inc. (EEA) study completed in July 2004 for the Interstate Natural Gas Association of America (INGAA) determined that U.S. gas consumers would pay an extra $200 billion (in constant 2003 dollars) by 2020 (INGAA, 2004).

It is purely speculative to predict the reactions of potential end users of the natural gas that would have been supplied by the Project, and the direct or indirect environmental impacts related to their actions, if the Commission selects the no action alternative. Because the demand for natural gas in the U.S. is projected to increase from approximately 22 trillion cubic feet per year (tcf/yr) currently to approximately 30 tcf/yr. In 2020, potential end users may have fewer and more expensive options for obtaining natural gas from traditional supply sources.

The National Petroleum Council's (NPC) September 2003 publication, Balancing Natural Gas Policy, determined that traditional North American producing areas will provide 75 percent of long-term U.S. gas needs, but will be unable to meet projected demand. The NPC study found that the overall level of indigenous production will be dependent on industry's ability to increase its production of nonconventional gas – gas from tight formations, shales, and coal-bed methane. The NPC study determined that LNG imports and arctic gas (from Alaska's North Slope and Canada's Mackenzie Delta) could meet up to 20 to 25 percent of U.S. demand by 2025. The report concluded that nine new LNG terminals and nine terminal expansions will be needed that could provide up to 15 bcf/day or 17 percent of U.S. natural gas supply by 2025. Cheniere could be one of the nine projected LNG terminals.

Additionally, the no action alternative would circumvent the desires of the U.S. Senate Committee on Environment and Public Works. Committee Chairman, Senator James M. Inhofe of Oklahoma, announced the Committee's support of the Project in his June 14, 2004 letter to the FERC Chairman Patrick Wood, III. Chairman Inhofe cites a March 24, 2004 hearing conducted by the Committee that found that increasing natural gas costs undermine domestic U.S. manufacturers' ability to compete in the international market place, and that high natural gas prices have caused the mothballing of several plants that have sent thousands of high paying jobs overseas. His letter of the Committee's support included additional letters of support for the Project from Texas Governor Rick Perry, Gene Seaman from District 32 of the Texas House of Representatives, Mayor Samuel L. Neal, Jr., of the City of Corpus Christi, Executive Director John P. LaRue of the Port of Corpus Christi, and Patricia H. Souter, Chair of the Coastal Bend Chapter of the Sierra Club. Clearly, the Project is strongly supported at the local, state, and Federal levels.

Should the no action alternative be adopted, potential customers could select other available energy alternatives, such as oil or coal, to compensate for the reduced availability of natural gas. However, increased use of fossil fuels such as oil or coal would generally result in higher emissions rates of nitrogen oxide (NO_X) and sulfur dioxide (SO_2) than would be the case with natural gas. To comply with current air emission regulations, emission control technologies could be required that could limit the economic viability of projects using alternative fuels. Conversely, potential customers may choose renewable sources of energy such, such as wind or solar energy. However, at this time it is unclear if it is technologically achievable to use wind or solar energy to produce the amount of energy that the Project is capable of providing through the importation of LNG, or what the costs would be of an equivalent project using renewable energy sources. Lastly, it is possible that energy conservation in the future could lessen the need for additional supplies of natural gas.

3.2 SYSTEM ALTERNATIVES

3.2.1 Onshore LNG Terminal System Alternatives

Our analysis of system alternatives considers using existing, recently authorized, or currently proposed but not yet authorized LNG import and storage facilities located in the continental U.S. to replace all or part of the proposed Cheniere Corpus Christi LNG Project. As discussed previously (see section 1.1.2), currently, there are four existing LNG import terminals that provide unloading, storage, and delivery services in the U.S. These facilities are operated by Trunkline LNG Company, L.L.C. (Trunkline, at Lake Charles, Louisiana); Southern LNG Inc. (Southern, at Elba Island, Georgia); Cove Point LNG, L.P. (Cove Point, in Calvert County, Maryland); and Distrigas of Massachusetts Corporation (Distrigas, at Everett, Massachusetts). The Cove Point LNG terminal is currently being expanded, and Cove Point is considering filing another expansion proposal in the near future. Likewise, Trunkline recently filed a proposal to expand its LNG facilities.

The Commission has recently approved two new LNG import terminal projects in the continental U.S. On September 11, 2003, the FERC authorized an LNG import terminal located near Hackberry, Louisiana, to be constructed and operated by Cameron LNG L.L.C. (Cameron, formerly Hackberry LNG). On June 18, 2004, the FERC authorized an LNG import terminal located in Brazoria County, Texas, to be developed by Freeport LNG Development, L.P. (Freeport, which is partly owned by Cheniere). Both the Cameron and Freeport LNG terminals are scheduled to be in operation during the same timeframe as the Cheniere Corpus Christi LNG Project.

In addition, there are nine other proposed LNG import terminal projects located in the continental U.S. that are currently being analyzed by the FERC staff. These include Weaver's Cove in Fall River, Massachusetts; Cheniere Sabine Pass in Louisiana; Sound Energy Solutions in Long Beach, California; Keyspan in Providence, Rhode Island; ExxonMobil Golden Pass in Louisiana; BP Crown Landing near Philadelphia, Pennsylvania; ExxonMobil Vista del Sol near Corpus Christi, Texas; Occidental Ingleside Energy Center near Corpus Christi Texas; and Sempra near Port Arthur, Texas. Weaver's Cove, Cheniere Sabine Pass, Sound Energy Solutions, Keyspan, ExxonMobil Vista del Sol, Occidental Ingleside Energy, BP Crown Landing, and ExxonMobil Golden Pass are filed applications before the FERC. Sempra is a pre-filing proposal. Of those onshore projects that are approved or proposed before the FERC, nine are located on the Gulf of Mexico (table 3.2-1.)

We considered whether any of the existing, recently authorized, or currently proposed LNG import terminal projects in the U.S. could be reasonable system alternatives to the Cheniere Corpus Christi LNG Project. To be considered a viable system alternative the existing or approved project would need to provide similar LNG ship unloading, storage, and sendout capacities to Cheniere's proposal, in addition to that terminal's current or planned expansion capacities. Also, the facilities would need to be in a location with access to both Texas intrastate natural gas pipelines and to interstate natural gas markets.

TABLE 3.2-1

Summary of Environmental Characteristics of Proposed or Approved Onshore and Offshore LNG Terminal Facilities in the Gulf of Mexico

	Property Size (acres)	Site Size (acres)	Existing Land Use	Adjacent Land Use a/	Wetlands Temporarily Affected within LNG Terminal Site (acres)	Wetlands Permanently Affected within LNG Terminal Site (acres)	Dredging Required (mcy)	Associated Nonjurisdictional Facilities	Residences within 0.5 mile of Property Line (number)	Onshore Sendout Pipeline (miles)	Offshore Sendout Pipeline (miles)
ONSHORE LNG TERMINALS											
Sabine Pass, TX/LA:											
Cheniere Sabine	568	236.6	DMPA	DMPA, O	56.5	47.7	4.5	None	0	16	NA
Golden Pass	477	205	DMPA	DMPA, O	1.4	40.2	5.7	10 miles power	17	122.5 b/	NA
Sempra Port Arthur	540	250	DMPA	DMPA, O	NA	NA	NA	23 miles power 3 miles highway relocation	0	73	NA
Calcasieu Lake, LA:											
Trunkline	395	125	I	I, A, R	None	None	0.07	None	3	22.8	NA
Cameron	118.6	100.8	I	I, F, O	67.7	55	2.1	None	0	35.4	NA
Quintana Island, TX:											
Freeport	188	120	O, C/I, P	O, C/I, R, P	22.5	46.9	2.2	2-4 miles power	9	9.6	NA
Corpus Christi, TX:											
Vista del Sol	311	288	A, I	I	24.7	24.7	5.8	0.08-mile power Onsite water 0.03-mile interconnects	0	27	NA
Ingleside Energy	1196	82	I	I	0	4.5	3.7	.	0	26	NA
Cheniere Corpus Christi	772	366	I	I	12.4	10.7	4.4	1.6-mile power 1.6-mile water 0.7-mile natural gas pipeline relocation	0	23	NA
OFFSHORE LNG TERMINALS											
Excelerate	NA	0	W	W	NA	NA	NA	NA	NA		5.3
Port Pelican	NA	c/	W	W	NA	NA	NA	NA	NA		42.6
Gulf Landing	NA	12.6 c/	W	W	NA	NA	NA	NA	NA		75.6
Compass Port	NA	31 c/	W	W	NA	NA	NA	NA	NA	5	27
Pearl Crossing	NA	4 c/	W	W	NA	NA	NA	NA	NA	65	106
Freeport-McMoRan	NA	0	W	W	NA	NA	NA	NA	NA	5.1	192

a/ DMPA = Former Dredged Material Placement Area; O = Open; C = Commercial; I = Industrial; F = Forest; A = Agriculture, R = Residential; W = Water, P= Park
b/ Total includes 42.8 miles of looping.
c/ Does not include land impacts associated with construction of the GBSs.

3.2.1.1 Existing or Approved Onshore LNG Terminals

The Distrigas LNG terminal in Massachusetts, the Cove Point LNG terminal in Maryland, and the Southern LNG terminal in Georgia are not reasonable alternatives to the proposed Cheniere Corpus Christi LNG Project. None of these three facilities has the capacity or the space to add the capacity necessary to receive the additional storage and delivery volumes proposed by Cheniere. In addition, all of these facilities are on the East Coast, so that transportation of natural gas from these LNG import terminals to Texas would require either major construction of new pipeline facilities or restructuring of existing infrastructure. Therefore, we will do no further analysis of these three LNG terminals as system alternatives to the Cheniere Corpus Christi LNG Project.

Trunkline

Currently, the largest operational LNG terminal import facility in the U.S. is located in Calcasieu Parish, Louisiana, owned by Southern Union and operated by Trunkline. The Commission approved an expansion of the Trunkline LNG terminal on December 18, 2002. The expansion project, as amended, includes adding a second berth, a new 880,000-barrel LNG storage tank (in addition to the three existing 600,000-barrel storage tanks), three additional first stage pumps, four additional second stage pumps, three additional vaporizers, and appurtenant facilities. Expansion of these facilities would increase the sustainable sendout capacity to about 1.2 bcfd and would increase LNG ship volume from 62 ships per year to about 175 ships per year. In February 2004, applications were filed to further amend the expansion project to increase sendout capacity.

Trunkline currently has signed agreements for the capacity that would be provided by the expanded facilities. After the expansion work is completed, the Trunkline LNG terminal would not have adequate space within its 125-acre fenced site necessary to accommodate storage tanks and sendout facilities that would be required to add the capacity proposed by the Cheniere Corpus Christi LNG Project. Further expansion outside of the existing fenceline is limited by other industrial facilities. In addition, Trunkline does not connect with the Texas intrastate market.

Cameron

The Cameron LNG import terminal, to be located on the Calcasieu River (ship channel) near Hackberry, Louisiana, would consist of a ship unloading slip with two LNG ship berths; three 1,006,000-barrel LNG storage tanks; nine first stage pumps; 10 second stage pumps; 12 SCVs; a BOG compressor and condensing system; a natural gas liquids recovery unit; ancillary facilities; and a 35.4-mile-long, 36-inch-diameter natural gas sendout pipeline. The marine terminal would have the capability of unloading up to 210 LNG ships per year. The proposed facilities would transport up to 1,500,000 dekatherms (dth) per day (approximately 1.5 bcfd) of imported natural gas.

The Cameron location has been optimized to provide sufficient space for the proposed LNG terminal facilities while minimizing the filling of on-site wetlands. Consequently, there is not sufficient buildable area for the additional storage tanks and other related facilities that would be needed to increase the proposed throughput of the terminal to meet the additional capacity of the

Cheniere Corpus Christi LNG Project without similar or greater impacts on wetlands. The design of the Cameron 36-inch-diameter natural gas pipeline was also optimized to handle the output of the originally proposed terminal and does not have sufficient excess capacity to support additional volumes of gas. We anticipate that expansion of the proposed pipeline or looping would be required to add significant volumes equivalent to those proposed by the Cheniere Corpus Christi LNG Project. These activities would result in additional environmental impacts. According to Cheniere, the Cameron/Hackberry project would provide only 60 percent of the regasification capacity of the proposed Project for 40 percent more cost than the Cheniere Corpus Christi LNG Project. In addition, the Cameron project does not directly connect to Texas intrastate pipelines.

Freeport

The recently authorized Freeport LNG import terminal would be located on Quintana Island, outside of the city of Freeport, Texas, about 188 miles northeast from Corpus Christi. The project would consist of a single LNG ship berth capable of unloading up to 200 LNG ships per year; two transfer lines and a vapor return line; two LNG storage tanks with a combined volume of 2,012,000 barrels; six in-tank pumps; seven booster pumps; three BOG compressors and a gas condensing system; six vaporizers; and an associated 9.6-mile-long, 36-inch-diameter natural gas pipeline with a nominal output of 1.5 bcfd. The Freeport LNG terminal would occupy about 120 acres, and disturb about 69 acres of coastal marsh.

The Freeport LNG terminal project cannot be considered a viable system alternative to the Cheniere Corpus Christi LNG Project. First, Freeport does not provide access to the interstate natural gas pipeline network. It is designed to only serve the Texas intrastate market. Second, all of Freeport's capacity is subscribed through binding agreements with customers. Thus, Freeport could not handle the additional volumes proposed for the Cheniere Corpus Christi LNG Project, and could not meet the Project objective of providing new supplies of imported natural gas to the U.S. interstate pipeline market.

3.2.1.2 Proposed Onshore LNG Terminals Under Review

Of the nine proposed LNG import terminal projects before the FERC, the Weaver's Cove Project in Massachusetts (Docket Nos. CP04-36 and CP04-41), Keyspan Project in Rhode Island (Docket No. CP04-223), Crown Landing Project in Pennsylvania (Docket No. CP04-411), and Sound Energy Solutions terminal in California (Docket No. CP04-58) are not reasonable alternatives to the proposed Cheniere Corpus Christi LNG Project given their locations. They are too far away to serve markets in Texas. The five other proposed onshore LNG terminal projects along the Gulf Coast would have the potential for serving Texas markets, and are summarized in table 3.2.1.2-1 and briefly described below.

TABLE 3.2.1.2-1

Proposed Onshore LNG Facilities Under Review in Texas and Louisiana

Operator	Project	County, State	Capacity (bcfd)
Golden Pass LNG LP	Golden Pass LNG Project	Jefferson, TX	1.0 to 2.6
Sempra Energy LNG	Port Arthur LNG Project	Jefferson, TX	1.5 to 3.0
Vista del Sol LNG Terminal LP	Vista del Sol LNG Project	San Patricio, TX	1.0
Ingleside Energy Center LLC	Ingleside Energy LNG Project	San Patricio, TX	1.0
Sabine Pass LNG LP	Cheniere Sabine Pass LNG Project	Cameron Parish, LA	2.6

Golden Pass LNG Project

The Golden Pass LNG Project (Docket Nos. CP04-386-000, CP04-400-000, CP04-401-000, and CP04-402-000), as proposed by Golden Pass LNG LP (an affiliate of ExxonMobil Corporation [ExxonMobil]), would be constructed in two phases and would ultimately consist of two ship berths, five LNG storage tanks, two 36-inch-diameter sendout pipelines (one approximately 78 miles long and one approximately 43 miles long), and a 1.8-mile-long lateral. The first phase (three LNG storage tanks) would have a nominal output of 1 bcfd, increasing up to 2.6 bcfd when all five storage tanks are in operation. One LNG tanker would visit the terminal every 4 days in the first phase, increasing to one tanker every 2 days in the second phase. The LNG terminal would be located on approximately 298 acres within a 477-acre site on the Port Arthur Ship Channel. Publication of the draft EIS expected in early 2005.

Port Arthur LNG Project

The Port Arthur Project (Docket No. PF04-11-000), as proposed by Sempra Energy LNG, would consist of two LNG unloading ship berths and three LNG storage tanks with a nominal output of 1.5 bcfd for the first phase and 3.0 bcfd after the second phase. The project would also involve construction of two sendout pipelines (one 3 miles long and one 70 miles long) to interconnections with several exiting pipelines northeast and south of the terminal. The LNG terminal would be built on approximately 250 acres on the Port Arthur Ship Channel, in Port Arthur, Jefferson County, Texas. This project is under review in our pre-filing environmental review process[5] with publication of the draft EIS expected in early 2005.

Vista del Sol LNG Project

The Vista del Sol Project (Docket Nos. CP04-395-000, CP04-405-000, CP04-406-000, and CP04-407-000) as proposed by Vista del Sol LNG Terminal LP (an affiliate of ExxonMobil), would consist of two LNG ship berths, three LNG storage tanks, and about 25.3 miles of 36-inch-diameter sendout pipeline. The three LNG storage tanks would have a nominal output of 1.1 bcfd and a peak capacity of 1.4 bcfd. The marine terminal would be capable of receiving up to 100 LNG ships per year, or the equivalent of about one LNG tanker visiting the terminal

[5] This process provides a pre-filing (PF) docket number and allows for early stakeholder involvement by the applicant, FERC, regulatory agencies, and the public to allow for early issue identification and resolution, and a coordinated project design process.

every 4 days. The LNG terminal would be located on approximately 92 acres within a 311-acre site between the communities of Ingleside and Gregory, San Patricio County, Texas, and adjacent to the Sherwin plant to the north, and the Occidental and DuPont chemical plants to the east and south. The terminal would be designed to accommodate future expansion that would include an additional berth and two more LNG tanks. The expanded facility would be capable of unloading up to 200 LNG ships with a nominal sendout capacity of 2 bcfd and peak capacity of 2.7 bcfd. Publication of the draft EIS is expected in late 2004.

Ingleside Energy Center LNG Project

The Ingleside Energy Center LNG Project (Docket Nos. CP05-11-000, CP05-12-000, CP05-13-000, and CP05-14-000), as proposed by Occidental Energy Ventures Corporation (Occidental), would consist of one ship berth, two LNG storage tanks, regasification facilities, and about 26 miles of 26-inch-diameter pipeline with interconnections to nine existing interstate and intrastate pipelines. The project would have an output of 1 bcfd and would be located on an 82-acre site adjacent to Occidental's chemical manufacturing facility north of Ingleside, San Patricio County, Texas. Occidental filed its applications for this project with the FERC on October 25, 2004, and the draft EIS could be produced in early 2005.

Cheniere Sabine Pass LNG Project

The Sabine Pass LNG Project (Docket Nos. CP04-47-000, CP04-38-000, CP04-39-000, and CP04-40-000), as proposed by Cheniere, would be located in Cameron Parish, Louisiana. The project would consist of two marine berths capable of unloading up to 300 LNG ships per year, three LNG storage tanks, vaporization and processing facilities, and 16 miles of 42-inch-diameter sendout pipeline with a nominal output of 2.6 bcfd. The LNG terminal would occupy about 237 acres of land. The draft EIS was published in August 2004.

3.2.1.3 Conclusions on Onshore LNG Terminal System Alternatives

Cheniere is proposing a facility that would have the ability to import and store up to 2.6 bcf of LNG and deliver up to 2.7 bcfd of natural gas directly to Texas intrastate and interstate markets. None of the other existing, authorized, or proposed LNG facilities could handle the additional volumes proposed by Cheniere for its Corpus Christi LNG Project without significant expansion and the associated environmental impact. The Distrigas LNG terminal in Massachusetts, Weavers Cove in Massachusetts, Keyspan in Rhode Island, BP Crown Landing in Pennsylvania, Cove Point LNG terminal in Maryland, Southern LNG terminal in Georgia, and Sound Energy Solutions in California are located too far away from Cheniere's proposed market in Texas to be seriously considered as system alternatives. The Freeport LNG terminal was dropped from consideration as a viable system alternative because its capacity is fully subscribed, and it would not be able to provide natural gas to the interstate pipeline network. The other Corpus Christi sites (Vista del Sol and Ingleside Energy Center) are likely too small to accommodate a third or fourth berth and an additional three LNG tanks. The Port Arthur Ship Channel sites are probably large enough to accommodate the additional LNG tanks and could probably accommodate the additional berths and LNG ships. However, takeaway capacity would need to be increased because the proposed pipelines are only designed for the proposed sendout volumes. This would likely result in more than 16 miles of pipeline. In each case, environmental impacts at an alternative site would be similar to those at the proposed site. Therefore, we do not believe that any of these sites represent a viable system alternative or offer significant environmental advantages over construction of the proposed project as proposed and have eliminated all of them from further consideration. Because of their location, physical constraints, and lack of additional capacity, we do not believe that using existing, authorized, or proposed LNG import terminals is a reasonable system alternative to the proposed action.

3.2.2 Offshore LNG Terminal System Alternatives

All existing LNG import terminals in the U.S. are located at shoreline marine transfer terminals with onshore LNG storage and vaporization facilities. Recently, however, companies have begun exploring methods of importing LNG into the U.S. through the use of deepwater ports that would avoid many of the perceived environmental and safety issues associated with onshore LNG facilities. As defined in the Deepwater Port Act of 1974, and as amended by the Maritime Transportation Security Act of 2002 to include natural gas, deepwater ports include a fixed or floating structure (other than a vessel) or a group of structures that are located off the coast of the U.S. and that are used as a port or terminal for the transportation, storage, and further handling of oil or natural gas. This legislation requires that the DOT (Maritime Administration) and the USCG regulate the licensing, siting, construction, and operation of deepwater ports for natural gas.

Although an offshore LNG import facility has not yet been built, the technology for doing so is being developed and guidance documents for building offshore LNG storage and vaporization terminals have recently been produced (American Bureau of Shipping, 2002). Currently, offshore LNG terminals have been proposed and are under review in the U.S., Australia, West Africa, Taiwan, and Italy (LNG Express, 2002a). Because of the demand for natural gas and the potential advantages of offshore unloading and vaporization facilities, we have identified up to 11 proposed or planned offshore LNG import terminals in the U.S. (FERC, June 2004). The four main offshore technologies under development include:

- regasification vessels where vaporization equipment is installed on LNG ships and the LNG ships are offloaded to a pipeline via a floating buoy and riser system;
- gravity-based structures (GBS) where LNG storage tanks, offloading, and vaporization facilities are placed on platforms with foundations that are anchored directly to the seafloor;
- reuse of existing platforms for storage and vaporization facilities; and
- floating storage and regasification units (FSRU) where storage tanks, offloading, and vaporization facilities are placed on a floating structure (or ship) that is moored to the seafloor.

Our review of potential offshore LNG terminal facility locations included offshore LNG facilities approved or currently proposed and under review by the USCG as listed in table 3.4-1. No FSRUs are currently planned for the Gulf of Mexico. These offshore technologies and planned offshore projects are discussed in the following sections.

TABLE 3.4-1

Approved and Proposed Offshore LNG Facilities Under Review in the Gulf of Mexico

Operator	Project	Type of Facility	Capacity (bcfd)	Status
Excelerate Energy LLC (formerly El Paso Energy Bridge Gulf of Mexico LLC)	Energy Bridge GOM Project	Regasification vessel	0.5	a/
Port Pelican LLC	Port Pelican Project	GBS	1.6 to 2.0	a/
Gulf Landing LLC	Gulf Landing Project	GBS	1.0 to 1.2	b/
Compass Port LLC	Compass Port Project	GBS	1.0	b/
Pearl Crossing LNG LLC	Pearl Crossing Port Project	GBS	2.0 to 2.8	b/
Freeport-McMoRan Energy LLC	Main Pass Energy Hub Project	Platform reuse	2.5 to 3.1	b/

a/ Approved.
b/ NEPA review in process.

3.2.2.1 LNG Regasification Vessels

Several companies are investigating the feasibility of installing vaporization equipment on conventional LNG ships. These ships would be able to dock at a floating unloading buoy and riser system where LNG could be vaporized onboard the LNG ship and injected directly into offshore pipelines that interconnect with onshore natural gas transmission systems. The vaporization equipment located on the ships would use technology that is similar to land-based LNG terminals. The Energy Bridge GOM is the only project of this type currently planned for the Gulf of Mexico.

Energy Bridge GOM

In December 2002, El Paso Energy Bridge Gulf of Mexico, LLC submitted an application (Docket No. 14294) for a Deepwater Port License to the USCG and the Administrator of the Maritime Administration to own, construct, and operate a deepwater port approximately 116 miles off the coast of Louisiana in the Gulf of Mexico (LNG Express 2002b and 2003). The USCG's Final EIS for this project was issued in December 2003, and the final license was issued in April 2004. Excelerate Energy LLC acquired rights to the project in December 2003 and has begun manufacturing various components of the facility, including the construction of three regasification vessels. The project is expected to be operational in January 2005; although LNG deliveries would not begin until mid-2005.

The Energy Bridge GOM system will utilize new specially-designed LNG tankers (El Paso Energy Bridge Vessels or EPEBVs) with onboard regasification equipment to directly input natural gas into the pipeline grid. This system will include a submerged turret loading (STL) buoy, a flexible riser pipe to carry the natural gas from the STL buoy to a subsea manifold, a metering platform, and about 5.3 miles of undersea pipelines to connect to the existing Sea Robin and Bluewater offshore pipeline systems.

When an EPEBV reaches the buoy port, it will retrieve and connect to the STL buoy and the mooring system. When not in use, the STL buoy will remain submerged about 80 feet below the sea surface in about 298 feet of water. The STL buoy will be secured to the EPEBV and function as both the mooring system and the offloading mechanism for transferring the natural gas. After the connection procedures are completed, the LNG will be vaporized using the onboard regasification equipment, and natural gas will be transferred to the pipeline system through the STL buoy. It is anticipated that each EPEBV will have a transport capacity of about 138,000 m^3 of LNG. Under optimal operating conditions, each EPEBV will have the capability to regasify and unload a maximum of 0.69 bcfd of natural gas for an average natural gas delivery rate of about 0.5 bcfd.

Our review of the Energy Bridge GOM Project indicates that it would not be able to accommodate the additional 2.6 bcfd required to meet the throughput volumes proposed by Cheniere Corpus Christi without the addition of five or more STL buoy ports. Further, because there is no storage component to this system, a significant number of EPEBVs would be required to provide continuous service to the STL buoy ports to avoid any disruption in service. The EPEBVs are unique and the first of their kind. None of the existing LNG worldwide fleet can provide onboard vaporization capability so increased use of this technology would require new ships. Three EPEBVs are under construction for this project alone. To provide comparable delivery rates to replace the Cheniere Corpus Christi LNG Project, five or more new EPEBVs would need to be constructed.

3.2.2.2 GBS

The use of a GBS would be limited to areas with suitable substrates and where water depths range from 55 to 85 feet. Safety zones surrounding these types of offshore LNG facilities would exclude certain ship traffic from operating in the vicinity and the GBS would need to be located outside of shipping lanes. Although designs would vary depending on site-specific circumstances, offshore GBS facilities could be built to store between 290,000 and 400,000 m^3 of LNG with sendout capacities ranging between 0.8 and 2.8 bcfd.

In addition, because a GBS is fabricated in a graving dock (or dry dock) at an onshore location, the GBS design is not completely devoid of adverse onshore impacts, such as impacts to wetlands and other sensitive land uses. The onshore graving dock must be of sufficient size and depth to fabricate the GBS, and in an area with access to a 45- to 50-foot-deep channel to float the GBS. This requires that the graving dock area be large enough to accommodate the GBS and be excavated deep enough to allow the GBS to be floated out after construction is completed. One side of the graving dock must be directly adjacent to a waterbody, and that side must be removable to flood the dock and float the GBS so that it may be towed from the dock to its final destination. GBS units for the currently proposed projects range from 210 to 248 feet wide by 500 to 1,110 feet long. The fabrication site for the GBS would require between 50 and 100 acres, and availability of adequate infrastructure to facilitate construction.

Currently, there are one approved and three proposed projects that would use the GBS technology in the Gulf of Mexico.

Port Pelican Project

Port Pelican, LLC (an affiliate of the ChevronTexaco Corporation) received approval in November 2003 from the U.S. Maritime Administration (Docket No. 14134) for its Port Pelican Project, an LNG unloading, storage, and vaporization terminal that would be located about 37 miles offshore from Vermillion Parish, Louisiana. The vaporized natural gas will be transported into the interstate natural gas pipeline system at Henry Hub by constructing a new 42.6-mile-long, 42-inch-diameter pipeline to the existing Tiger Shoal "A" platform, then using the existing pipeline infrastructure to Henry Hub. The Port Pelican Project will have the capability of vaporizing and transporting up to 2.0 bcfd of natural gas to U.S. markets.

The Port Pelican Project will use two GBSs for the offshore terminal that will be anchored to the sea bottom in 83 feet of water. Each GBS will consist of a large concrete structure that will be specially designed and fabricated to provide a safe and secure foundation for the LNG tanks, and a supportive deck for vaporization equipment and crew quarters. Berthing facilities (mooring and breasting dolphins and unloading platforms) will be able to accommodate two LNG ships, one on either side of the terminal.

In June 2004, the USCG announced its intent to prepare an environmental assessment for the fabrications of the GBSs and consideration of two alternative onshore sites for fabrication. The preferred site would occupy 174 acres at Port Aransas, Texas, while the alternative site would occupy 67 acres on Pelican Island in Galveston, Texas.

The Port Pelican Project would require two GBSs to provide unloading, storage, and vaporization facilities for 2.0 bcfd. An additional two to three GBSs would be required to accommodate the additional 2.6 bcfd proposed by Cheniere Corpus Christi, affecting an additional 150 to 300 acres of shoreline for construction. In addition, while the existing infrastructure (as enhanced by the new 42.6-mile-long Port Pelican pipeline) can accommodate the output from the Port Pelican terminal, it would not be able to accommodate an additional 2.6 bcfd at that location. Overall, the environmental impact associated with construction of the GBSs on land, combined with construction of additional new offshore and onshore pipelines, likely would be equal to or greater than impacts associated with construction of the proposed Project.

Gulf Landing Project

In November 2003, Gulf Landing LLC (part of the Royal Dutch/Shell Group of Companies) filed an application (Docket No. 16860) with the USCG for a Deepwater Port License for its Gulf Landing Project, an LNG unloading, storage, and vaporization terminal that would be located about 38 miles offshore of Cameron, Louisiana. The vaporized natural gas would be transported from the proposed facility into the existing interstate natural gas pipeline system through five segments of 16- to 36-inch-diameter offshore pipeline totaling about 75.6 miles. The Gulf Landing Project would have the capability of storing up to 180,000 m^3 of natural gas, and vaporizing and transporting up to 1.2 bcfd of natural gas to U.S. markets.

The Gulf Landing Project would use two GBSs, each approximately 1,100 feet by 248 feet, for the offshore terminal that would be anchored to the sea bottom in about 55 feet of water. Each GBS would consist of a large concrete structure designed and fabricated to provide a secure foundation for the LNG tanks, and a supportive deck for accommodating all of the regasification equipment, utilities, and other related facilities (living quarters, metering, workshops, helicopter access, etc.). Berthing facilities (mooring and breasting dolphins and unloading platforms) would be able to accommodate up to 135 LNG ships per year, ranging in size from 125,000 m^3 to 165,000 m^3. The GBSs would be initially built onshore, towed to the site, and installed on the seabed.

The USCG issued a draft EIS for the Gulf Landing Project in June 2004. In August 2004, the USCG suspended processing of the application pending receipt of supplemental information regarding potential impacts on the marine environment.

For this project to accommodate the volumes proposed by Cheniere Corpus Christi, an additional two to three GBSs would be required, affecting between 150 and 300 acres of shoreline for the graving docks. As with the Port Pelican Project, the environmental impact associated with construction of the GBSs on land, combined with construction of additional new offshore and onshore pipelines, likely would be equal to or greater than the impacts associated with construction of the proposed Project.

Compass Port Project

In March 2004, Compass Port LLC (a wholly owned subsidiary of ConocoPhillips Company) filed an application (Docket No. 17659) with the USCG for a Deepwater Port License for its Compass Port Project in the Gulf of Mexico. The project would consist of two GBSs, with docking facilities for one LNG ship, two LNG storage tanks and regasification facilities, located in 70 feet of water, approximately 11 miles south of Dauphin Island and about 15 miles off the coast of Alabama. The project would also involve construction of approximately 27 miles of offshore and 5 miles of onshore[6] 36-inch-diameter sendout pipeline to connect the deepwater port with existing natural gas pipelines near Coden, Alabama.

The generalized dimensions of the entire terminal facility (including the GBSs; regasification, unloading, and living quarters platforms; mooring, berthing, and support structures; and flare tower) would be 1,350 feet by 1,000 feet (31 acres) and anchored in water depth of 70 feet. However, facility structures would occupy only about 6.2 acres. Construction of the two GBSs would require approximately 70 acres of land adjacent to a navigable channel with a minimum depth of 50 feet. Construction is expected to take about 42 months.

To accommodate the volumes proposed by Cheniere Corpus Christi, this project would require an additional two to three GBSs for the three LNG storage tanks and potentially two large diameter pipelines to move the natural gas to shore and interconnects with the existing natural gas pipeline system. Additional environmental impacts associated with an expanded Compass Port facility would include up to 140 acres of land for construction of the GBSs, an offshore facility footprint that would be nearly triple of that proposed (or about 90 acres), and a subsea construction disturbance for the pipelines. Thus, the environmental impact associated with expansion of the Compass Port Project would be similar, if not greater, than the impacts associated with construction of the proposed Project.

[6] On April 16, 2004, Compass Pass Pipeline LLC filed an application with the FERC (Docket Nos. CP04-114 and CP04-115) to construct and operate 5 miles of onshore pipeline near Coden, Alabama.

Pearl Crossing Port Project

In May 2004, Pearl Crossing LNG LLC (an affiliate of ExxonMobil) filed an application (Docket No. 18474) with the USCG for a Deepwater Port License for its Pearl Crossing Port Project that would be located in the Gulf of Mexico, approximately 41 miles southeast of Johnsons Bayou, Cameron Parish, Louisiana. The GBS would be about 590 feet long and 295 feet wide, occupying an area of approximately 12 acres. The terminal would be designed with two LNG storage tanks, two ship berths, and vaporization equipment to provide for an average sendout rate of 1.4 bcfd and a peak sendout rate of approximately 2.8 bcfd. Two parallel 42-inch-diameter offshore pipelines would extend about 53 miles from the offshore terminal to the high water mark south of Johnsons Bayou. From there, the two onshore pipelines would extend about 1.1 miles north to Johnsons Bayou, and then one 42-inch-diameter pipeline would continue north for about 64 miles to interconnections with up to 10 interstate and intrastate existing pipelines. The pipeline would end near Starks, Calcasieu Parish, Louisiana.[7]

To accommodate the volumes proposed by Cheniere Corpus Christi, the capacity of this project would need to be approximately doubled, resulting in a minimum of one to two more GBSs in the Gulf of Mexico, and additional offshore and onshore pipelines. Environmental impacts would be similar to, if not greater than, those of the proposed Project.

3.2.2.3 Reuse of Existing Platforms

This concept involves the conversion of abandoned platforms and associated infrastructure that exist in the Gulf of Mexico for reuse as LNG import, storage, and vaporization terminals. On a conceptual level, reuse of any of these platforms for an LNG receiving and vaporization terminal would require decommissioning of the existing production facilities, installation of mooring and LNG vaporization facilities, and construction of new underwater, pressurized natural gas pipelines with interconnections to existing onshore pipelines. Currently, there is one such project proposed in the Gulf of Mexico.

Main Pass Energy Hub Project

In February 2004, Freeport-McMoRan Energy LLC (a division of McMoRan Exploration Company) (McMoRan) filed an application (Docket No. 17696) with the USCG for a Deepwater Port License for its Main Pass Energy Hub, an LNG unloading, storage, and vaporization facility that would be located about 37 miles off the coast of Venice, Louisiana. The Main Pass Energy Hub Project would make use of existing platforms and other infrastructure in the Gulf of Mexico, including a nearby salt dome for underground storage of up to 28 bcfd of natural gas and would have the capability of a peak deliverable volume of 3.1 bcfd of natural gas to U.S. markets. The existing offshore platform facility was constructed in 1992 and would be reconfigured to consist of an LNG berth, LNG surface storage of up to 145,000 m^3, vaporization and compression facilities, living quarters, and associated facilities. Approximately 192 miles of offshore pipeline

[7] On July 8, 2004, Pearl Crossing Pipeline LLC filed an application with the FERC (Docket Nos. CP04-374, CP04-375, and CP04-376) to construct and operate the onshore pipelines.

and 5.1 miles[8] of onshore pipeline would be constructed to connect the terminal to the existing pipeline infrastructure. The USCG has begun its environmental review of the project.

As proposed, the Main Pass Energy Hub Project would utilize an existing offshore platform and salt cavern to provide unloading, vaporization, and storage facilities for LNG shipments. This project could accommodate storage of the Cheniere Corpus Christi natural gas volumes (480,000 m^3), but it may be unable to accommodate the proposed number of LNG ships (up to 300 ships per year) without additional berths, and possibly additional platform construction, or the proposed sendout (2.6 bcfd) without construction of additional, or larger, takeaway pipelines.

3.2.2.4 Offshore Site Alternative

It is possible that an offshore LNG terminal with a EPEBV, a FSRU, or a gravity-based design (similar to the Port Pelican or Gulf Landing projects) could provide an import service similar to the Cheniere Corpus Christi LNG Project and that suitable sites could be located and developed in the offshore in the Gulf of Mexico. By constructing an LNG terminal offshore, some of the environmental impacts associated with the proposed Cheniere Corpus Christi LNG Project may be avoided (*e.g.*, permanent fill of coastal wetlands, ship traffic in La Quinta Channel). For an offshore site alternative, we considered the technologies using a FSRU or a GBS. The regasification vessel (EPEBV) would not provide LNG storage, which is provided by the LNG tanks in onshore projects, and therefore would not meet the storage requirement objective of the proposed Project. The EPEBV, as well as the FSRU, would need to be located in deeper water to accommodate the STL buoy, thus significantly increasing the length of offshore sendout pipeline and associated environmental impacts. Reuse of existing platforms would involve identifying decommissioned production facilities and determining whether these facilities were appropriate for conversion to import LNG, both of which are beyond the scope of this analysis. Therefore, our consideration of an offshore site alternative for the Project was limited to use of the GBS offshore technology since this technology can be applied in the shallower waters of the Gulf of Mexico.

In addition to considering the potential technical issues and environmental impacts associated with construction and operation of an offshore LNG storage and vaporization facility, we also considered the relative impacts associated with the need to construct an additional sendout pipeline from an offshore site to allow for market deliveries. We made several assumptions in estimating the length of pipeline that would be required, both on and offshore. First, in order to make deliveries to the energy market proposed by Cheniere, an offshore LNG terminal would require a 48-inch-diameter sendout pipeline that ultimately interconnects with the intrastate and interstate pipeline system near Sinton, Texas. Ideally, the cost and environmental impacts associated with construction of a sendout pipeline between an offshore terminal and the intrastate and interstate pipeline system would be avoided or reduced by connecting to and using existing offshore pipelines that have excess capacity available to carry gas from offshore waters to or near interconnect sites onshore in Texas. Two existing offshore pipelines service two gas wells located north of Cheniere's proposed docking facility. The pipelines and gas wells would be removed to accommodate Cheniere's proposed docking facility and administration building.

[8] On February 27, 2004, Freeport McMoRan filed an application with the FERC (Docket Nos. CP04-68 and CP04-69) to construct and operate 5.1 miles of onshore pipeline near Coden, Alabama.

While it may be possible to construct an offshore LNG storage and vaporization facility as an alternative to the Cheniere Corpus Christi LNG Project, it is not a reasonable alternative. Construction of an offshore alternative would require the construction of a graving dock, which would impact the shoreline, and a permanent onshore facility for terminal support activities and would involve a longer pipeline. In addition, the evaluation of an offshore facility as an alternative to the Cheniere Corpus Christi LNG Project cannot merely transpose the onshore facility to an offshore location. Rather, it represents a complete redesign of the entire facility such that the feasibility of meeting the operational and economic objectives of the proposal is highly questionable. Although offshore storage and vaporization structures may eventually find a role for importing LNG into the U.S. the current level of information and limited operation experience is not sufficient to justify consideration of this emerging application or offshore technology as a reasonable alternative to the proposed Cheniere Corpus Christi LNG Project.

3.2.2.5 Discussion of Offshore LNG Terminal System Alternatives

There are both operational and environmental tradeoffs associated with offshore LNG terminal technology. Offshore LNG terminals need to be located in areas that are away from shipping fairways and operating oil or gas platforms. In addition, a safety zone would be established that would preclude commercial or recreational fishing within a range of between 1,640 and 3,280 feet of an offshore terminal. An offshore terminal must be self-contained, providing its own power, water, communications, and other utilities. This would translate to additional construction and operational costs associated with provision of these utilities; transportation by boat or helicopter of materials, supplies, and workers; and permanent onshore facilities for these terminal support activities. Although specific numbers are not available, preliminary estimates indicate that the construction and operational costs for an offshore terminal are higher than a typical onshore facility. For a GBS, the tanks are an internal component of the GBS and form the foundation of the offshore structure. These structures, and consequently the tanks, would be designed to withstand the greater natural forces associated with the offshore location and terminal operation. As a result, the capital expenditures for the GBS would be about double the cost of the onshore Cheniere Corpus Christi LNG terminal. In addition, permanent staffing and personnel requirements for the proposed Cheniere Corpus Christi LNG terminal would be about one-fourth that needed for an offshore facility.

An LNG import terminal that is located in an offshore setting would be exposed to the effects of meteorological and oceanographic forces such as high winds, waves, and currents. A key technical issue for the successful operation of an LNG terminal in this environment includes designing the LNG transfer system (*i.e.*, unloading arms) to compensate for the relative motion between the terminal and LNG ship during unloading operations. Although storage and unloading technologies similar to those that would be used with an offshore LNG terminal have been applied for many years at onshore LNG terminals and at offshore petroleum product facilities (LNG Express, 2002a), the technologies needed to transfer a cryogenic liquid under the harsher conditions in an offshore setting have not been demonstrated. This may be particularly problematic for offloading to a FSRU where the stresses on a transfer system could be even greater than what would be experienced at a stationary GBS or an existing platform. For a GBS, an artificial breakwater must be constructed to protect the docked LNG vessel as well as the terminal itself. This breakwater could be combined with the GBS, however the GBS must then be much larger to withstand the physical forces of wind, waves, and water currents at the terminal location. This protective function is more easily and economically achieved in a protected harbor onshore.

In general, the offshore terminals would vaporize the LNG using open rack vaporization, where water is withdrawn from the Gulf, used to transfer heat to the LNG, and then discharged back at a lower temperature. This would decrease the water temperature, increase turbidity, and increase dissolved oxygen content in marine waters within about 300 feet of the terminal. Although a GBS terminal could serve as an artificial reef, potentially resulting in some beneficial impacts on the populations of commercial and recreational fish species, the intake structures would impinge or entrain fish eggs or larvae that are floating in nearby waters. However, the EISs prepared for the Energy Bridge GOM and Port Pelican Projects conclude that impacts on fish or fish habitats would not result in population-level effects or changes to the biomass of the stocks of any species.

In addition to considering the potential technical issues and environmental impacts associated with construction and operation of an offshore LNG storage and vaporization facility, we also considered the relative impacts associated with the need to construct an additional sendout pipeline from an offshore site to allow for market deliveries. Ideally, the costs and environmental impacts associated with constructing a sendout pipeline between an offshore terminal and the interstate pipeline system could be avoided or reduced by connecting to and using existing offshore pipelines that have excess capacity and could transport the gas from offshore waters to interconnection sites onshore in Louisiana. However, our analysis indicates that it is likely that no one pipeline system could accommodate all of the 2.6 bcfd proposed by Cheniere Corpus Christi and that new pipeline would need to be constructed to multiple interconnects. With the exception of the Energy Bridge GOM Project, which would only deliver up to 0.5 bcfd, the other proposed offshore projects would require new offshore pipeline.

One of the tradeoffs for the regasification vessel technology is that it requires a dedicated LNG fleet with vaporization equipment on all of the vessels. This fleet does not exist, although three EPEBVs are on order for the Energy Bridge GOM Project. Additionally, it would take up to 6 days to unload a ship at a maximum design rate of about 0.5 bcfd, and no fixed LNG storage would be provided. Further, since the STL buoy must be located in waters between 130 to 490 feet deep, the length of offshore pipeline and associated environmental impact could be significant. Finally, to maintain continuous sendout, two buoys likely would be required to transition between successive ships. With a one STL buoy system, sendout is disrupted each time a ship connects and disconnects to the buoy system. A two STL buoy system would avoid this disruption.

One of the more significant tradeoffs for the GBS technology is the potential for environmental impacts associated with fabrication of the GBS within a graving dock. The final EIS for the Port Pelican Project indicated that each of the project's two GBS units would be 210 feet wide by 500 feet long. The Gulf Landing Project GBS units are about twice as large. There are no existing graving dock facilities in the U.S. of the size needed for a GBS. Fabrication of the GBSs would require between 50 and 100 acres of land and adequate infrastructure to move materials and workers to the site. The graving dock must be located along the shoreline so that the completed GBS can be floated (in water about 45 feet deep) and towed to its final destination. Because many of the western Gulf Coast channels are 42 feet deep or less, dredging would probably be required for any new graving dock. Fabrication of the GBS outside of the western Gulf Coast area and floating it into the offshore Louisiana/Texas area would increase costs and could potentially interfere with shipping.

3.2.2.6 Conclusions on Offshore Technology

In summary, we conclude that, although offshore technologies provide an alternative means for the import of LNG, the proposed offshore technologies would not provide the same capability as the proposed Cheniere Corpus Christi LNG Project and would likely result in a similar level of (although different) environmental impacts. The proposed Project would provide berthing for LNG ships of up to 250,000 m^3, storage for approximately 480,000 m^3 of natural gas, a sendout capacity of 2.6 bcfd, and a 23-mile-long pipeline to connect to the existing natural gas infrastructure. In comparison:

- Use of the new specially-designed regasification vessels (or EPEBVs) with transport capacities of 138,000 m^3 would provide less delivery capacity, lack LNG storage, and may be less reliable due to transitioning between incoming and outgoing EPEBVs.
- While the GBS terminal is a proven technology for offshore petroleum production, with existing offshore petroleum facilities along the east coast of Canada and in the North Sea, it is not yet a proven technology for the storage and vaporization of LNG. Although an offshore GBS terminal can provide similar storage and sendout capabilities, environmental impacts associated with the graving dock and offshore pipeline likely would be similar if not greater than those associated with the proposed Project.
- The FSRU is not a proven technology for an offshore LNG import terminal. While a graving dock would not be required for the FSRU, the FSRU would need to be moored in deeper waters (greater than 160 feet) to accommodate a flexible pipeline connection between the FSRU and the sendout pipeline, thus potentially increasing the length of the offshore pipeline. Since it makes use of a floating platform, it typically provides less storage and sendout capacity than a GBS. Depending on the unloading system configuration, the relative motion of two vessels at sea could increase difficulty of cargo transfers, thus affecting overall reliability.
- The reuse of existing platforms is limited by the availability of abandoned platforms that can be adapted to accommodate the LNG storage and vaporization facilities and crew quarters, as well as being at sufficient depth to allow for berthing of LNG ships (*e.g.*, over 40 feet).

3.2.3 Pipeline System Alternatives

Our analysis of pipeline system alternatives includes examining the use of existing interstate pipeline systems to meet the objectives of the proposed Project. As discussed in section 1.0 of this EIS, the overall purpose of the Project is to provide facilities that would allow imported LNG to be vaporized and transferred to U.S. markets via existing interstate and intrastate natural gas pipeline systems. Expansion of an existing interstate or intrastate pipeline to connect with the proposed LNG terminal would result in the construction of a pipeline similar to that proposed by Cheniere. The environmental impacts of an expanded interstate or intrastate pipeline would also be similar to Cheniere's pipeline. Therefore, a pipeline system alternative would provide no environmental advantage over the proposed Project, and we have conducted no further analysis of pipeline system alternatives.

3.3 ONSHORE LNG TERMINAL SITE ALTERNATIVES

The examination of alternative sites for a LNG import terminal involved a comprehensive process that considered environmental, engineering, economic, safety, and regulatory factors. The first step was to identify the most suitable region within the U.S. for a LNG terminal based on the stated purpose of the proposed Project. The second step was the identification of specific ports within the selected region that could accommodate LNG ship traffic. The third step was the evaluation of suitable sites within those ports meeting Project objectives.

3.3.1 U.S. Regional Review

To identify the most suitable region within the U.S. for a LNG terminal that would serve its market objectives, Cheniere applied two general criteria: (1) the presence of a significant gas market, and (2) proximity to an existing pipeline infrastructure that had the capacity to serve Texas intrastate and interstate markets. As a result of the application of these criteria, the east and west coasts, as well as certain Gulf coast states like Florida, Mississippi, and Alabama were eliminated due to the lack of pipeline infrastructure capacity that could serve the Texas intrastate and interstate markets. Cheniere indicated that Louisiana and Texas contained the necessary existing pipeline infrastructure to handle the volumes it proposes to import, and these states were identified as significant natural gas markets, utilizing about 15 bcfd, or approximately 25 percent of the nation's consumption.

3.3.2 Texas Regional Review

Cheniere identified 15 operating ports along the Texas Gulf Coast from the border with Mexico to the border with Louisiana that met its general goals (figure 3.3-1). The ports were then evaluated against the following screening criteria: (1) proximity to natural gas transmission systems; (2) channel depth and access; and (3) availability of isolated tracts of land and zoning that would support industrial development.

3.3.2.1 Proximity to Natural Gas Pipeline Systems

Access to the Texas intrastate and interstate natural gas markets was a critical consideration for the development and long-term viability of the LNG import terminal conceived by Cheniere. Ports near existing natural gas pipelines were deemed by Cheniere as more desirable than those located in areas without significant take-away capacity. The construction of a sendout pipeline to connect the LNG terminal to existing intrastate and interstate pipeline systems would involve construction and operational costs and result in a variety of environmental impact depending on the project size, length, and design. It is typical for significant pipeline construction projects to result in short- or long-term impacts on water resources, upland vegetation, wetlands, wildlife habitats, traffic patterns, and land use. To minimize these impacts and costs, only those ports that would have no significant routing impediments for a sendout pipeline were considered. Cheniere identified eight ports in Texas that met this criteria: Port Arthur, Sabine Pass, Houston, Texas City, Galveston, Freeport, Corpus Christi, and Brownsville.

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Page 3-20
Map

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3.3.2.2 Channel Depth and Access

Ships that are currently used to transport LNG have capacities that range from 75,000 to 138,000 m^3, and future ships may be sized to transport up to 165,000 m^3. The larger LNG ships have typical loaded drafts of 38 feet. To ensure that the LNG ships do not easily or frequently run aground an additional 2 feet of draft is required under the keel. This means importing LNG requires sea-going access and berthing facilities within waterbodies containing depths of a minimum of 40 feet. Although dredging in shallow-water areas could provide access for LNG ships, the costs and environmental impacts of significant dredging requirements could be prohibitive. Consequently, LNG terminal alternative sites that were outside of existing deepwater ports and/or areas with depths less than 40 feet were excluded from further analysis. Five ports (Isabel, Harlingen, Mansfield, Lavaca, and Palacios) were eliminated from further consideration because their ship channels were less than 40 feet deep.

A typical LNG carrier is in the range of 950 feet long by 145 feet wide, and requires an air draft (space between the water and an overhead stationary object that the ship would be required to pass under such as a bridge) larger than 180 feet. One port (Beaumont) was eliminated from further consideration because its channel has an air draft only 135 feet. Potential LNG terminal sites at the Port Arthur Channel and Houston Point were also dropped from consideration because of lack of channel access.

3.3.2.3 Zoning and Available Isolated Tracts

Cheniere desired to identify sites that are located within a previously disturbed area of the port and that are zoned for industrial development. Avoiding populated areas would minimize land use conflicts and maximize Project safety. Cheniere had to identify tracts of available isolated land at suitable ports that were large enough to accommodate the proposed facilities, including berths for LNG ships up to 950 feet long, and room for safety features required by 49 CFR 193 and NFPA 59A. Potential LNG terminal sites at Galveston and Texas City were eliminated from further consideration because of the lack of isolated tracts of available land located within an existing industrial zoned area. Potential LNG terminal sites at Pleasure Island at Port Arthur, Morgan's Point at Houston, and La Porte at Houston were dropped from consideration because Cheniere could not identify available tracts of land large enough to accommodate its proposed facilities (see table 3.3.2.3-1).

Only the ports of Brownsville, Freeport, Sabine Pass, and Corpus Christi passed all of the selection criteria for suitable sites for Cheniere's proposed LNG terminal. Cheniere and its affiliates filed separate applications for LNG import terminals at Freeport, Texas, and Sabine Pass, Louisiana. As discussed above, the Freeport project has already received Commission authorization. Cheniere selected Corpus Christi for this Project because the area has existing industries that could be potential end users for the imported natural gas. Specifically, the Sherwin plant has been identified as a potential customer, which is why Sherwin is part owner of the Project. Brownsville was rejected as a viable alternative site for the LNG terminal, because it is located about 200 miles away from Corpus Christi, the site does not offer a significant environmental advantage over the proposed site, and Cheniere is evaluating this site for a potential project that is unrelated to the proposed Project.

TABLE 3.3.2.3-1

Potential LNG Terminal Sites at Texas Ports

Port Site	Channel Depth a/	Channel Access b/	Industrial Zoning c/	Available Land	Take Away Capacity
Brownsville	Yes	Yes	Yes	Yes	Yes
Isabel	No	No data	No data	No data	No
Harlingen	No	No data	No data	No data	No
Mansfield	No	No data	No data	No data	No
Corpus Christi	Yes	Aransas Pass – Yes Ingleside – Yes Sherwin – Yes Bay Construction – No Koch – No	Yes	Aransas Pass – Yes Ingleside – No Sherwin – Yes Bay Construction – No Koch – No	Aransas Pass – No Ingleside – Yes Sherwin – Yes Bay Construction – Yes Koch – Yes
Port Lavaca	No	No data	No data	No data	No
Palacious	No	No data	No data	No data	No
Freeport	Yes	Yes	Yes	Yes	Yes
Galveston	Yes	Yes	No	No	Yes
Texas City	Yes	Yes	No	No	Yes
Houston	Yes	Houston Point – No La Porte – Yes Morgan Point - Yes	Yes	Houston Point – Yes L Porte – No Morgan's Point – No	Yes
Sabine Pass	Yes	Yes	Yes	Yes	Yes
Port Arthur	Yes	Channel – No Pleasure Island – Yes	Yes	No	Yes
Beaumont	Yes	No	No data	No data	No
Orange	No	No data	No data	No data	No

a/ Ship channel more than 40 feet deep
b/ Ship channel more than 180 feet wide
c/ Existing land is zoned for industrial use

3.3.3 Alternative Sites Near Corpus Christi

As can be seen from the above analysis, the port at Corpus Christi met the criteria of having a deepwater channel with access for LNG ships, available land that was zoned for industrial use, and close proximity to existing intrastate and interstate pipelines with adequate take-away capacity. Cheniere evaluated other alternative locations for the LNG terminal within Corpus Christi Bay, including sites at Aransas Pass, Ingleside, Bay Construction Ltd. property, and the Koch property. The criteria used by Cheniere in its site selection process is outlined in table 3.3.3-1. The Bay Construction Ltd. property and the Koch property were rejected from further consideration because of the presence of bridges that would reduce the air draft to only 138 feet, which is not enough for LNG ship passage. The Aransas Pass site was rejected because there was no acceptable route for a sendout pipeline. The pipeline route examined would cross through the bay, marshlands, and the town, with land use conflicts and adverse environmental impacts. The sites at Ingleside are not available for use by Cheniere, because they have already been taken by ExxonMobil for its proposed Vista del Sol LNG terminal project, and by Occidental Energy Ventures for its Ingleside Energy Center LNG terminal project. We will conduct separate environmental reviews of the Vista del Sol and Ingleside Energy Center projects.

TABLE 3.3.3-1

Criteria Used in a Site-Specific Review of LNG Terminal Site Alternatives

Criteria	Description
REQUIRED CRITERIA	
U.S. Department of Transportation - LNG Federal Safety Standards (49 CFR 193)	Relevant DOT safety requirements pertain to thermal exclusion and vapor dispersion zones (49 CFR 193.2057 and 193.2059) that must be identified in accordance with NFPA 59A - Standard for the Production, Storage, and Handling of Liquefied Natural Gas (2001 edition). Applied the same full containment storage tank design to alternative sites so that the space requirements and general layout of alternatives sites are similar to that proposed. Eliminated alternative locations that would not have enough available, property zoned land to accommodate the facilities proposed for the Cheniere Corpus Christi LNG terminal.
USCG - LNG Waterfront Handling Requirements (33 CFR 127)	Waterfront facilities where LNG is handled must comply with USCG regulations pertaining to layout and spacing of the marine transfer area. These regulations require that each LNG loading flange be located at least 985 feet from general public or railway bridges crossing navigable waterways or entrances to any tunnel under navigable waterways (33 CFR 127.105).
FAVORABLE CRITERIA	
Avoidance of Wetlands	To avoid or minimize impacts on wetland resources, LNG terminal sites should be located in upland or previously filled wetland areas.
Minimal Dredging Requirements	Areas requiring minimal dredging to develop and maintain an unloading slip and a shipping channel of sufficient depth for the LNG ships were considered more favorable than those areas requiring more significant dredging. In addition to avoiding impacts on water quality, minimal dredging requirements provide the added benefit of reducing costs associated with disposal of dredged material. Because clean dredged material could be used in restoring open water areas to emergent coastal marshes as part of offsite mitigation efforts, the COE and NOAA Fisheries consider the disposal of dredged material as having potentially beneficial environmental impacts.
Navigational Suitability	LNG ships operating in the Corpus Christi Ship Channel would impact other ship traffic due to the size of the LNG ships, operating restrictions, and safety exclusion zones. Additionally, the economic viability of a LNG import terminal is dependent on the movement of LNG through the terminal. The quicker a ship can reach the terminal, unload the LNG, and return to the sea, the better the economics of the project. Sites that offer minimal disturbances to existing shipping and that allow for rapid access by LNG ships were considered a favorable selection criterion.
Proximity to Areas of Special Interest	Considered favorably those sites that avoided land use conflicts. When applying this criteria, identified potential conflicts with special interest areas from either a LNG terminal or its associated sendout pipeline.
Proximity to Population Centers/Residences	An effort was made to identify alternative LNG terminal sites in areas that are not in close proximity to population centers and/or residences. Similarly, alternative LNG terminal sites were considered preferable if the location did not require LNG ships to transit areas with high population densities. Favorable sites would ideally avoid perceived safety conflict issues related to transport and storage of LNG.
Previously Disturbed or Industrial Areas	Areas previously disturbed or cleared of vegetation were preferable over undisturbed areas when identifying alternative LNG terminal sites. Existing industrial areas were considered to offer an environmental advantage over previously undeveloped or agricultural areas.
Site Development Capability and Potential Parcel Availability	To avoid significant cumulative development impacts, areas with little or no ongoing or planned large-scale development activities were considered more favorable than those areas where significant development activities were underway. For a site to be considered a practicable alternative, there must also be some indication that the site could be reasonably obtained from the current landowners.

Cheniere selected the site adjacent to the Sherwin plant on the north shore of Corpus Christi Bay, between Gregory and Portland, Texas as its preferred Project location. This site offered the following advantages:

- available isolated tract within an existing industrial area large enough for the proposed facilities and exclusion zones;
- willing seller who would become a partner in the project;
- existing infrastructure on site includes roads, raw water reservoir, tailings beds which could be utilized for DMPAs, and adjacent La Quinta ship channel and turning basin;
- nearby potential industrial customers;
- proximity to intrastate and interstate pipelines with adequate take-away capacity and route for a sendout pipeline along mostly existing right-of-ways (ROWs) over agricultural land; and
- no residences within 1.6 miles of the proposed LNG terminal.

3.4 PIPELINE AND ASSOCIATED ABOVEGROUND FACILITY LOCATION ALTERNATIVES

On May 11, 2004 Cheniere filed information that identified a revised proposed pipeline route and meter station locations that differed from those identified in its original application filed December 22, 2003. The revised locations are based on civil surveys, environmental surveys, and landowner consultations conducted by Cheniere after December 22, 2003. The proposed facilities evaluated in this EIS are those as filed on May 11, 2003. Where appropriate, we have evaluated the locations of the originally proposed facilities as alternatives.

3.4.1 Pipeline Route Alternatives

In evaluating pipeline alternatives, we examined variations that could reduce or avoid impact on environmentally sensitive resources such as population centers, special use areas, waterbodies, wetlands, existing or planned residences, or specific landowner concerns. During scoping for the Cheniere Corpus Christi LNG Project (see section 1.4 of this EIS) and during our review of Cheniere's application, we identified no areas that would warrant pipeline route alternatives or variations. However, since filing its application, Cheniere has completed civil and environmental surveys and conducted landowner consultations that have resulted in mostly minor changes to the route that Cheniere had identified as its preferred route. Collectively, these route changes are evaluated in this EIS as the proposed route. We have evaluated the originally proposed Cheniere pipeline route (Route Alternative A) as an alternative to the proposed route.

ExxonMobil and Occidental have proposed to construct separate LNG import terminals approximately two miles, and four miles, respectively, southeast of Cheniere's proposed terminal. Each of these projects would include a sendout pipeline that would also interconnect with existing interstate and intrastate pipelines in the area. The pipeline routes identified by ExxonMobil and Occidental could serve as partial alternative routes to Cheniere's proposed route, therefore we evaluated them as Route Alternative B and C, respectively. However, these route alternatives would be only partial alternatives since they start and end at different locations from the proposed route. Additional pipeline would be required to connect the alternatives to Cheniere's start and ending points. Because we identified no significant concerns along Cheniere's proposed route, the identification of additional pipeline routing necessary to fully connect Route Alternatives B and C to Cheniere's proposed start and ending locations was not warranted.

3.4.1.1 Route Alternative A

Route Alternative A would begin at the proposed Cheniere LNG terminal and proceed west for about one mile across open land owned by the PCCA, which will become part of its La Quinta Container Terminal. It would then turn northwest, cross the Southern Pacific Railroad and SH 35, skirt the west side of the city of Gregory, and cross CR 2986. Alternative Route A would then parallel Boykin Road between MPs 4.0 and 11.0, skirting the west of the city of Taft. It would follow local farm roads between MPs 14.0 and 15.0, then turn northeast, parallel to CR 1074, crossing U.S. Highway (US) 181, to MP 17.0, where it would turn northwest again. Following an existing pipeline corridor, Alternative Route A would cross Oliver Creek at MP 18.0, Chiltipin Creek at MP 19.0, and US 77 at MP 21, before terminating at MP 24.0. In total, the original route alternative would be about 24.0 miles long, 69 percent (16.5 miles) of which would be co-located with existing rights-of-way. Table 3.4.1.1-1 compares significant environmental factors of the original route alternative with the proposed route. Route Alternative A is shown with the proposed route on figure B-1, appendix B.

TABLE 3.4.1.1-1

Environmental Comparison of Cheniere's Preferred Pipeline Route with Route Alternative A

Environmental Factor	Proposed Route	Route Alternative A
Total Length of 48-inch Mainline (miles)	23.0	24.0
Length of 30-inch Lateral Pipeline (miles)	0.8	0
Length Adjacent to Existing Rights-of-Way (miles)	21.0	16.5
Construction Disturbance (acreage) a/	334.6	350.6
Waterbodies Crossed (number)	10	7
Wetlands Crossed (number/acres affected)	8/1.8	5/4.5
Railroad Crossings (number)	3	3
Road Crossing (number)	14	14
Houses within 50 feet of construction work area (number)	0	0

a/ Based on nominal right-of-way width of 120 feet.

Route Alternative A would be 1.0 mile longer than the corresponding segment of the proposed route, and it would be adjacent to 4.5 miles less of existing rights-of-way. It would affect 16.0 acres more land and affect 2.7 acres more wetlands.

The primary disadvantage of the alternative is that it would cross a greater portion of the PCCA property located east and west of La Quinta Road. The PCCA intends to construct the La Quinta Container Terminal on this property, which would include a marine terminal, intermodal yard, landside access, buffer zones, DMPA, ancillary facilities, and other uses. In addition, a landowner northwest of the PCCA property, may develop this property for residential use.

We believe that the Route Alternative A does not offer an environmental advantage over the corresponding segment of the proposed route, and therefore we do not recommend use of the alternative.

3.4.1.2 Route Alternative B

Route Alternative B would begin at ExxonMobil's proposed Vista del Sol LNG terminal, located south of the DuPont chemical plant about 0.6 mile southeast of Cheniere's proposed LNG terminal site, and proceed northward past the DuPont plant, crossing Edwards Road and a railroad, avoiding an existing pond, and crossing SH 361 and the Southern Pacific Railroad at MP 2.3. It would then follow existing ExxonMobil and Koch pipelines heading northwest across agricultural land, crossing SR 35 at MP 5.5. At MP 17.7 Route Alternative B would leave the existing pipeline corridor and become a greenfields route, crossing Chiltipin Creek at MP 19.0, and proceeding over open scrubland to MP 20.8, where it would follow another existing pipeline. It would cross US 77 at MP 24.8 and terminate at MP 27.4. Table 3.4.1.2-1 compares significant environmental factors of Route Alternative B with Cheniere's proposed pipeline route. Route Alternative B is shown on figure 3.4-1.

TABLE 3.4.1.2-1

Environmental Comparison of Cheniere's Preferred Pipeline Route with Route Alternative B

Environmental Factor	Proposed Route	Route Alternative B
Total Length of Mainline Pipeline (miles)	23.0	27.4 a/
Length Adjacent to Existing Rights-of-Way (miles)	21.0	23.6
Construction Disturbance (acreage)	334.6 b/	332.1c/
Waterbodies Crossed (number)	10	9
Wetlands Crossed (number/acres affected)	8/1.8	13/2.8
Railroad Crossings (number)	3	2
Road Crossing (number)	14	33
Houses within 50 feet of construction work area (number)	0	0

a/ Preliminary Vista del Sol pipeline route as of July 22, 2004.
b/ Based on nominal right-of-way width of 120 feet. Additional temporary workspace not included.
c/ Based on nominal right-of-way width of 100-feet. Additional temporary workspace not included.

Route Alternative B would be 4.4 miles longer than Cheniere's proposed route. It would affect 1.0 acre more wetlands, and cross 19 more roadways. We believe that Route Alternative B does not offer an environmental advantage over Cheniere's preferred pipeline route, and therefore we do not recommend use of the alternative.

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Page 3-27
Map

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3.4.1.3 Route Alternative C

Route Alternative C would begin at the proposed Ingleside Energy Center LNG terminal, and proceed northward, past the Occidental chemical plant, crossing SH 361 and the Southern Pacific Railroad at MP 1.5. It would continue in a northwesterly direction, crossing SH 35 at about MP 4.0, skirting the east side of the city of Gregory near MP 6.5, and the east site of the city of Taft near MP 14.5. This route alternative would cross Chiltipin Creek at MP 21.5, and terminate at MP 26.4. For about 22.9 miles Route Alternative C would be co-located with existing rights-of-way. Table 3.4.1.3-1 compares significant environmental factors of Alternative C with the proposed route. Route Alternative C is shown on figure 3.4-1.

TABLE 3.4.1.3-1

Environmental Comparison of Cheniere's Preferred Pipeline Route with Route Alternative C

Environmental Factor	Proposed Route	Route Alternative C
Total Length of Mainline Pipeline (miles)	23.0	26.4 c/
Length Adjacent to Existing Rights-of-Way (miles)	21.0	22.9
Construction Disturbance (acreage)	334.6 a/	320.0 b/
Waterbodies Crossed (number)	10	9
Wetlands Crossed (number/acres affected)	8/1.8	2/<0.1
Railroad Crossings (number)	3	2
Road Crossing (number)	14	22
Houses within 50 feet of construction work area (number)	0	0

a/ Based on nominal right-of-way width of 120 feet. Additional temporary workspace not included.
b/ Based on nominal right-of-way width of 100 feet. Additional temporary workspace not included.
c/ Corresponds to route filed by San Patricio Pipeline LLC on June 23, 2004.

Route Alternative C would be 3.4 miles longer than Cheniere's preferred pipeline route. It would affect less wetlands. The disadvantage of Route Alternative C is that it would cross eight more roadways than Cheniere's proposed route. We believe that Route Alternative C does not offer an environmental advantage over Cheniere's proposed route, and therefore we do not recommend use of the alternative.

3.4.2 Aboveground Facility Site Alternatives

Cheniere proposes to construct eight meter stations in the Sinton, Texas area as part of the proposed Project. Cheniere identified seven meter station locations in its December 22, 2003 application. As a result of civil surveys and landowner consultations completed since the original application was filed, Cheniere now proposes new locations for four meter stations (Tetco Pipeline Interconnect, Gulf South, Channel, and FGT) that would move the meter stations from the middle of agricultural fields to near existing roads (see appendix B, figure B-1). This would eliminate the need for permanent access roads to these meter stations across the fields. The area required for construction and operation of these stations would remain the same; however, lateral pipelines would be required to the Gulf South, Channel, and FGT meter stations to connect to the mainline. The Gulf South meter station would require a 3,100-foot-long lateral that would be within the same operational right-of-way as the mainline. The Channel and FGT meter stations would require 950- and 400-foot long lateral pipelines, respectively.

Our review of the revised proposed sites identifies no issues that warrant the identification of alternative sites. The revised proposed sites would minimize impacts to agricultural land from the originally proposed sites, and the revised site locations would not adversely affect other existing land uses or protected resources. In particular, the new locations would minimize the permanent loss of agricultural land that would result from the original placement of the meter stations and the need for permanent access roads in the middle of fields. Therefore, we have not conducted further alternatives analysis of other potential sites for aboveground facilities associated with the proposed pipeline.

4.0 ENVIRONMENTAL ANALYSIS

4.1 GEOLOGIC RESOURCES

4.1.1 Geologic Setting

The proposed Cheniere Corpus Christi LNG Project would be located in the Gulf Coastal Prairie region of the Gulf Coastal Plains geomorphic province. The region is characterized by recent Holocene alluvial deposits, deltaic, beach, bay-estuary, and marsh deposits underlain by deep Pleistocene deltaic and alluvial deposits of interlayered clays and sands. The regional topography is nearly flat, with soils and subsurface sediments that slope gently toward the Gulf.

The LNG terminal would be located within a bay-estuary system that formed upon the Pleistocene Nueces River fluvial deltaic system. Large sediment loads were deposited towards the coast during interglacial periods, and broad deltas and large floodplain areas were formed. The Nueces River valley filled with fluvial and marine sediments as the shoreline receded to its present position. Holocene alluvial and floodplain deposits that are underlain by the Pleistocene Beaumont Formation occur at the LNG terminal site. Upper layers of this formation consist of sands, silty sands, and clayey sands that are deposited in a tidally influenced back bay environment. The Pleistocene Lissie Formation underlies the Beaumont Formation and consists of alluvial clay and lenticular sandstone. The proposed pipeline would also be located on recent Holocene alluvial deposits that are underlain by deep Pleistocene deltaic and alluvial deposits. From MP 0.0 to MP 18.9 the pipeline would be underlain by the Beaumont Formation and from MP 18.9 to MP 23.0 it would be underlain by the Lissie Formation.

4.1.2 Extractive Resources

4.1.2.1 Oil and Gas

Four plugged and abandoned wells are located within the LNG terminal and marine basin site. The La Padre Well, located in the north-northwest section of the site, is a dry well that was plugged in March 1945. Two wells, the Reynolds Aluminum Well (gas well) and State Tract 1 Unit Well (dry well), located in the south-southeast section of the site, were plugged in August 1977 and September 1975, respectively. One well, the Green Estate Well (gas well), lies about 100 feet east of the LNG terminal and marine basin site and was plugged in January 1975. All wells were plugged with cement. Cheniere is in the process of determining whether any of the four plugged and abandoned wells would interfere with or be impacted by construction of its proposed LNG facility and marine basin; Cheniere would file its determination with the Commission and identify future action.

Cheniere identified three existing natural gas pipelines, Royal, Crosstex, and Gulf South, that would be impacted by construction of the LNG terminal and marine basin. These facilities are described in section 2.9 of this EIS.

The pipeline would cross an unnamed oil and gas field between MPs 5.5 and 6.5. The Midway Oil Field, Taft Oil and Gas Field, and Potilla Oil and Gas Field would be crossed between MPs 7.5 and 8.5, MPs 15.1 and 19.0, and MPs 19.0 and 23.0, respectively. Oil and gas deposits would be significantly below the depth of the pipeline trench, and should not be disturbed by construction or operation of the Project.

The pipeline would be within 150 feet of 12 oil and gas wells. Four wells would be within the construction right-of-way (MPs 8.0, 8.2, 17.9, and 21.0) and 3 wells would be within 50 feet of the construction right-of-way (MPs 7.9, 8.4, and 22.6). Generally, these are abandoned wells located in agricultural fields; however, their exact location in relation to the pipeline has not yet been field verified. Cheniere indicated it would consult with the RRC of Texas to obtain additional information about oil and gas wells within 150 of the construction right-of-way. Field verification surveys would be conducted to confirm the location of such wells prior to construction. If an oil or gas well is found near the pipeline centerline, Cheniere would request a variance from the FERC if necessary, and adjust the pipeline centerline to avoid the well. Should an unidentified oil and gas well unexpectedly be encountered during construction, Cheniere would stop all work, notify the environmental inspector and the FERC, contain any spillage of product and secure the area, and consult with the TCEQ regarding remediation. The well owner would be identified and notified, and may take such action as plugging the well, and Cheniere would reroute the pipeline around the discovery if possible.

4.1.2.2 Mineral and Gravel

The proposed pipeline would be within 200 feet of a sand and clay pit between MPs 1.7 and 1.8. The proposed pipeline would not affect this pit.

4.1.3 Paleontological Resources

No sensitive paleontological resources have been identified in the proposed Project area.

4.1.4 Geologic Hazards

Geologic hazards that can potentially affect LNG and pipeline facilities include seismicity and faulting, soil liquefaction, subsidence, karst terrain, slope stability, and flooding/storm damage.

4.1.4.1 Seismicity and Faulting

The proposed Project is located within the Gulf Coastal Plains geomorphic province, which is characterized by a low seismic hazard potential. According to the Seismic Risk Map for the Uniform Building Code, the Gulf Coast region, including the Project area, is within Seismic Zone 0, the lowest risk zone.

To further assess seismic hazards at the LNG terminal site, Cheniere conducted a site-specific seismic hazard analysis. This analysis included development of a seismotectonic model in order to evaluate seismic hazards with respect to the NFPA guidelines for stationary LNG storage containers. Results of this study indicate that due to very low level of ground motion predicted at the site, earthquake hazards were not considered a controlling factor in facility design.

Although numerous faults exist in the Gulf Coast Region, review of the physiographic and historical data for the Project indicates that movement along these faults in modern times is the result of subsidence due to petroleum production and groundwater pumping (see section 4.1.4.3, below). A low risk of seismic activity and faulting effects can be reasonably anticipated for the Project area. Therefore, we conclude that the potential for large-magnitude seismic activity in the vicinity of the Project is low.

4.1.4.2 Soil Liquefaction

Soil liquefaction is the transformation of loosely packed sediment, or cohesionless soil, from a solid to a liquid state as a result of increased pore pressure and reduced effective stress, such as intense and prolonged ground shaking from seismic events. While sediments and landforms present in the Project area have the potential to perform in this manner under seismic shaking events, our analysis indicates that the low risk of seismic activity in this area minimizes the potential hazard to the Project from soil liquefaction. Therefore, we conclude that soil liquefaction would not be a significant hazard for the Cheniere Corpus Christi LNG Project.

4.1.4.3 Subsidence

Subsidence is defined as sudden sinking or gradual downward settling of land with little or no horizontal motion, caused by surface faults, and intensified or accelerated by subsurface mining or the pumping of oil, natural gas, or groundwater. Groundwater extraction in San Patricio County is primarily for irrigation and the amount of groundwater pumped varies. There are a number of oil and gas fields in San Patricio County. Various degrees of subsidence have been documented along the entire Texas coast, with the most significant subsidence in the Houston-Galveston area (Gibeaut et al., 2000).

Subsidence is typically a concern when designing LNG storage tank foundations. However, the Project area is underlain by consolidated stiff to hard clays and medium to dense sands, and the property has been loaded by bauxite storage piles up to 80 feet high. In addition, there is no significant oil and groundwater extraction in the vicinity of the proposed LNG terminal. We believe that subsidence would not be a significant hazard to the proposed LNG terminal.

The pipeline would cross oil and gas fields at MPs 5.5 to 6.5, 7.5 to 8.5, 15.1 to 19.0, and 19.0 to 23.0. Subsidence has been documented at the Saxet Oil Field west of Corpus Christi (Gibeaut et al., 2000), over 20 miles from the Project site, but no subsidence has been reported in the oil and gas fields that would be crossed by the proposed pipeline.

4.1.4.4 Karst Terrain

Karst terrain develops in areas that are underlain by carbonate rocks and evaporites. Groundwater dissolution of near-surface carbonate rocks and evaporites, combined with surface weathering and erosion produces karst topography. The potential for karst is greatest where surficial deposits are less than 30 feet thick and the underlying carbonate rocks occur at a depth at or just above the water table. These conditions do not exist in the Project area; therefore, we conclude that subsidence related to karst terrain would not be a hazard for the Cheniere Corpus Christi LNG Project.

4.1.4.5 Slope Stability

Cheniere analyzed slope stability at the LNG facility because the sides of the proposed marine berth would have a 3:1 slope and would be dredged to a depth of minus 42 feet. The analysis indicated that La Quinta Channel receives minimal wave action; however, scour from tugboat propeller wash could cause slumping or slope failure of the new marine basin. To minimize this impact, Cheniere would require that tugboats pull LNG vessels off of the dock from the bayward side of the vessel rather than push from the landward side, which would avoid propeller wash directed towards the shoreline. Cheniere would also protect the shoreline by installing rock breakwaters and articulated block revetments.

Fill slopes in upland portions of the LNG terminal site would be graded to 4:1 slopes following construction. All slopes would be seeded and maintained in a grassy condition as part of terminal operations.

The proposed pipeline crosses land that is relatively flat, with elevations ranging from 25 to 80 feet above msl. We conclude that landslide and slope stability would not be a significant hazard for the Cheniere Corpus Christi LNG Project.

4.1.4.6 Flooding/Storm Damage

The Cheniere Corpus Christi LNG Project would be located along the Gulf of Mexico shoreline and would be subject to coastal storms, hurricanes, flooding, and other coastal processes. According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), a majority of the proposed LNG terminal site would lie within Coastal Flood Zone C; however, shoreline areas would be located in Zones V22, A16, and B. The marine terminal and LNG transfer lines would be in Zones V, A, or B. The proposed pipeline would lie within either Zone A or B. Project facilities within Zone A (MPs 1.0 to 2.0, 2.4 to 3.3, 10.5 to 11.3, and 17.6 to 20.4) would be subject to more frequent flooding. Table 4.1.4.6-1 includes definitions of FEMA flood hazard zone designations in the Project area.

TABLE 4.1.4.6-1

Federal Emergency Management Agency Flood Hazard Zone Designations in the Cheniere Corpus Christi LNG Project Area

Zone Designation	Description
Zone A	Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.
Zone A1-A30	Zones A1-A30 are the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.
Zones B and C	Zones B and C are the flood insurance rate zones that correspond to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No Base Flood Elevations or depths are shown within this zone.
Zone V	Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

Cheniere reported that the Digital Storm Atlas of Texas predicts that a Category 5 hurricane could produce a storm surge of up to 20 feet at the LNG terminal site. Cheniere stated that the marine slip site would be located in an area that is susceptible to storm surge and flooding. The shoreline facilities would be designed to withstand this storm surge and flooding. The top of the dock, main processing equipment, storage tanks, and administrative buildings would be located in upland areas at elevations greater than 20 feet msl, above the elevation of a 20-foot storm surge.

4.2 SOILS AND SEDIMENTS

4.2.1 Soils

Four soil series are mapped by the NRCS at the southern portion of the proposed LNG terminal, in the open land between bauxite residue Beds 22 and 24 and the La Quinta Channel. These soils are classified as Edroy clay, Monteola clay (5-8 percent slope), Papalote fine sandy loam (0-1 percent slope), and Orelia sandy clay loam. The northern portion of the terminal is mapped by the NRCS as "wasteland." This includes existing bauxite residue Beds 22 and 24 and the area formerly used for bauxite ore storage.

Cheniere had a consultant conduct geotechnical studies at the LNG terminal. A 6-inch thick layer of shell was found in the stockpile area, separating the bauxite ore from the natural soils. Three soil borings were drilled at the center of each LNG tank location to a depth of almost 300 feet; eight borings were made in the process area and along the proposed transfer pipeline route, at depths between 25 feet and 74 feet; and nine borings were made in the berth area, to a maximum depth of 175 feet. Onshore subsurface stratigraphy consists of interbedded layers of stiff to hard fat clays, lean clays, sandy lean clays, and dense silty sands.

Between 1957 and 1984, the U.S. government arranged to have approximately 5,685,195 tons of bauxite ore, imported from British Guyana and Jamaica, stockpiled in the northern portion of the proposed LNG terminal site where Cheniere proposes to place its LNG storage tanks and vaporization and processing facilities (see table 4.2.1-1 below). All but one of these stockpiles have been removed, and Sherwin expects to remove the remainder by 2005. Bauxite is aluminum ore. Naturally occurring, it is composed of aluminum hydroxide, aluminum silicate, iron oxide, silica, titania, and other trace minerals. Bauxite is principally used in the production of alumina, the oxide of aluminum, which is then used in the production of aluminum metal.

TABLE 4.2.1-1

Government Stockpiles of Bauxite Formerly Stored at the Proposed Cheniere Corpus Christi LNG Terminal Site

Stockpile No.	Size (acres)	Height (feet)	Weight (tons)	Origin	Years Deposited	Years Removed
5	8.3	50	262,106	British Guyana	1961-1962	1998-1999
4	62.6	62	4,304,545	Jamaica	1960-1984	1994-2003
2	21.5	74	1,118,544	Jamaica	1957-1959	2003-2005

Since 1953, the Reynolds Metal Company (Reynolds), and its successor, Sherwin, have processed bauxite ore at the plant next to the proposed Cheniere Corpus Christi LNG terminal. The plant is capable of producing 1.4 million tons of smelter grade alumina and 300,000 tons of chemical grade alumina hydrate per year. The plant uses the so-called "Bayer" process, in which the bauxite ore is crushed and screened, mixed with caustic alkaline solution, heated in autoclaves, and then precipitated using sodium hydroxide. During the filtration portion of the process, residues that do not dissolve during the caustic treatment are separated out from the sodium aluminate solution, washed to recover the caustic soda, and pumped to disposal areas. This bauxite residue is referred to as "red mud," and consists of oxides of alumina, silicon, calcium, sodium, iron, titanium, with trace amounts of barium, boron, cadmium, cobalt, gallium, scandium, and lead. The red mud is discharged in a slurry of 25 to 60 percent solids, and sent to impoundment areas (also referred to as tailings ponds). The impoundments for the Sherwin plant are underlain by in-situ clay; and are equipped with run-on/run-off controls. Once the water in the tailings ponds is removed, the red mud dries, with a very fine particle size (EPA, 1990; World Bank, 1998; Energetics, Inc., 2000). Between 1954 and 1969 Reynolds deposited about 1.6 mcy of alumina processing waste materials in the areas known as Beds 22 and 24, and about 7.5 mcy of red mud was deposited in what is known as Alcoa Facility 200.

Cheniere proposes to cover existing bauxite residue beds with materials dredged from its LNG marine basin and maneuvering area. About 1.2 mcy of dredged material would be deposited in DMPA 1, covering Beds 22 and 24 and the adjacent V-Ditch, and about 3.2 mcy would be deposited in DMPA 2 at Alcoa's Facility 200. The dredged sediments would consist mainly of lean or fat clays, and silty clays (see section 4.2.2 below). Proposed DMPAs are shown on figure 2.3-1.

Cheniere's proposed pipeline would cross two soil series mapped by the NRCS: the Victoria-Raymondville-Oriela association, and the Orelia-Papalote association. These soils include clay, clay loam, and sandy clay loam.

4.2.1.1 Soil Limitations

We reviewed data provided by Cheniere and other published data to evaluate the soils that would be most susceptible to impact from the Project. Limitations were reviewed for soils within the LNG terminal site as well as the proposed pipeline route. Table 4.2.1.1-1 provides a summary of soil limitations associated with the proposed LNG facility and table 4.2.1.1-2 summarizes soil characteristics crossed by the proposed pipeline. Major soil limitations are discussed below.

Hydric Soils

Hydric soils are defined as "soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (FR, July 13, 1994). Soils that are artificially drained or protected from flooding (*e.g.*, by levees) are still considered hydric if the soil in its undistributed state would meet the definition of a hydric soil. These soils are typically associated with wetlands, although that is not the case for the hydric soils on the LNG terminal site. Construction of the LNG terminal would affect about 1.0 acre of hydric soils (see table 4.2.1.1-1). No hydric soils have been identified along the route of the sendout pipeline, except at the few wetlands crossed and in isolated areas where soils with high clay content have been subjected to periods of heavy saturation. Cheniere would construct the Project in accordance with our Procedures, which include provisions for wetland crossings and special construction measures in areas of saturated soils. We believe that Cheniere's implementation of these measures, as well as use of Best Management Practices (BMPs) during construction, would minimize impacts on hydric soils.

TABLE 4.2.1.1-1

Soil Series Impacted by the Cheniere Corpus Christi LNG Terminal

Soil Series	Area Affected by Construction (acres)	Area Affected by Operation (acres)	LNG Terminal Component	Prime Farmland	Hydric Characteristics
Edroy clay	1.0	1.0	LNG Transfer Piping, Utility Lines, Maintenance, Warehouse, Control Facilities	No	Hydric
Monteola clay, 5 - 8 % slopes	1.5	1.5	Marine Slips and Dock	No	Not Hydric
Papalote fine sandy loam, 0 - 1 % slopes	0.4	0.4	Administration Building	Yes	Not Hydric
Orelia sandy clay loam	1.4	1.4	LNG Transfer Piping, Utility Lines	No	Not Hydric
Raymondville clay loam, 0 - 1 % slopes	0.5	0.5	Utility Lines	Yes	Not Hydric
Wasteland	283.1	283.1	LNG Storage Tanks, DMPA 1, LNG Transfer Piping, Utility Lines, Vaporization Facilities, Maintenance, Warehouse, Control Facilities	NA	NA
Total	287.9	287.9			

NA – Not applicable

TABLE 4.2.1.1-2

Soils Crossed by the Proposed Pipeline

Milepost	Soil Association	Area Affected by Construction (acres) a/	Severe Erosion Potential	Revegetation Potential	Severe Compaction Potential	Drainage	Rock	Flooding
0.0-18.5	Victoria-Raymondville-Orelia	287.8	Little to none	High	High	Very slow to slow	NA	Moderate
18.5-22.5	Orelia-Papalote	60.4	Little to none	Medium	Low	Very slow to slow	NA	Moderate
22.5-23.0	Victoria-Raymondville-Orelia	9.7	Little to none	High	High	Very slow to slow	NA	Moderate

a/ Includes area within 120-foot-wide construction right-of-way, additional temporary work space (appendix C), and aboveground facilities.

Compaction Potential

Soil compaction modifies the structure and reduces the porosity and moisture-holding capacity of the soil. The degree of compaction is dependent on moisture content and soil texture. Fine-textured soils with poor internal drainage are the most susceptible to compaction. Construction equipment traveling over wet soils could disrupt soil structure, reduce pore space, increase runoff potential, and cause rutting. Compaction and rutting impacts would be more likely to occur when soils are moist or saturated.

Approximately 2.5 acres that would be disturbed during construction of the LNG terminal have the potential to experience some level of soil compaction. The Edroy clay and Monteola clay associations were identified as having a high compaction potential. The potential impacts would be minimal given that the site would be highly developed with systems designed to manage stormwater runoff; the potential increase in stormwater runoff is the primary concern from compacted soils at the terminal site.

Along the sendout pipeline route, the Victoria-Raymondville-Orelia soil association, between MPs 0.0 and 18.5, has a high potential for compaction. Construction of the pipeline and aboveground facilities in this area would temporarily affect about 288 acres of this soil association. Cheniere would mitigate for potential compaction in agricultural areas by following measures in FERC's Plan. Mitigation for soil compaction would include topsoil segregation and deep tillage operations using a paraplow or similar implement. In areas where topsoil is segregated, plowing to alleviate compaction would take place before the topsoil is replaced. We believe that use of these measures during construction would minimize soil compaction resulting from construction of the proposed Project.

Revegetation Potential

Areas where aboveground facilities would be built would not be revegetated. This would encompass about 59 acres at the LNG terminal, including roads. The aboveground facilities along the pipeline would cover about 4.3 acres. Along the pipeline route, no soils were identified which have a low potential for revegetation.

The existing bauxite residue beds at the LNG terminal, covering about 458 acres, have very poor potential for revegetation in their present condition. The pH of red mud is between 10 and 12. The refining of bauxite ore removes most of the organics, and imparts some process materials into the residue that inhibits the growth of plants. Beginning in 1993, at its Facility 200, Alcoa experimented with the application of treated wastewater bio-solids and effluent, hauled in from the cities of Aransas Pass, Gregory, and Portland, on its alumina tailings. The deposit of nutrients near the surface of the tailings worked to promote plant growth. In a similar manner, Cheniere claims that using Facility 200 and Beds 22 and 24 for DMPAs will beneficially aid in the future revegetation of these areas. Based on consultations with the NRCS, Cheniere has filed a revegetation plan, including seed mixes, fertilization, and irrigation rates (see section 4.4.2 of this EIS).

4.2.1.2 Prime Farmland

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion as determined by the U.S. Secretary of Agriculture. In addition, prime farmland includes land that possesses the above characteristics but is being used currently to produce livestock and timber. Urbanized land and open water are excluded from prime farmland. Prime farmland typically contains few or no rocks, is permeable to water and air, is not excessively erodible or saturated with water for long periods, and is not subject to frequent, prolonged flooding during the growing season. Soils that do not meet the above criteria may be considered prime farmland if the limiting factor is mitigated (*e.g.*, artificial drainage).

We evaluate prime farmland where proposed permanent aboveground facilities would result in the loss of significant amounts of prime farmland. Construction and operation of the LNG terminal would affect about 0.9 acre of prime farmland soils. However, these soils are currently in industrial use, therefore loss of this acreage would not be a significant impact on prime farmland. The eight meter stations associated with the proposed pipeline would each be located on prime farmland soil (table 4.2.1.2-1). Operation of these aboveground facilities would result in the removal of a total of 3.9 acres of prime farmland soils from agricultural use. Because the majority of soils crossed by the pipeline are considered prime farmland, there is little opportunity to avoid placement of aboveground facilities on prime farmland. Because each of the meter stations would require only from 0.4 to 0.6 acre for operation, impact at each particular site would be minimal. We believe the loss of 3.9 acres of prime farmland as a result of operation of the proposed meter stations would not be a significant impact.

There could also be impacts on prime farmland from construction of the pipeline. These impacts could include interference with agricultural drainage, mixing of topsoil and subsoil, and soil rutting and compaction. These impacts would result primarily from trench excavation and backfilling, and vehicular traffic along the construction right-of-way. Most impacts would be short-term and would not affect the potential use of prime farmland for agricultural purposes. Cheniere consulted with NRCS regarding potential impacts on prime farmland soils and has agreed to segregate topsoil to a depth of 18 inches in Victoria clays and Raymondville clay loams (about 12.8 miles of the proposed pipeline route would cross these soil types). In addition, by adhering to the measures in our Plan designed to minimize impact on agricultural soils, Cheniere would minimize impacts on prime farmland.

TABLE 4.2.1.2-1

Meter Stations Located on Prime Farmland Soils

Facility	Milepost	Land Required for Operation (Acres)	Soil Classification
Tetco Pipeline Interconnect	7.8	0.5	Victoria-Raymondville-Orelia Association; Victoria Clay, 0-1% slopes
Gulf South Pipeline Interconnect	11.2	0.5	Victoria-Raymondville-Orelia Association; Victoria Clay, 0-1% slopes
Channel Pipeline Interconnect	14.6	0.5	Victoria-Raymondville-Orelia Association; Victoria Clay, 0-1% slopes
Florida Gas Pipeline Interconnect	16.5	0.5	Victoria-Raymondville-Orelia Association; Victoria Clay, 0-1% slopes
Tejas Pipeline Interconnect	21.3	0.5	Orelia-Papalote Association; Papalote fine sandy loam, 0-1% slopes
Natural Gas Interconnect	22.8	0.4	Victoria-Raymondville-Orelia Association; Victoria Clay, 0-1% slopes
Transco Interconnect	22.8	0.4	Victoria-Raymondville-Orelia Association; Victoria Clay, 0-1% slopes
Tennessee Gas Interconnect	23.0	0.6	Victoria-Raymondville-Orelia Association; Victoria Clay, 0-1% slopes
Total		**3.9**	

In a letter dated December 9, 2003, the NRCS indicated that it did not consider the construction of the pipeline to represent a permanent conversion of Important Farmland, because the land could still be used for agricultural production after the pipeline is installed, and the right-of-way reclaimed. However, construction of the aboveground facilities would result in the permanent conversion of 3.9 acres of prime farmland. In a letter dated May 24, 2004, the NRCS indicated that it had reviewed the aboveground structures and pipeline interconnects along the pipeline, and completed an AD-1006 (Farmland Conversion Impact Rating) form for each. The NRCS stated that the Farmland Protection Policy Act law states that sites with a score of less than 160 will require no further consideration. All sites scored less than 160.

4.2.1.3 Contaminated Soils

The EPA (1990) did a study to determine if bauxite residue, or red mud, could be considered a contaminant or hazardous material. Only three toxic constituents of concern were identified in red mud (arsenic, chromium, and radium-226), but in such small percentages as to not be considered a risk. The EPA concluded that red mud does not exhibit any of the characteristics of hazardous waste and these deposits have a low potential for danger to health and the environment. Alcoa has registered Beds 22 and 24 as Class 1 industrial waste sites with the TCEQ. Alcoa has entered into a Texas Risk Reduction Program (TRRP) with the TCEQ due to concentrations of arsenic in groundwater at Bed 22. The TRRP Closure Plan has not yet been finalized. Cheniere contends that use of Bed 22 as a DMPA would act as an infiltration barrier.

Cheniere proposes covering Beds 22 and 24 and Facility 200 with about 4.4 mcy of materials to be dredged out of the LNG marine basin and maneuvering area. Cheniere indicated that the dredged material would be virgin clay from the Beaumont formation of the Texas Gulf Coast, and does not contain contaminants (see section 4.2.2 below). Alcoa has submitted amendments to its existing permit with the TCEQ to allow it to take in the dredged material from the Cheniere Project.

Cheniere had a consultant conduct an environmental data search (EDS) of the Project area to identify known hazardous or contaminated sites. Only the Sherwin plant was identified as a potential hazardous waste site within 0.5 mile of the LNG terminal. Several reported spills or releases have been recorded at the Sherwin plant; however, these spills appear to have been within the plant property, and were relatively small. A number of potential hazardous waste sites were identified within 0.5 mile of the sendout pipeline route, mostly clustered in the cities of Gregory and Taft. However, the pipeline would not cross any known hazardous waste sites or areas that are known to contain contaminated soils. Additional information on hazardous, potentially hazardous, and solid waste management sites is included in section 4.7.6 of this EIS.

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment could adversely affect soils. The effects of contamination would typically be minor because of the low frequency and volumes of spills and leaks. Cheniere has developed a SPCC Plan for construction that specifies cleanup procedures in the event of soil contamination from spills or leaks of fuel, lubricants, coolants, or solvents. Cheniere has stated that it will file with the Commission a revised SPCC Plan that includes additional Project-specific measures (see section 4.3.2.3 of this EIS). Implementation of the measures in the SPCC Plan, revised to include certain Project-specific measures, would minimize potential for soil contamination.

4.2.1.4 Erosion Control

Factors that influence soil erosion include soil texture, structure, length and percent of slope, vegetative cover, and rainfall or wind intensity. Soils most susceptible to erosion by water are typified by bare or sparse vegetative cover, noncohesive soil particles with low infiltration rates, and moderate to steep slopes. Wind erosion processes are less affected by slope angles. Clearing, grading, and equipment movement could accelerate the erosion process, and without adequate protection could result in discharge of sediment to waterbodies and wetlands. Soil loss due to erosion could also reduce soil fertility and impair revegetation.

Soils within the LNG terminal with high erosion potential would be limited to the area labeled "wasteland" by the NRCS, which are highly disturbed due to previous industrial activity. Project impact on these soils would be from construction of the LNG storage tanks and vaporization and related processing equipment. None of the soils that would be crossed by the pipeline route have high potential for erosion.

While the remaining soil types affected by the Project are designated as having low erosion potential, areas such as stream banks and the banks of drainage ditches could also be susceptible to erosion resulting from construction activities. Cheniere would implement our Procedures and incorporate the erosion and sediment control practices specified in our Plan. These erosion control measures include the installation of slope breakers and sediment barriers such as silt fence or hay bales, and the use of mulch, seed, and erosion control fabrics. We believe that use of these measures would minimize soil erosion resulting from construction of the proposed Project.

4.2.1.5 Shoreline Erosion

The shoreline between Aransas Pass and the north boundary of the Padre Island National Seashore changes at variable rates because of engineering modifications which affect sediment deposits by trapping sand in the littoral drift system. Cheniere reported that the shoreline at its proposed LNG terminal site has been stable from about 1937 to 1982, and that there was no net change in the shoreline in this area due to erosion. The shoreline to the west and east of the site has retreated at an average rate of one to three feet per year during the same period due to bay wave action. A portion of the shoreline within the proposed LNG terminal site would be modified by dredging of the proposed marine basin and maneuvering area. The shoreline of the maneuvering area would be protected from erosion by articulated block mats or rock breakwaters.

The City of Port Aransas, in its comments on the proposed Ingleside Energy Center and Vista del Sol LNG projects, indicated that LNG ships passing through the channel within its city limits could contribute to its ongoing problem of shoreline erosion. The City of Port Aransas also stated that the LNG companies proposing facilities in the Corpus Christi Bay area "are aware of this problem and are willing to look at ways they can participate in the solution."

The potential for LNG ship movements to cause shoreline erosion is dependent on a number of factors, including number of ships; ship size, hull shape, speed, and draft; propeller action; and proximity to shore. The LNG ships would be generally comparable in size to the existing oil tankers and bulk freighters calling at Corpus Christi. Although LNG ships are quite long and wide they have a shallower draft and a greater under keel clearance than some of the other larger vessels using the channels. In the relatively narrow and shallow Corpus Christi and La Quinta Ship Channels this would mean the LNG ships would tend to have less wash effect in comparison to vessels with a deeper draft of similar overall size.

Vessel speed is the single most important factor in the generation of damaging wash. Because of their size and water displacement, and navigational safety, LNG ships calling on the Cheniere Corpus Christi LNG terminal would undertake the passage through the Corpus Christi and La Quinta Ship Channels at slow speeds, under the assistance of tug boats. The wave energy generated would be consistent with that of other large vessels traveling through the channels.

LNG ship traffic and frequency of passage is discussed in detail in sections 4.9.2 and 4.12.5 of this EIS. In summary, up to 300 ships would call on the proposed LNG terminal per year, which on average would be a frequency of one vessel movement inward and one vessel movement outward through the Corpus Christi and La Quinta Channels per day. This would represent a 5 percent increase over existing large vessel traffic in the channels. If the size of the LNG ships were to increase in the future, the number of dockings would decrease.

The City of Port Aransas has partnered with the TGLO and the PCCA to construct concrete bulkheads which protect about 5,335 linear feet of shoreline along the Corpus Christi Ship Channel. Cheniere has stated that a contribution of funds to the City of Port Aransas could potentially assist with ongoing or future projects to construct shoreline protection structures. For example, matching funds are often required for Federal or state grants. Cheniere indicated that it has discussed this possibility with the City Manager of Port Aransas and other Port Aransas officials. We recommend that:

- **<u>Prior to construction</u>, Cheniere should file with the Secretary details of its coordination with the City of Port Aransas, or other entities, regarding its planned or potential assistance with ongoing or future shoreline protection efforts.**

4.2.2 Sediments

The sediments that would be affected by the Cheniere Corpus Christi LNG Project are located within the proposed marine basin and maneuvering area. Dredging to an elevation of -42 feet plus up to 2 feet additional overdepth would remove about 4.4 mcy of sediments. The sediment types that would be dredged are described as stiff clays with interbedded sand and silt layers.

The physical properties of the sediment that would be dredged are represented by borings CB-47, CB-48, CB-52, and CB-54 that were drilled by Cheniere in 2003 near the proposed ship berths. The sampling and physical testing was done in accordance with standard methods published by the American Society of Testing Materials (ASTM). The sediment types observed in the borings are summarized below:

- CB-47. Lean Clay or Fat Clay from the mudline at elevation -6 feet (NGVD 29 datum) to the depth of dredging at elevation -42 feet.
- CB-48. Predominately Lean Clay or Fat Clay from the mudline at elevation -7 feet to the depth of dredging at elevation -42 feet. The sampling showed a 3-foot-thick layer of silty sand at elevation -23 feet and a 4-foot-thick layer of clayey sand at elevation -36 feet.

- CB-52. Predominately Silty Clay or Fat Clay from elevation -7 feet to the depth of dredging at elevation -42 feet. A 5-foot-thick layer of silty sand layer was observed at the ground surface at elevation -2 feet and the sampling showed a 4-foot-thick silty sand layer at elevation -30 feet.
- CB-54. Predominately Lean Clay, Fat Clay, or Sandy Lean Clay from elevation -6 feet to the depth of dredging at elevation -42 feet. A 5-foot-thick layer of silty sand was observed at the ground surface at elevation -1 foot and the sampling showed a 3-foot-thick clayey sand layer at elevation -18 feet.

The clay sediment consists of moderately to highly plastic, fat clay (classified as CH) or lean clay (CL). The clay samples have Liquid Limits from 31 to 93 percent, Plasticity Indices from 14 to 68 percent, and *in situ* moisture contents that are 1 to 8 percent above the Plastic Limits. The undrained shear strengths generally range from 500 pounds per square foot (psf) near the mudline to about 1,200 psf at a depth of about 10 feet, to about 1,500 to 2,500 psf at depths of 10 to 40 feet below the mudline. The clay sediment is over-consolidated, which is typical for clays in the Beaumont Formation. The clays are over-consolidated as a result of cyclical moisture content changes after deposition and cementing of the minerals along grain contacts.

Sediments near the surface in urban environments may be contaminated by release of various chemicals from human activities along the shoreline. The Final Environmental Impact Statement for the Corpus Christi Ship Channel Improvement Project (COE, 2003a) reported the results of sediments that were sampled and analyzed for organic and metallic chemicals. The COE's EIS included samples from the La Quinta Channel extension. In addition, three sediment cores were taken and analyzed for metals. In the COE's Final EIS, the results were compared to the Effects Range Low (ERL), which are used by NOAA Fisheries as screening levels for assessing sediment quality. These are conservative concentration levels and are considered the lowest concentrations where effects on the marine ecology have been observed. These are conservative levels used to identify sediment that may require additional evaluations before decisions on disposal or beneficial re-use are made.

In 1985 samples from the La Quinta Channel, arsenic ranged from 12 to 15 milligram per kilogram (mg/kg) in all six samples, which is above the ERL of 8.2 mg/kg. Six samples were taken from the same stations in 1990 and again in 2000, and all metals were below the ERL levels. Three samples were taken in 2000 from the La Quinta Extension and analyzed for metals, and all metals were below the ERLs.

The samples taken in 1985 were analyzed for polychlorinated biphenyls (PCBs) and pesticides and all detections were below ERL levels. The samples taken in 1990 and 2000 were analyzed for PCBs, pesticides, and polycyclic aromatic hydrocarbons (PAHs), and all detections were below ERL levels.

Cheniere reported that sediment samples were obtained from three cores and analyzed for metals. The results were compared to the Protective Concentration Levels (PCL) for Tier 1 commercial/industrial soil protective of Class 3 groundwater. All concentrations were below the PCL level.

4.3 WATER RESOURCES

4.3.1 Groundwater

The Project area is underlain by the Gulf Coast aquifer, characterized as an unconfined aquifer with unconsolidated sand, silt, and clay deposits. The lithology of the Gulf Coast aquifer system reflects three depositional environments: continental (alluvial plan), transitional (delta, lagoon, and beach), and marine (continental shelf). Numerous retreats and advances of ancient shorelines have resulted in a complex, overlapping mixture of sand, silt, and clay (Ryder, 1996). In San Patricio and Nueces Counties, the primary water-bearing stratigraphic units are the Pliocene Goliad Sand, the Pleistocene Lissie and Beaumont Formations, and Holocene alluvial and beach sands in the Nueces River valley (Shafer, 1968).

The Chicot and Evangeline aquifers are commonly used hydrogeologic unit designations for subdivisions of the upper, mostly sandy portion of the deposits. Water supply wells in southeastern San Patricio County are screened in the Chicot aquifer at depths typically less than 50 feet deep. Groundwater in the county is mainly used for irrigation. However, its use is limited by high chloride, salinity, and alkalinity in the groundwater.

The EPA has not designated the Gulf Coast aquifer as a sole source aquifer. The Project crosses no locally zoned aquifer protection areas.

Because no near surface bedrock has been identified in the Project area, Cheniere anticipates that no blasting would be required. Based on Cheniere's review of Texas Water Development Board data there are no public or private water supply wells located within 150 feet of the proposed Project. In addition, there are no wellhead protection areas (also known as source water protection areas) crossed by the Project. Most municipal water systems in San Patricio and Nueces Counties obtain water from Lake Corpus Christi, Lake Texana, or the Nueces River.

Cheniere's geotechnical consultant discovered static groundwater in its subsurface borings at the LNG storage tank locations between 4 to 5 feet below existing grade. It may be necessary to dewater during construction, if shallow groundwater is encountered during excavations. Freewater can be pumped out of the trench using sumps. This dewatering would result in the temporary lowering of groundwater. Because of the relatively small amount of water removed, the short duration of the activity, and the local discharge of the water, groundwater levels would quickly recover after pumping stops. Cheniere has offered no mitigation measures for groundwater impacts. However, Cheniere would follow our Plan and Procedures. Our Plan requires the location of dewatering structures so that there would be no deposition of sediments into wetlands and waterbodies, and no cultural resources or habitat for sensitive species would be impacted. We believe that effects of dewatering on groundwater and other environmental resources would be localized, temporary, and insignificant.

Hydraulically driven pilings would be used during the construction of the berthing docks and pipe racks. A potential impact associated with driven pilings is the contamination of aquifer layers through seepage from one layer to another. Cheniere's design plans for the berthing facilities show maximum depth of pilings at less than –40 feet msl. At this depth, the pilings would stay within the permeable zone (Chicot aquifer). Keeping the pilings within one layer of the aquifer system and not crossing multiple aquifer layers minimizes the potential for cross-contamination. Foundations of all other facilities associated with the LNG terminal would be shallow in depth.

The greatest potential for impacts on groundwater would be an accidental release of a hazardous substance, such as fuels, lubricants, and coolants, during construction or operation. Cheniere has agreed to implement the FERC's Procedures, which include the preparation and implementation of Spill Prevention and Response Procedures that meet state and Federal requirements. Cheniere filed a SPCC Plan that provides measures to minimize the potential impacts of spills of hazardous materials. The SPCC Plan describes general preventative BMPs, including personnel training, equipment inspection, and refueling procedures to reduce the likelihood of spill. It also describes mitigation measures, including containment and cleanup, to minimize potential impacts should a spill occur. However, Cheniere's SPCC Plan included with its application does not include Project-specific provisions for designated refueling and hazardous materials transfer locations, hazardous materials disposal, or specific BMPs. Cheniere stated that it will develop a Project-specific SPCC Plan to address these items when it has selected a primary construction contractor for the LNG terminal and pipeline. Cheniere would coordinate with the RRC during development of this plan, and submit the final plan to the FERC and the RRC for approval. Implementation of Cheniere's Project-specific SPCC Plan would minimize or eliminate the potential for adverse impacts on groundwater resources.

4.3.2 Surface Water

4.3.2.1 Marine Water

The LNG terminal is on the north shore of Corpus Christi Bay, situated at the northwestern end of the La Quinta Channel. Corpus Christi Bay is included in the National Estuary Program, with a designation as an estuary of "national significance." The entire estuary system encompasses more than 25 smaller bays, including Nueces Bay north of the city of Corpus Christi and Redfish Bay east of the city of Ingleside, and numerous saltwater bayous. Corpus Christi Bay is approximately 75 miles long and covers about 600 square miles, extending from the brackish Aransas and Copano Bays at its northern boundary to Baffin Bay and the hypersaline Upper Laguna Madre at its southern boundary. Barrier islands, such as Mustang Island and Padre Island, separate Corpus Christi Bay from the Gulf of Mexico. The average depth of the bay ranges from 3 to 8 feet. The Corpus Christi and La Quinta Ship Channels have been dredged to a depth of 45 feet.

Corpus Christi Bay drains a semi-arid watershed encompassing about 11,000 square miles of land. The average annual rainfall on the bay varies from 24 to 36 inches; and its annual surface evaporation rate is 60 inches. The system's primary sources of freshwater are the San Antonio, Mission, Aransas, and Nueces Rivers. In recent years, freshwater inflows have declined due to increasing diversions and demands by municipalities, industries, farmers, and other residents, resulting in increased water salinity levels in the bay.

Wind speeds in the bay are high, while tidal currents are relatively weak. As a result, the bay can have high ambient suspended solid concentrations. A COE sea grass study in Laguna Madre modeled the relative contribution of dredging and wind in resuspending sediment in the bay. The study concluded that wind-caused waves are the most important factor for sediment resuspension in that part of Corpus Christi Bay (COE, 2000).

All designated uses of the Corpus Christi Bay are fully supported. Nevertheless, water quality issues affecting the bay include reduced inflow of fresh water; wetland habitat loss; chemical, heavy metal, and nutrient increases; brown tide; and floating debris.

The primary impacts on Corpus Christi Bay from construction and operation of the Project would be from dredging for the marine basin and from stormwater runoff from the LNG terminal. There is also the potential for impacts on the bay from accidental spills of hazardous materials during construction, or LNG spills during operation.

Details of Cheniere's proposed dredging are described in section 2.1.1.1 of this EIS. The primary impact on water quality from dredging would be a temporary increase in suspended solids in the water around the dredged area. Although hydraulic dredges capture the majority of sediment loosened by the dredge, there are some sediment particles that become suspended in the water.

Cheniere indicates that most of the material above elevation –43.0 feet consists of clay, whereas the material between elevation –2.0 and –8.0 feet and –29.0 and –35.0 feet consists of silty sand clay (11 percent passes through a –200 sieve). Silty sands are encountered between elevation –1.0 and –4.0 feet and poorly graded sands (7 percent passes through a –200 sieve) are encountered between elevation –4.0 and –6.0 feet. Clayey sands (41 percent passes through a –200 sieve) are encountered between elevation –18.0 and –22.0 feet.

Cheniere contends that turbidity caused by a cutterhead dredge is relatively minor, and is limited to the lower portion of the water column. Because of the width and depth of the dredging, channel currents should not be strong, and suspended sediments are expected to remain within the confines of the marine basin. Cheniere would use best management practices during dredging, including adjusting cutterhead rotational speed and hydraulic pump operating parameters to entrain the maximum amount of material and minimize turbidity.

The COE's EIS for its proposed Corpus Christi ship channel improvements addressed potential impacts on water quality from dredging an extension of La Quinta Channel. The EIS evaluated historical data on a number of contaminants found in sediments, dredge maintenance material, and water quality samples. The COE concluded that, overall, there is no indication of current water quality problems in the La Quinta Channel, or problems that would result from dredging to extend the La Quinta Channel (COE, 2003a).

Cheniere would use hydraulic dredging to remove sediment to create the necessary depth at the marine basin. In order for a hydraulic dredge to move sediment, a large volume of water must be added to make a slurry that can be pumped. The volume of water is typically 4 to 8 times the in-place volume of sediment removed, so that about 800 to 1,600 gallons of water are added for each cubic yard of sediment dredged. The dredged material slurry would be pumped into the DMPAs (see figure 2.3-1), where the sediment particles would settle by gravity to the bottom of the ponds and be separated from the overlying water (called return water). This water would then flow to Corpus Christi Bay via an existing San Patricio County drainage canal along the west boundary of the LNG terminal site. The water that is separated from the sediment would contain some fine-grained sediment particles that would not settle out but would remain in suspension.

Cheniere would be required to obtain several permits that would address dredging and dredged material management, including permits from the COE under Section 404 of the CWA and Section 10 of the Rivers and Harbor Act. Permits for water discharges into the bay from the LNG terminal would be obtained from the EPA and/or the TCEQ under Section 401 of the CWA. A National Pollutant Discharge Elimination System (NPDES) permit under Section 402 of the CWA issued by the RRC would be necessary to regulate return water emanating from the DMPAs.

Operational impacts of the LNG terminal on marine waters would include periodic maintenance dredging of the marine basin, as well as propeller wash from ship traffic in La Quinta Channel. Both maintenance dredging and propeller wash could result in increased turbidity in the bay from the resuspension of bottom sediments. The marine basin would include rock breakwaters and concrete revetments to stabilize the shoreline and prevent erosion from wave action and propeller wash. In addition, the LNG ships berthed at the docks would act as a shield against propeller wash. We believe that turbidity caused by maintenance dredging using a hydraulic cutterhead dredge would be short-term, localized, and not significant. Cheniere has stated that materials removed by maintenance dredging would be pumped to DMPA 2.

During operation of the LNG terminal the SCVs would generate fresh water (see sections 2.1.4.5 and 4.3.2.2 of this EIS). This water would be pumped into the Sherwin raw water reservoir for use at the alumina plant. Cheniere estimates that on rare occasions when the reservoir is full due to heavy rains, excess water would be discharged through the existing drainage ditch at the west side of the Cheniere property into Corpus Christi Bay (see section 4.3.2.2 below). Cheniere stated that it anticipates acquiring permits from the EPA and the TCEQ for this water disposal.

Stormwater collected at the LNG terminal would also be discharged through the San Patricio County drainage canal on the west side of the Cheniere tract into Corpus Christi Bay. Stormwater removal from within the LNG storage tank dikes must conform to 49 CFR 193.2173, requiring water to be pumped out at 25 percent of the maximum predictable collection rate from a storm of 10-year frequency and 1-hour duration. Our Procedures, which Cheniere would follow, require that prior to construction Cheniere must prepare a Stormwater Pollution Prevention Plan that complies with the EPA's National Stormwater Program General Permit requirements. Cheniere indicated it would need to acquire permits from the EPA and the TCEQ for stormwater discharges from the LNG terminal.

Sanitary wastewater, treated on site, would be released to the Corpus Christi Bay with stormwater under the NPDES permit. The potable water supply would be obtained from a San Patricio Municipal Water District 24-inch main water line at the junction of SHs 35 and 361.

In the event of an accidental spill of oil, gas, lubricants, or other hazardous materials during construction or operation, Cheniere would follow the measures outlined in its SPCC Plan. Cheniere has designed its LNG terminal to account for an accidental spill of LNG during operation of the facility, and prevent the LNG from entering Corpus Christi Bay (see section 2.7.1 of this EIS). Any LNG spills along the docks would be collected in a trough leading to a spill impoundment basin. Likewise, an accidental spill along the transfer pipeline would be collected in a trough draining to an impoundment basin. The LNG tanks would be surrounded by earthen dikes to contain any spills.

LNG vessels calling at the LNG terminal would be required to have a vessel response plan that satisfies USCG requirements and where applicable international standards. Cheniere would confirm that operators of vessels that call on the LNG terminal are aware of this requirement.

4.3.2.2 Fresh Water

The only body of fresh water in the vicinity of the proposed LNG terminal is Sherwin's raw water reservoir. This reservoir is within the thermal exclusion zone for the LNG terminal. Although the reservoir is owned by Alcoa, it is used by Sherwin for its alumina manufacturing. The reservoir holds approximately 128,800,000 gallons of water, and Sherwin uses about 1,855,000 gallons per day.

Cheniere would utilize the reservoir to dispose of hydrostatic test water, and water generated by its SCVs during operation of the LNG terminal. Cheniere would initially fill the SCVs with water it obtains from the San Patricio Water District and trucks to the LNG terminal. It would take about one million gallons of water to initially fill all the SCVs (63,000 gallons per unit). Once the LNG terminal is operating, the SCVs would generate up to 304 gpm. In total, the SCVs would contribute about 430,000 gallons per day to the reservoir, which is less than Sherwin's daily withdrawals. The SVC water would replace water Sherwin is currently purchasing from the San Patricio Water District. On rare occasions when the Sherwin raw water reservoir is full (most likely because of heavy rain events), excess water would be discharged into the San Patricio County drainage ditch at the west side of the LNG terminal, ultimately ending up in Corpus Christi Bay. Cheniere would obtain all appropriate permits before discharging any water to Sherwin's raw water reservoir or the drainage ditch.

The water from the SCVs would contain dissolved sodium carbonate from the vaporization process, and have a pH between 6.0 and 8.0. Cheniere claims this should not be considered contaminated water. This slightly acidic water would be buffered in a holding basin (up to 20,000 gallons located approximately 300 feet northeast of the vaporizer area). The water would be held for up to one hour before being pumped into the raw water reservoir.

Cheniere states that SCV water quality is generally below available risk screening levels, and that two analytes, copper and silver, may exceed the Texas Natural Resource Conservation Commission (now known as TCEQ) screening level for Marine Surface Water, and that total suspended solids may exceed the Texas Surface Water Quality Standards. Any discharge of SCV water to Corpus Christi Bay would be monitored and limited by the conditions of Cheniere's NPDES permit.

At the southern end of the LNG terminal property is a drainage area referred to as the V-ditch. The V-ditch collects stormwater runoff from bauxite residue Beds 22 and 24 and discharges into Corpus Christi Bay via two 54-inch-diameter concrete pipes. The V-ditch would be covered by Cheniere's proposed DMPA 1.

The proposed pipeline would cross 10 surface waterbodies. None of the waterbodies crossed by the Project are listed in the TCEQ Draft 305(b) Water Quality Inventory, so there are no officially designated uses for them. There are no potable water intakes within 3 miles downstream of any waterbody crossings. No waterbody segments that would be crossed by the pipeline are included on the list of impaired waterbodies under Section 303(d) of the CWA or have concerns resulting from contaminated sediments. Table 4.3.2.2-1 provides a list of the waterbodies crossed by the proposed pipeline, including location by MP, waterbody name, type, crossing width, water quality classification, fishery type, and proposed crossing method. Only two natural, permanently flowing streams would be crossed by the pipeline: Oliver Creek (MP 16.8), and Chiltipin Creek (MP 18.0).

TABLE 4.3.2.2-1

Waterbodies Crossed by the Cheniere Corpus Christi Pipeline

Milepost a/	Waterbody	Type b/	Crossing Width (feet)	State Water Quality Classification	Fishery Type	Crossing Method
1.4	Drainage Ditch	C	35	Not Available	Warmwater	Open cut
2.6	Drainage Ditch	I	12	Not Available	Warmwater	Open cut
4.9	Drainage Ditch	I	20	Not Available	Warmwater	Open cut
10.1	Drainage Ditch	I	8	Not Available	Warmwater	Bore
12.6	Drainage Ditch	I	10	Not Available	Warmwater	Open cut
16.8	Oliver Creek	P	15	Not Available	Warmwater	Open cut
18.0	Chiltipin Creek	P	18	Not Available	Warmwater	Open cut
18.5	Tributary to Chiltipin Creek	I	10	Not Available	Warmwater	Open cut
18.6	Tributary to Chiltipin Creek	I	7	Not Available	Warmwater	Open cut
18.7	Tributary to Chiltipin Creek	I	5	Not Available	Warmwater	Open cut

a/ Milepost at canal/creek centerline
b/ Waterbody type: C=canal, I=intermittent drainage or stream, P=perennial stream

Cheniere would cross 9 of the 10 waterbodies using the open cut crossing method that would involve trenching directly across the waterbody. The greatest potential impact of the open cut construction method on surface waters is turbidity and sedimentation caused by instream construction or by erosion of cleared stream banks and riparian areas. The extent of the impact would depend on sediment loads, stream velocity, turbulence, stream bank composition, sediment particle size, and the extent of the disturbance to the channel. These factors would determine the density and downstream extent of the sediment plume. Turbidity from resuspension of sediments caused by instream construction or erosion of cleared riparian areas could reduce light penetration and the corresponding photosynthetic oxygen production. Resuspension of deposited organic material and inorganic sediments could increase consumption of biological and chemical oxygen, decreasing available dissolved oxygen in the water at the crossing and downstream.

Six of the nine waterbodies that would be crossed by the open cut method are intermittent streams and one is an irrigation canal. It is possible that no flow would be present during construction across these waterbodies, in which case crossing by the open cut method would have minimal impact on the waterbody. If flow were present in these waterbodies, and for the two perennial waterbodies that would be crossed by the open cut method, Cheniere would complete most instream work within 24 hours (for streams less than 10 feet across) or within 48 hours (for streams greater than 10 feet across). Trench spoils would be stored at least 10 feet from the water's edge and would have erosion and sedimentation controls installed. Stream banks would be stabilized and temporary sedimentation barriers installed across the right-of-way within 24 hours of completing instream construction. Therefore, most impacts would be temporary, and suspended sediment concentrations and turbidity levels would be expected to return to preconstruction levels soon after construction in each stream was completed.

Cheniere proposes to cross one waterbody, a canal at MP 10.1, by boring underneath the waterbody. This crossing method would avoid direct impact on the waterbody.

Stormwater from areas disturbed during construction would be discharged under a Construction General Permit, which Cheniere would obtain from the EPA under the NPDES program. In addition, Cheniere would obtain a Section 10 permit from the COE for work in navigable waterways and a Section 404 permit for placement of dredged or fill material into all waters of the U.S., including wetlands. A wastewater discharge permit would be obtained from the TCEQ.

In response to past concerns raised by Federal, state, and local agencies regarding the potential impact of construction of pipeline projects in general, we developed our Procedures to provide the minimum level of protection for surface waterbodies affected by pipeline projects. Our Procedures include requirements for pre-construction planning, environmental inspection, construction methods, sediment and erosion control, restoration, and post-construction maintenance. It includes provisions to handle stormwater and protection of waterbodies and wetlands from accidental spills of fuels or hazardous materials. Cheniere proposes to cross all waterbodies in accordance with our Procedures. We believe that using the measures detailed in our Procedures would minimize impacts on water resources.

Cheniere requested a variance to Section V.B.1 of our Procedures, which requires instream work be completed between June 1 and November 30 of any year for warm water fisheries. Cheniere proposes to conduct instream construction activities between March 1 through August 31. Cheniere notes that this is when San Patricio County, Texas experiences the lowest rainfall, and the streams would be at their lowest levels. We find this variance acceptable because it would increase protection of the streams and reduce impacts on surface fresh water resources.

Lubricant, hydraulic fluid, and fuel spills from refueling construction equipment, fuel storage, or equipment failure in or near a waterbody could flow or migrate to the waterbody and immediately affect aquatic resources and contaminate the waterbody downstream of the release point. Cheniere would follow the measures outlined in its SPCC Plan to minimize the potential impacts of spills of hazardous materials during construction on waterbodies.

4.3.2.3 Hydrostatic Testing

Prior to being placed into service, the proposed LNG storage tanks and pipelines would be hydrostatically tested to ensure structural integrity. Hydrostatic testing procedures for the LNG storage tanks and pipeline are discussed below.

LNG Storage Tanks

The three LNG storage tanks would require hydrostatic testing. Upon completion of construction, the inner tanks of the three LNG storage tanks would be tested hydrostatically, in accordance with API 620, Appendix Q.8. API Standard 620 deals with the design and construction of large, welded, field-erected low-pressure carbon steel aboveground storage tanks (including flat-bottom tanks) with a single vertical axis of revolution, and Appendix Q deals with low-pressure storage tanks for liquefied hydrocarbon gases at temperatures not lower than -270°F (Techstreet, 2004). Hydrostatic testing of the tanks would involve filling the inner tanks with approximately 27 million gallons of water each. Provided the tanks are completed on schedule, water used to test one tank would be transferred to the adjacent tank, until all three tanks are tested. Test water would be obtained from the San Patricio Municipal Water District by connecting to an existing 30-inch industrial waterline located on the adjacent Sherwin property. Hydrostatic test water would be discharged to the Sherwin raw water reservoir located just to the north of the proposed LNG storage tanks, vaporization, and processing area. The raw water reservoir provides approximately 128.8 million gallons of water storage, and Sherwin uses an average of 1.8 million gallons per day. Therefore the raw water reservoir would have enough volume to accommodate the additional one time discharge of hydrostatic test water from the LNG storage tanks.

Pumps in each tank would control the discharge rate of the test water. Energy dissipation devices, such as a splash plate or hay bale structure, would be used during discharge of hydrostatic water per the FERC's Plan and Procedures to prevent scouring and erosion. No chemicals would be added to the hydrostatic test water before or after testing. All test waters would be analyzed for chemical composition prior to discharge, and dissolved oxygen would be restored before discharge into surface waters.

Pipeline

Prior to being placed into service, the pipeline would also be tested to DOT standards, as listed in 49 CFR 192. Cheniere would use hydrostatic testing for the pipeline, which would require approximately 11.4 million gallons of water to fill the pipeline. Cheniere would obtain the water from an existing 30-inch-diameter raw waterline owned and operated by the San Patricio Municipal Water District located on the Sherwin property, approximately 2,300 feet east of the south end of the pipeline. The water would be transferred to the new pipeline for testing via an existing 8-inch service connection. The pipeline would be tested in two sections (MPs 0.0 to 2.1 and MPs 2.1 to 23.0). Water would be pushed from one section into the next via connecting piping at manifold sites as each test section is filled sequentially. The pipeline, or segments of the pipeline, would be pressurized to the design test pressure, and maintained at that pressure for a minimum of 8 hours and in accordance with regulatory code requirements. If during the test period any leaks are detected, the leaks would be repaired and the test section re-pressurized until the DOT specifications are met.

After testing each section, Cheniere would dewater and dry the pipeline by pushing the test water out with a foam pig using compressed air. Water would be discharged at an average rate of approximately 4,000 gpm into the Sherwin raw water reservoir located approximately 400 feet north of the south end of the pipeline. Cheniere would uses appropriate energy dissipation and erosion control measures to prevent scouring during dewatering. No chemicals would be added to the test water. As described above the raw water reservoir would have enough volume to accommodate the one time discharge of hydrostatic test water from the pipeline.

Discharge of hydrostatic test water used to test the integrity of oil and gas facilities requires permitting from the RRC, as regulated by the Texas Administrative Code (TAC) Title 16, Part 1, Chapter 3, Rule 3.30 Memorandum of Understanding Between the RRC and the TCEQ under Section (e)(6)(A). In addition, hydrostatic test waters that fall under the jurisdiction of the RRC and that would be discharged into waters of the state would require a permit from the EPA under the NPDES, as regulated by the CWA. The appropriate Section 401 Water Quality Certification and Section 404 permit must also be obtained prior to discharge of hydrostatic test water into surface waterbodies. Compliance with requirements of our Plan and Procedures, and with permitting requirements from EPA and state and local agencies would minimize impacts resulting from the discharge of hydrostatic test water.

4.4 VEGETATION

4.4.1 Wetlands and Submerged Aquatic Vegetation

The proposed Cheniere Corpus Christi LNG Project would affect both coastal and freshwater wetlands. The COE defines wetlands as areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Cheniere identified wetlands within the Project area by field delineations conducted in 2003 and 2004. Delineations followed the 1987 COE Wetland Delineation Manual (COE, 1987). Wetland types were classified using the FWS classification system (Cowardin et al., 1979). The wetland delineation reports are accessible as part of the Cheniere Corpus Christi LNG Project public files in Docket No. CP04-37-000 et al., using the e-library link on the FERC's Internet website.

The near-shore marine habitat and terrestrial wetland types that would be affected by the LNG terminal include estuarine emergent marsh (coastal marsh), estuarine submerged aquatic bed (seagrass), and estuarine tidal flat. Wetlands within the LNG terminal site are shown on figure 4.4-1. About 11.2 acres of coastal marsh occurs as a narrow strip of vegetation within the proposed LNG terminal within the intertidal shoreline. The dominant species in the estuarine marsh is smooth cordgrass (*Spartina alterniflora*), with lesser amounts of black mangrove (*Avicennia germinans*).

About 6.3 acres of tidal flat occurs as a narrow band between the coastal marsh and upland. This area is sparsely vegetated with glasswort (*Salicornia* spp.) and saltwort (*Batis maritime*).

The National Wetland Inventory maps identify several areas of spent bauxite tailings ponds on the proposed terminal site as palustrine and lacustrine, diked, impounded, and spoil wetlands.

Non-Internet Public

Page 4-23
Map

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

However, Cheniere's field delineations indicated that these areas do not support wetland hydrology and vegetation as defined by the COE delineation manual and therefore are not considered wetlands. In a letter to Cheniere dated July 15, 2004 the COE provided a jurisdictional determination and confirmed Cheniere's wetlands delineation, including confirmation that features within the tailings ponds on the site are not jurisdictional.

Cheniere has identified and mapped 16.4 acres of submerged aquatic seagrass beds within the area of the bay in the vicinity of the LNG terminal facilities. Seagrasses occur in shallow water (less than 4 feet deep) along the margin of Corpus Christi Bay and along a spoil island across the La Quinta Channel from the LNG terminal site (figure 4.4-1). Dominant vegetation observed included shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiforme*), turtle grass (*Thalassia testudinum*), clover grass (*Halophila engelmanni*), and widgeon grass (*Ruppia maritima*). Seagrasses occur as discontinuous and patchy beds of primarily shoal grass.

Seagrass beds are an important habitat in coastal bay systems. Juvenile sea turtles utilize seagrass beds, as seagrass leaves comprise a major portion of their diets. There is no evidence that these species presently utilize the seagrass beds in the Project area. A variety of birds use seagrass meadows as feeding and resting areas including wading birds, gulls and terns, and waterfowl. Seagrass beds also provide important habitat for a variety of fishes, particularly juvenile stages.

The proposed pipeline would cross narrow bands of palustrine (freshwater) emergent wetlands at eight locations (table 4.4.1-1). However, at two of those locations (MPs 19.3 and 21.3) Cheniere has modified its proposed construction right-of-way to avoid any impact on the wetlands. Dominant herbaceous species identified in upland wetlands crossed by the pipeline include Olney's bulrush (*Scirpus americanus*), water hyssop (*Bacopa* sp.), Carolina wolfberry (*Lycium carolinianum*), and torpedo grass (*Panicum repens*).

A total of about 13.7 acres of submerged aquatic vegetation and wetlands would be affected during construction of the Project, including 12.4 acres combined of seagrass, coastal marsh, and tidal flats at the LNG terminal, and 1.3 acres of palustrine emergent wetlands crossed by the pipeline. Table 4.4.1-1 lists submerged aquatic vegetation and wetlands that would be affected by the Project and the anticipated area of impact.

In addition to direct impacts on seagrass beds within the proposed dredging footprint, adjacent seagrass beds could potentially be affected by turbidity and sedimentation created by dredging activity. It is expected that any turbidity or sedimentation impacts would be limited to within several hundred feet of dredging operations. Cheniere would comply with any project-specific recommendations or requirements to minimize suspension of sediments that are attached to dredging permits. In addition, Cheniere's Aquatic Resources Mitigation Plan (see below) is intended to compensate for impacts to aquatic resources adjacent to the Project area as well as aquatic resources directly within the Project area. Cheniere has also committed to conducting post-construction monitoring of areas adjacent to the project footprint, and if secondary impacts to theses areas are observed would consult with resource and regulatory agencies to develop additional mitigation measures as necessary.

TABLE 4.4.1-1

Wetlands Affected by the Cheniere Corpus Christi LNG Project

Facility	Location	Crossing Length (feet)	Wetland Classification a/	Construction Impact (acres) b/	Operational Impact (acres) c/
Terminal	See Fig 4.4-1	NA	E2EM	4.77	3.97
		NA	E2FL	1.59	1.33
		NA	E1AB	5.99	5.35
			Subtotal:	**12.35**	**10.65**
Pipeline					
	MP 16.7	50	PEM	0.03	0.02
	MP 18.0	50	PEM	0.06	0.04
	MP 18.0	50	PEM	0.01	0.0
	MP 18.3	1,110	PEM	0.87	0.60
	MP 19.2	160	PEM	0.34	0.16
	MP 19.2	105	PEM	0.03	0.03
	MP 19.3	0	PEM	0.0	0.0
	MP 21.3	0	PEM	0.0	0.0
		1,525	**Subtotal:**	**1.34**	**0.85**
			Total:	**13.69**	**11.50**

NA = not applicable

a/ E2EM=Estuarine intertidal emergent, E2FL=Estuarine tidal flat, E1AB=Estuarine submerged aquatic bed, PEM=Palustrine emergent

b/ Construction impacts for the pipeline are based on a 100-foot-wide construction right-of-way for wetlands at MPs 16.7, 18.0, and 18.0 and a 75-foot-wide construction right-of-way for wetlands at MPs 18.3, 19.2, and 19.2. Wetlands at MPs 19.3 and 21.3 would not be affected by Cheniere's latest proposed right-of-way configuration.

c/ The operational impact for the pipeline is based on a 50-foot-wide maintained right-of-way.

For those wetlands that would be temporarily affected during construction, potential impacts would include the temporary disturbance of wetland vegetation, soils, and hydrology. Soil disturbance and removal of wetland vegetation could temporarily affect wetland capacities to buffer flood flows and/or control erosion. Failure to properly segregate topsoil over the pipeline trenchline could result in the mixing of the topsoil with the subsoil, which could affect the success of post-construction reestablishment and natural recruitment of native wetland vegetation. Rutting of soils from construction equipment could result in soil mixing, which could also affect success of post-construction restoration. Trenching during pipeline installation could penetrate impervious soil layers, which could alter perched water tables. Altered perched water tables could result in drier soil conditions that could inhibit the reestablishment of wetland vegetation. Uncontrolled surface runoff from adjacent disturbed upland areas could transfer silt and sediment into off right-of-way wetlands.

To minimize construction-related impacts on wetlands, Cheniere would implement our Procedures during construction of the Project. In response to past concerns raised by Federal, state, and local agencies regarding the potential impact of construction of pipeline projects in general, we developed our Procedures to provide the minimum level of protection for wetlands affected by natural gas projects. In 2003, we revised and updated these Procedures. Our Procedures include requirements for pre-construction planning, environmental inspection, construction methods, sediment and erosion control, restoration, and post-construction maintenance. Some of the major components of our Procedures applicable to wetland construction are listed below:

- Construction equipment operating within the right-of-way would be limited to that equipment necessary for clearing, excavation, pipe installation, backfilling, and restoration activities. All nonessential equipment would use upland access roads to the maximum extent practicable.

- Equipment operating within saturated wetlands would be low-ground-weight equipment or would operate from prefabricated construction mats.
- Temporary erosion and sediment control measures would be installed immediately after the initial disturbance of wetland soils and would be inspected and maintained regularly until final stabilization.
- Sediment controls would be installed across the construction right-of-way, as needed, within wetlands to contain trench spoil.
- The uppermost foot of wetland topsoil would be segregated from the underlying subsoil in areas disturbed by trenching, except in areas with standing water or saturated soils, or where no topsoil layer is evident.

Cheniere originally requested a variance to Section V.A.3 of our Procedures to allow for a 120-foot-wide construction right-of-way within wetlands due to the combination of the larger-than-typical diameter of the proposed pipeline (48 inches), and the unconsolidated nature of the soil types encountered in the Project area wetlands. Our Procedures limit the standard construction right-of-way width within wetlands to 75 feet. In response to a data request, Cheniere provided site specific information for each wetland crossing. For five of the eight wetlands crossed Cheniere modified its proposed construction right-of-way configuration such that the construction right-of-way width across the wetlands would be limited to 75 feet (MPs 18.2, 19.2, and 19.2) or the wetlands would be avoided entirely (MPs 19.3 and 21.3). No variance from our Procedures would be required for these five wetland crossings. For the remaining three wetland crossings (MPs 16.7, 18.0, and 18.0) Cheniere reduced its proposed construction right-of-way width to 100 feet, and provided site-specific plan drawings and justification for the additional 25 feet of temporary workspace. These wetlands are associated with Chiltipin and Oliver Creeks, and additional workspace would be required to allow for extra trench depth and width, use of temporary sheet piling to protect adjacent existing in-service pipelines, and grade cuts of steep stream banks. We have reviewed the site-specific plans and information for the wetlands at MPs 16.7, 18.0, and 18.0 and find the proposed 100-foot-wide construction right-of-way is an acceptable variance from our Procedures.

Following construction, temporarily disturbed wetlands would be restored and allowed to revegetate in accordance with our Procedures. All of the 1.3 acres of palustrine emergent wetland affected by construction of the pipeline would be allowed to revegetate. Of this 1.3 acre approximately 0.8 acre would be within the 50-foot-wide permanent operational right-of-way of the pipeline. No vegetation maintenance would typically be required in emergent wetlands; therefore there should be no operational impacts to this 0.8 acre.

About 1.7 acres of wetlands affected during construction of the LNG terminal would only be temporarily affected during construction. Following construction Cheniere would restore these areas to pre-construction contours and elevations, and they would be allowed to revegetate naturally. Because these areas are in close proximity to wetlands adjacent to the site that would not be disturbed by the Project, it is expected that they would revegetate naturally. Following construction Cheniere would monitor these temporarily impacted wetlands, as well as adjacent non-impacted wetlands, and if they are not revegetating naturally or are adversely impacted by the Project, Cheniere would develop additional mitigation measures to restore or mitigate the impacts.

In its original application to the Commission, Cheniere proposed to transplant black mangroves following construction in areas of shoreline wetlands temporarily affected by LNG terminal construction. However, during subsequent consultations with resource agencies, including NOAA Fisheries, Cheniere was advised that transplanting of mangroves would not be suitable as a mitigation feature. This is because of the collective experience of various natural resource agencies that transplanting mangroves in south Texas has been largely unsuccessful (NOAA Fisheries, 2004c). Cheniere does not currently propose to transplant black mangroves, but would address impact on black mangroves in its conceptual wetlands mitigation plan.

Based on the wetland delineation conducted by Cheniere in May 2004, it is estimated that 10.7 acres of wetlands would be permanently affected by operation of the LNG terminal. The 10.7 acres would include about 5.4 acres of seagrass, 4.0 acres of coastal marsh, and 1.3 acres of tidal flats.

In addition to the measures required by our Procedures, Cheniere would be required to comply with the permit conditions contained in the COE's Section 404 permit and the state Section 401 permit. As part of its review of the project, the COE will evaluate whether practicable alternatives have been taken to avoid wetland impacts to the maximum extent possible. Cheniere must also demonstrate that it has taken appropriate and practicable steps to minimize wetland impacts in compliance with the COE's Section 404(b)1 guidelines that restrict discharges of dredge or fill material where a less environmentally damaging alternative exists. The loss of estuarine wetlands as a result of the marine terminal construction would require compensatory mitigation. The specific type and amount of compensatory mitigation would be determined by the COE as part of the Section 404 permit process. Cheniere submitted to the COE a revised wetlands delineation report and request for formal verification of Waters of the U.S. on June 7, 2004. On July 15, 2004 the COE provided a jurisdictional determination that confirmed the boundaries of jurisdictional wetlands affected by both the LNG terminal and pipeline. On September 9, 2004, Cheniere filed a Section 404/10 individual permit application with the COE.

Cheniere has prepared an Aquatic Resources Mitigation Plan that includes an analysis of potential alternatives to mitigate for unavoidable wetland impacts, and the selection of a preferred wetland mitigation alternative. The Aquatic Resources Mitigation Plan is included in Cheniere's Section 404/10 permit application to the COE and is attached as appendix D of this EIS. Cheniere's preferred mitigation alternative is off site mitigation at Shamrock Island, the current wetland mitigation site for the Federal Packery Channel dredging project. Cheniere's Aquatic Resources Mitigation Plan includes a conceptual wetland mitigation plan for the Shamrock Island alternative. Cheniere's proposed mitigation would involve construction of ten breakwaters bordering the northern end of Shamrock Island to create a sheltered area of approximately 16.8 acres of potential submerged aquatic vegetation. In addition, mitigation would include the preservation of existing habitats, including 19.0 acres of submerged aquatic vegetation, 13.5 acres of coastal marsh, and 4.6 acres of adjacent upland. Cheniere's conceptual mitigation plan also identifies additional mitigation acreages if the proposed mitigation is determined by the COE not to be sufficient.

Cheniere will continue to coordinate with the COE during the COE's review of the Aquatic Resources Mitigation Plan and its conceptual wetlands mitigation plan. Cheniere will file with the FERC all copies of correspondence with agencies, and the final mitigation plan.

4.4.2 Terrestrial Vegetation

The terrestrial vegetation communities that would be affected by construction and operation of the proposed Project include grasslands, scrub/shrub rangelands, and agricultural lands. Much of the proposed LNG terminal contains highly disturbed industrial areas that have been used for storage of bauxite and bauxite tailings. These industrial areas, encompassing about 573 acres within the proposed LNG terminal tract, largely do not support vegetation. Scrub/shrub uplands and grasslands occur along the edges of the disturbed industrial areas.

About 78 acres of open land exists at the LNG terminal between bauxite residue Beds 22 and 24 and the shoreline along Corpus Christi Bay. This area is covered by about 12 acres of coastal grasslands and 51 acres of scrub/shrub vegetation. Construction and operation of the LNG terminal would impact 1.5 acres of grasslands and 3.3 acres of scrub/shrub vegetation.

A narrow band of coastal grasslands occurs between the tidal flats and the scrub/shrub community within the LNG terminal site. Vegetation within coastal grasslands band include marshhay cordgrass (*Spartina patens*), saltgrass (*Distichlis spicata*), Bermuda grass (*Cynodon dactylon*), Camphor daisy (*Machaeranthera phyllocephala*), sea ox-eye (*Borrichia frutescens*), coastal dropseed (*Sporobolus virginicus*), and sea oats (*Uniola paniculata*).

Vegetation within the scrub/scrub community consists of herbaceous undergrowth and woody overstory. Typical herbaceous species include western ragweed (*Ambrosia psilostachya*), common sunflower (*Helianthus annus*), prickly pear (*Opuntis* sp.), scarlet sage (*Salvia coccinca*), silver-leaf night-shade (*Solanum elegnifolium*), and various grasses. Typical woody overstory species include mesquite (*Prosopis juliflora*), saltcedar (*Tamarix ramosissima*), sugarberry (*Celtis laevigata*), Carolina holly (*Ilex ambigua*), Georgia holly (*Ilex longipes*), and various species of palm trees.

Construction of the proposed pipeline would require about 373.3 acres of land, of which 290.5 acres would be agricultural land and 54.5 acres would be open land. The open land is covered by grasslands and scrub/shrub vegetation. Typical crops grown on the agricultural land include sorghum, cotton, corn, and soybeans. After installation of the pipeline, crops could still be grown over the right-of-way. The permanent pipeline easement in open land would be kept in an herbaceous state.

Only 4.4 acres along the pipeline route would be permanently "lost" or converted from agricultural land into industrial use. These would be at the meter stations and MLV locations.

In consultation with the NRCS, Cheniere developed a project-specific plan for revegetating dredged material disposal areas and disturbed upland areas. An erosion control blanket consisting of a mixture of fibrous mulch, fertilizer, tackifer, and seed would be applied. Hydroseeding is scheduled to take place between the months of February and October. An irrigation program would be established for the DMPAs. The seed mixture is presented in table 4.4.2-1.

TABLE 4.4.2-1

Seed Mixture for Cheniere Corpus Christi LNG Project

Species	Application Rate (pounds per acre)
Temporary Seed Mixture	
Oats	64
Hairy vetch	16
Foxtail millet	25
Rye	25
Permanent Seed Mixture	
Green sprangletop	8
Bermuda grass	11
Little bluestem	15
Indiangrass	20
K-R bluestem	10
Switchgrass	16

We believe that by following our Plan, and Cheniere's Project-specific reclamation plan, construction and operation of Cheniere's Corpus Christi LNG Project would have little potential for significant adverse effects on upland vegetation.

4.5 WILDLIFE AND AQUATIC RESOURCES

This section describes the marine, fresh water, and terrestrial wildlife species that could potentially occur in the habitats associated with the Project area, and describes potential effects of the Project on those species.

4.5.1 Marine Species

Major marine habitat complexes in the vicinity of the Project area include the extensive brackish marsh complex of the Nueces River Delta, the fringing wetlands and open waters of Nueces Bay and Corpus Christi Bay, other similar habitats throughout the Nueces Estuarine System, and the near-shore shallow waters of the Gulf of Mexico. These habitats are highly productive of plankton and dead organic material that provides an abundant food base for those species that can tolerate the stressful estuarine environment.

Within the northern portion of Corpus Christi Bay, the Project area encompasses four aquatic/intertidal habitat types including open bay, seagrass, coastal marsh, and tidal flats. The marine species that occupy the water column above the substrate of open bays (collectively called the nektonic community) includes a variety of invertebrates and fishes. The following biological resources discussion is based primarily on the research referenced in a baseline study prepared by Cheniere and included in its application to the FERC (Ecology and Environment, Inc. (E&E), 2003).

4.5.1.1 Fish Species

The Gulf of Mexico (Gulf) and its surrounding estuarine waters support a great diversity of fishery resources as near-shore Gulf fish communities consist of species found in both estuarine and offshore marine habitats, most of which are temperate in biogeographic distribution with a few tropical species. Tunnell et al. (1996) reports that 234 fish species occur within the Corpus Christi Bay National Estuary Program (CCBNEP) study area, which includes the Aransas, Corpus Christi, and Upper Laguna Madre estuary systems. These species can be classified as warmwater marine or estuarine. Distribution and abundance varies greatly from time to time and place to place, depending on such factors as temperature, salinity, and predictable cycles directly related to reproduction. While some species spend their lives within the estuary, many are migratory, using the estuaries as nurseries for rapidly growing juveniles, or opportunistically as adults when conditions are favorable.

Fishes are the dominant nektonic constituents of the open bay community, although most are not permanent residents of these areas and spend only a portion of their lifecycle in estuaries. Open bay fish species are the dominant secondary consumers, feeding on benthic organisms, detritus, or pelagic organisms such as zooplankton and other fish. Fish species common in the open bay habitats include Atlantic croaker (*Microponias undulatus*), spot (*Leiostomus xanthurus*), bay anchovy (*Anchoa mitchilli*), hardhead catfish (*Arius felis*), pinfish (*Lagodon rhomboides*), sand seatrout (*Cynoscion arenarius*), star drum (*Stellifer lanceolatus*), spotted seatrout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), southern flounder (*Paralichthys lethostigma*), gafftopsail catfish (*Bagre marinus*) and striped mullet (*Mugil cephalus*).

Seagrass habitats are often populated by diverse and abundant fish fauna because the seagrass canopy provides shelter for juvenile fish (*e.g.*, spotted seatrout and red drum) and for small permanent residents such as the tidewater silverside, rainwater killifish (*Lucania parva*), pinfish, bay anchovy, striped mullet, menhaden (*Brevoortia* spp.), silver perch (*Bairdiella chrysura*), dusky pipefish (*Syngnathus floridae*) and speckled worm eel (*Myrophis punctatus*). These species feed on the abundant invertebrate population, epiphytic algae and/or living or decaying seagrasses. Seagrass beds also provide important feeding grounds for larger invertebrate and fish predators that are attracted to these areas in pursuit of the aforementioned prey species. Such species include the hardhead catfish, spotted seatrout, red drum, southern flounder, spot, and various sharks and rays.

Much like the seagrass habitats, coastal marshes are an important nursery habitat for a variety of marine and estuarine fishes. In addition to the species found in submerged aquatic vegetation, coastal marshes support several small, resident fish including important forage species, such as killifishes (*Fundulus* spp.), menhaden (*Brevoortia* spp.), the bay anchovy, striped mullet, and western mosquitofish (*Gambusia affinis*). Moving into tidal marshes to feed on these forage fishes are a variety of larger predatory fishes such as tarpon (*Megalops atlanticus*).

When flooded, small fish will move into the tidal flats to feed on the polychaetes, gastropods and crustaceans; common fish species include sheepshead minnow (*Cyprinodon variegatus*), Gulf killifish (*Fundulus grandis*), rough silverside (*Membras martinica*), and larval inshore lizard fish (*Synodus foetens*), southern flounder, red drum, and spotted sea trout.

4.5.1.2 Invertebrates

The value of benthic organisms in the food chain is considerable. Additionally, invertebrates are valuable indicators of water/sediment pollution and construction-related sediment disturbance.

Open bay communities support a variety of benthic invertebrates, which are typically subdivided into three size classes listed in order of increasing size: microbenthos, meiobenthos, and macrobenthos. Microbenthos, including bacteria, yeasts, fungi, microalgae (diatoms and flagellates) and protozoans, are largely decomposers and are one of the most important components of the open bay community; they form a major link between primary producers and higher trophic level consumers. The meiobenthic community typically consists of permanent residents, such as nematodes, harpacticoid copepods, gastrotrichs, and kinorhynchs, and temporary residents, including juvenile stages of clams, snails, polychaete worms and amphipods. Macrobenthos includes adult stages of clams, polychaete worms, snails and crabs. Polychaetes and bivalve mollusks dominate the macrobenthic assemblages of the Nueces Estuary.

Whereas benthic invertebrates live in the bottom sediments, epibenthic invertebrates live on or near the surface of bottom sediments. Epibenthos typically prefer protected areas such as seagrass beds and salt marshes, but they also occur in the open bay communities. Shrimps and blue crabs (*Callinectes sapidus*) are the most abundant epifauna in these areas. Common invertebrates that occupy the water column above the substrate of open bays include zooplankton, jellyfish, and the bay squid (*Lolliguncula brevis*).

During periods of inundation, coastal marshes provide habitat for a variety of invertebrates including filter-feeding mollusks, crabs, and shrimp. Coastal marshes support a variety of grazing invertebrates, such as snails and various insects. During periods of inundation, tidal flats are inhabited by a variety of benthic invertebrates including polychaetes, gastropods, and crustaceans such as the blue crab and fiddler crab (*Uca* spp.).

Site-specific background information on the benthic infauna of La Quinta Ship Channel was provided by Dr. Paul Montagna of the University of Texas Marine Science Institute (UTMSI) in Port Aransas, Texas. While presently outside of the Project area, per se, these results would be applicable to the deep water habitat that would be created by the proposed channel connecting the LNG terminal with the existing La Quinta Ship Channel Turning Basin. A taxonomic listing of infauna with average abundances provided by Dr. Montagna (UTMSI, 2004) showed the benthic community of La Quinta Ship Channel is dominated by polychaete worms, which are habitat generalists and exhibit high tolerance to environmentally stressful conditions such as low dissolved oxygen levels. Other dominant infaunal species included mollusks, unidentified oligochaete worms, amphipod crustaceans, and sea grapes (*Molgula manhattenis*).

4.5.1.3 Commercial and Recreational Fisheries

The commercial and recreational fisheries of Corpus Christi Bay are important industries that reflect the high productivity, recreational values, and aesthetic values of the estuarine and nearby Gulf of Mexico waters. Most of the commercially and recreationally important species of the northern Gulf of Mexico depend to some extent on estuarine habitats and tend to dominate them in terms of numbers and biomass. Recreational and commercial fisheries information for Corpus Christi Bay was obtained from Texas Parks and Wildlife Department (TPWD) reports and fish landings data. Table 4.5.1.3-1 provides a list of representative commercial and recreational fish and shellfish species known to occur in Corpus Christi Bay.

TABLE 4.5.1.3-1

Representative Recreational and Commercial Fish and Shellfish Species Known to Occur in Corpus Christi Bay

Common Name	Scientific Name	Fishery Classification
Brown shrimp	*Farfantepenaeus aztecus*	Warmwater marine/estuarine
Pink shrimp	*Farfantepenaeus duorarum*	Warmwater marine/estuarine
White shrimp	*Litopenaeus setiferus*	Warmwater marine/estuarine
Blue crab	*Callinectes sapidus*	Warmwater marine/estuarine
Red drum	*Sciaenops ocellatus*	Warmwater estuarine
Spanish mackerel	*Scomberomorus maculatus*	Warmwater marine
Atlantic croaker	*Micropogonias undulatus*	Warmwater marine/estuarine
Black drum	*Pogonias cromis*	Warmwater marine/estuarine
Gafftopsail catfish	*Bagre marinus*	Warmwater marine/estuarine
Sand seatrout	*Cynocion arenarius*	Warmwater estuarine
Sheepshead	*Archosargus probatocephalus*	Warmwater marine/estuarine
Southern flounder	*Paralichthys lethostigma*	Warmwater marine/estuarine
Spotted seatrout	*Cynoscion nebulosus*	Warmwater estuarine
Striped mullet	*Mugil cephalus*	Warmwater marine

In 2000, approximately 738,782 pounds of seafood, valued at $1,043,829, was caught in Corpus Christi Bay, representing about 3 percent of the total poundage of seafood caught that year in the entire state of Texas. The most important commercial finfish species currently reported from the Project area are black drum, southern flounder, sheepshead, and striped mullet. Collectively, these four species accounted for about 90 percent of the 237,792 pounds of finfish harvested in Corpus Christi Bay in 2000. Principal shellfish species harvested in the Project area include brown shrimp, pink shrimp, white shrimp, and blue crab. In 2000, these species accounted for approximately 99 percent of the 500,990 pounds of shellfish harvested in Corpus Christi Bay.

4.5.1.4 Fisheries of Special Concern

Fish species of special concern that occur in the vicinity of the proposed Project include state and federally listed threatened and endangered species, those with EFH designations in the Corpus Christi Bay estuary, and those of commercial and recreational value. Commercial and recreational fish species are discussed above in section 4.5.1.3. Threatened and endangered fish species are discussed in section 4.6 of this EIS. Species with EFH designations in Corpus Christi Bay are discussed in section 4.5.2 and appendix E of this EIS.

4.5.1.5 Project Impacts on Marine Species

All marine habitats associated with the Project would occur in the vicinity of the proposed LNG maneuvering channel, marine basin, and docks. Construction and operation of the LNG terminal would require dredging about 78 acres, of which 73 acres would be open bay habitat. Operation would result in the permanent loss of 5.3 acres of seagrass, 4.0 acres of coastal marsh, and 1.3 acres of tidal flat habitats. About 32 acres of open water in the La Quinta Channel that would be affected by dredging and creation of the marine basin can be considered shallow bay habitat, while the remainder is classified as deepwater open bay habitat. Impacts on aquatic organisms would arise primarily from dredging, dock construction, and ballast water intake by LNG ships, which could result in habitat removal and conversion; losses of organisms by direct removal, entrainment, or burial; and losses related to turbidity or noise impacts.

Dredging of the marine basin would permanently convert existing habitat types (shallow bay, seagrass, coastal marsh, and tidal flat) to a deeper water habitat. While creation of the marine basin would have a permanent impact on species that specifically occupy tidal flats, coastal marsh, seagrass, and shallow bay habitats, most species are capable of occupying a variety of habitats, including a deeper open bay habitat sometime during their life cycle. Very slight changes in the hydrography and water and sediment quality parameters (*i.e.*, tidal amplitude, dissolved oxygen, salinity, toxic chemical accumulation, etc.) resulting from the creation of the marine basin would not cause detectable adverse effects on aquatic species. Impacts on aquatic habitats under the jurisdiction of the COE would be mitigated by the creation of similar habitats at a ratio determined by the COE, as discussed in section 4.4.1 of this EIS.

In addition to the loss or alteration of aquatic habitats, the primary impacts to fishes associated with dredging include entrainment of organisms by dredging machinery, and increased turbidity and sedimentation due to the resuspension of bottom sediments. The loss of benthic organisms due to entrainment would potentially occur during dredging, but should not be extensive enough to have a significant impact on the fishery resources of Corpus Christi Bay. Impacts of dredging on marine water turbidity are expected to be localized, short-term, and minor, as discussed in section 4.3.2.1 of this EIS.

Siltation from dredging for the marine basin is expected to have minor effects on the adjacent seagrass habitat in the shallow shoreline areas of Corpus Christi Bay in the vicinity of the Project. The distribution of seagrasses along the northern Corpus Christi Bay shoreline east and west of the existing La Quinta Turning Basin is sparse and patchy when compared to the overall seagrass coverage of the Coastal Bend area. Seagrasses nearest the northern slope of the La Quinta Channel may receive minor siltation during dredge activity. No burial of seagrasses is anticipated from the expected siltation, although primary production may be temporarily diminished due to the effects of turbidity. Turbidity tends to interfere with light penetration and thus reduce photosynthetic activity by phytoplankton and seagrasses. Such reductions in primary production would be localized around the immediate area of dredge operations in the La Quinta Channel and be limited to the duration of the sedimentation plume at the LNG marine basin.

Excessive nutrient loading from sediment resuspension can also have an adverse impact upon submerged grassbeds because it can cause dramatic increase in the productivity of planktonic algal populations. The shading effect of such algal blooms can significantly curtail the productivity of submerged aquatic plants. It is expected that impacts from sediment resuspension would be limited to within several hundred feet of dredging operations. Cheniere would comply with any project-specific recommendations or requirements to minimize suspension of sediments that are attached to dredging permits. In addition, Cheniere's Aquatic Resources Mitigation Plan is intended to compensate for impacts on aquatic resources adjacent to the Project area as well as aquatic resources directly within the Project area. Cheniere has also committed to conducting post-construction monitoring of areas adjacent to the project footprint, and if secondary impacts to theses areas are observed, would consult with resource and regulatory agencies to develop additional mitigation measures as necessary.

As discussed in section 2.3.1.2, tubular steel piles would be installed as part of the construction of the marine terminal (*i.e.*, for breasting/mooring dolphins and unloading platforms/trestles). Cheniere expects that pile driving activities would occur up to 24 hours per day, seven days per week, over approximately a four to six month period. In some cases, driving steel piles can generate intense underwater sound pressure waves that can adversely affect nearby marine organisms. Although the effects of pile driving are poorly studied and there appears to be substantial variation in a species' response to sound, intense sound pressure waves can change fish behavior or injure/kill fish through rupturing swim bladders or causing internal hemorrhaging. The degree to which an individual fish exposed to sound waves would be affected is dependent upon variables such as the peak sound pressure level and frequency as well as the species, size, and condition of a fish (*e.g.*, small fish are more prone to injury by intense sound waves than are larger fish of the same species). In some cases, sound pressure levels greater than 155 decibels (re: 1 micro Pascal [μPa]) can illicit avoidance behaviors or stun small fish (NOAA Fisheries, 2003). Sounds greater than 190 decibels (re: 1 μPa) are thought to physically injure some fish (Hastings, 2002). The presence of predators can also influence how a fish might be affected by pile driving (*e.g.*, fish stunned by pile driving activities may be more susceptible to predators).

The intensity of the sound pressure levels produced during pile driving depends on a variety of factors including, but not limited to, the type and size of the pile, the firmness of the substrate into which the pile is being driven, the depth of water, and the type and size of the pile driving hammer. For example, driving hollow steel piles with impact hammers produce intense, sharp spikes of sound which can injure fish. In some cases, fish may be startled by the first few strikes of an impact hammer. However, this response can wane and the fish may remain in the area (NOAA Fisheries, 2001). As such, the potential effect on fish from impact hammers could be magnified since fish would not only be exposed to intense sound waves but may not avoid pile driving activities, which would prolong their exposure to the potentially harmful sounds and increase their risk of injury or death. In a review of studies documenting fish kills associated with pile driving, NOAA Fisheries (2003) reported that all have occurred during use of an impact hammer on hollow steel piles. On the other hand, the rapid repetitions of vibratory hammers produce relatively low intensity sound waves. Evidence also suggests that fish consistently display an avoidance response to sound from a vibratory hammer, even after repeated exposure (Dolat, 1997; Knudsen *et al.*, 1997).

Cheniere has not yet identified the type of hammer that would be used to drive piles during construction of the marine terminal. Driving tubular steel piles with an impact hammer in similar settings has been shown to generate sound levels from 192 to 194 decibels (re: 1 μPa), above the level that is thought to injure some fish. Depending on the specific conditions at the site, these sounds can have a transmission loss rate of 0.021 to 0.046 decibels (re: 1 μPa) per foot (Nedwell and Edwards, 2002; Nedwell *et al.*, 2003). Based on these values, the use of an impact hammer at Cheniere's marine terminal could generate underwater sound levels great enough to injure some fish (*i.e.*, 190 decibels (re: 1 μPa)) as far as 190 feet from a steel pile; an impact hammer could generate sound levels that could also affect some fish as far as 1,860 feet from a steel pile (*i.e.*, 155 decibels (re: 1 μPa)). Although the sound waves of the greatest intensity would be limited to the immediate vicinity of the piles within the unloading slip, sound levels of 155 decibels (re: 1 μPa) could extend to the far shore of the La Quinta Channel while piles for some of the mooring dolphins are being driven. Because the piles would be located in a recently dredged unloading slip, it seems likely that construction noise and activities would cause many marine species to avoid the area of the most intense sound levels.

Ship and boat traffic associated with construction and operation of the project would also generate underwater sounds. Although vessel sounds would not generally be of the intensity produced from driving steel piles, project vessels (LNG carrier ships, tugs, construction barges) operating in the La Quinta Channel could result in sounds that illicit responses in fish. Most research suggests that fish exhibit avoidance behavior in response to engine noise (ICES, 1995). At the same time, research conclusions tend to suggest that since the effects are transient (*i.e.*, once the ship passes, behavior returns to normal), then the long-term effects on populations are negligible. However, it is nearly impossible to separate the effects of noise disturbance from other modern stresses on fish populations such as pollution or overfishing (Stocker, 2001).

Operation of the LNG terminal should not have a significant effect on area fisheries. Operation would involve berthing of an average of one LNG ship per day, or one additional vessel movement inward and one additional vessel movement outward through the Corpus Christi and La Quinta Ship Channels per day. LNG ship traffic to and from the Project would represent less than a 1 percent increase in total ship traffic in Corpus Christi Bay.

The potential for impacts to seagrass and coastal marsh habitats to occur in the La Quinta Channel will not significantly increase based on the additional ship traffic from the proposed construction of the LNG facility. Normal ship traffic to and from the proposed LNG facility and within the La Quinta Channel will not create abnormal conditions for existing seagrass beds or coastal marshes found within or bordering the channel. Therefore, no adverse impacts to seagrasses or coastal marsh habitats are expected due to increased shipping traffic within the La Quinta Ship Channel. Although designated EFH may occur within the La Quinta Channel, particularly along seagrass beds bordering the channel, adverse impacts to EFH as a result of increased shipping traffic are not expected.

The discharge of ballast water from ships could potentially impact marine organisms through the unintentional introduction of non-indigenous aquatic organisms. Ship ballast water is fresh water or salt water pumped aboard in the port of destination, as the cargo is unloaded. Ballast is a necessary safety feature of commercial shipping that provides transverse stability during voyages and while in port, ensures adequate submergence of the propeller, reduces stresses on the ship's hull, and lowers the center of gravity for improved maneuverability.

The LNG vessels arriving at the proposed LNG terminal would be fully loaded with LNG when arriving at the terminal and therefore, no ballast water would be on board the vessels. No ballast water would be discharged into the bay, therefore there would be no impact on aquatic species or habitats as a result of discharge of ballast water. Nevertheless, it is expected that any LNG carrier calling at the Cheniere Corpus Christi LNG terminal would be in full compliance with the domestic requirements for ballast water management as specified in the National Invasive Species Act of 1996 (NISA 1996) and international standards that were adopted on February 13, 2004.

Once at the terminal each vessel would discharge its entire cargo to LNG storage tanks on shore. While the vessel is discharging its LNG cargo, it would be taking on seawater ballast to maintain a constant draft at the berth. Cheniere estimates that the smaller and largest LNG ships would require approximately 56,000 m^3 and 112,000 m^3, respectively, of seawater ballast. For these volumes, ballast water intake would range from approximately 20,000 to 40,000 gallons per minute total. LNG ships have multiple ballast water intakes, therefore the rate of intake at each intake location would be some fraction of the total. Aquatic species in the immediate vicinity of the ship berths could therefore be impacted by entrainment during ballast water intake. Ballast water intakes on the LNG ships are near the bottom of the ships therefore entrainment would be limited to organisms in the deeper water column (30 - 40 feet below the surface) near the bottom of the marine basin. Ballast water intake at Cheniere's proposed LNG terminal would be similar to ongoing ballast water intake by numerous ships currently calling on the Port of Corpus Christi, and impact from entrainment during ballast water intake by LNG ships at the proposed terminal would not add appreciably to current impacts.

4.5.2 Freshwater Species

The proposed pipeline would cross 10 waterbodies, listed on table 4.3.2.2-1 of this EIS. Two of the waterbodies (Oliver Creek at MP 16.8 and Chiltipin Creek at MP 18.0) are perennial streams. The remaining waterbodies are intermittent-flowing drainages or ditches. All the waterbodies are very low gradient, and typically have high turbidity and high concentrations of suspended solids, particularly after rain events. All waterbodies are classified as warmwater fisheries. Species typical of warmwater fisheries in the Project area include largemouth bass, blue catfish, channel catfish, flathead catfish, bluegill, and red ear sunfish.

Cheniere proposes to cross 9 of the 10 waterbodies using the open-cut crossing method. Open-cut crossings would result in a temporary increase in the concentration of suspended solids at the crossing location and downstream, if water is flowing at the time of the crossing. The concentration of suspended solids would decrease rapidly following the completion of instream work. Cheniere would construct all waterbody crossings in accordance with the construction and mitigation measures in our Procedures. Our Procedures require completion of most instream work within 24 hours for waterbodies 10 feet wide or less, and within 48 hours for streams 10 to 100 feet in width. In addition, Cheniere has requested a variance from our Procedures, which we approve of, to cross all waterbodies between March 1 and August 31, which is the period of lowest rainfall in the Project area, and when water levels in streams would be lowest (see section 4.3.2.2 of this EIS).

Other measures from our Procedures would help reduce impacts on fisheries from construction-induced sedimentation and turbidity to short-term, temporary disturbances. Trench spoils would be stored within the approved right-of-way on or above the stream banks at least 10 feet from the water's edge. Temporary sediment control devices would be installed around spoil piles to minimize the potential for sediment-laden water to enter the stream. Additionally, all staging and temporary workspace areas would be located at least 50 feet back from the water's edge where topographic conditions permit (unless otherwise permitted), thus minimizing the potential for erosion and sedimentation along the stream banks.

Impacts on water quality would be short term and suspended sediment concentrations would be expected to return to pre-construction levels soon after construction across each waterbody is completed. Overall, the impact of pipeline construction on fish and other freshwater aquatic organisms is expected to be very localized and short term.

4.5.3 Terrestrial Wildlife

The proposed Project lies within the region of Texas described as the Gulf Coast Prairies and Marshes. This region is a nearly level, slowly drained plain less than 150 feet in elevation, bisected by streams and rivers flowing into the Gulf of Mexico. The Gulf Coast Prairies and Marshes are characterized by two main vegetation units: the low marshes in the zone of tidal influence, and prairies or grasslands that exist beyond the zone of tidal influence.

Terrestrial and wetland habitats that would be affected by the Project include coastal marsh and tidal flat along the margin of Corpus Christi Bay, and coastal grasses, scrub/shrub, and agricultural lands in areas beyond the zone of tidal influence. The specific vegetative communities that would be affected and that provide wildlife habitat are discussed in section 4.4. Acreages of habitat types that would be affected are listed in table 4.5.3-1. Numerous vertebrates inhabit these vegetative communities and use the resources for food, cover, shelter, and nesting purposes. The following subsections provide a brief description of each of the wildlife habitat types present and the wildlife commonly associated with each. The final subsection describes potential effects of the Project on these terrestrial wildlife species.

TABLE 4.5.3-1

Terrestrial Wildlife Habitat Affected by the Cheniere Corpus Christi LNG Project

Facility	Habitat Type	Construction Impact (acres)	Operational Impact (acres)
LNG Terminal a/			
	Tidal Flat	1.6	1.3
	Coastal Marsh	4.8	4.0
	Coastal Grassland	1.5	1.5
	Scrub/Shrub	3.3	3.3
	Industrial/Waste Land	283.1	283.1
	Subtotal:	**294.3**	**293.2**
Pipeline and Associated Facilities			
	Emergent Wetland	1.3	0.9
	Open Land b/	54.5	21.0
	Agricultural	320.5	117.6
	Industrial/Waste Land	26.5	16.6
	Subtotal:	**402.8**	**156.1**
	Total:	**697.1**	**449.3**

a/ Area within terminal operating limits, including; administration building, vaporization facilities, transfer pipe, storage tanks, maintenance, warehouse, and impoundment basin (43.4 acres); DMPA 1 (72.8 acres); south exclusion zone (31.9 acres); permanent facility road (15.9 acres); relatively undisturbed terminal property (109.6 acres); and temporary contractor yards 2 and 3 (14.3 acres).
b/ Includes pasture, rangeland, and scrub/shrub.

4.5.3.1 Coastal Marsh Habitat

Coastal marsh habitat occurs as a narrow band of vegetation lining the edge of Corpus Christi Bay. Few reptiles and amphibians occur in the coastal marsh habitat due to high salinity; however, some species such as the diamondback terrapin (*Malaclemys terrapin littoralis*), Gulf salt marsh snake (*Nerodia clarkii clarkii*), and American alligator (*Alligator mississipiensis*), are known to inhabit brackish marshes along the Gulf coast. Common wading and aquatic shorebirds likely to inhabit the coastal marshes in the Project area include mottled ducks (*Anas fulvigula*), lesser snow goose (*Chen caerulescens*), willets (*Cataptrophorus semipalmatus*), clapper rails (*Rallus longirostris*), great blue heron (*Ardea herodias*), tricolor heron (*Egretta tricolor*), black-crowned night heron (*Nycticorax nycticorax*), great egret (*Casmerodius albus*), snowy egret (*Egretta caerulea*), lesser scaup (*Aythya affinis*), white pelican (*Pelecanus erythrorhynchos*), and cormorants (*Phalacrocorax* spp.). Herbivorous mammals, such as nutria (*Coypus coypu*) and white-tailed deer (*Odocoileus virginiana*), are known to feed on marsh vegetation. Other mammals that utilize the coastal marsh habitat include the rice rat (*Oryzomys palustris*), cotton rat (*Sigmodon hispidus*), fulvous harvest mouse (*Reithrodonomys fulvescens*), and raccoon (*Procyon lotor*).

4.5.3.2 Tidal Flat Habitat

Tidal flats occur as a narrow band of sparse vegetation located between the coastal marsh and the coastal grassland habitat, in an area periodically flooded by tidal waters. Tidal flats provide excellent habitat for numerous species of gulls, terns, herons, shorebirds, and wading birds, including the laughing gull (*Larus atnicilla*), ring-billed gull (*Larus delawarensis*), royal tern (*Sterna maxima*), sandwich tern (*Sterna sandvicensis*), great blue heron, snowy egret, sanderlings (*Calidnis alba*), least sandpiper (*Calidnis minutilla*), roseate spoonbill (*Ajaia ajaja*), and white ibis (*Eudocimus albus*). Mammals likely to frequent tidal flats include the Virginia opossum (*Didelphis virginiana*), gray fox (*Urocyon cineroargentatus*), striped skunk (*Mephitis mephitis*), raccoon, coyote (*Canis latrans*), white-tailed deer, and eastern cottontail (*Sylvilagus floridanus*).

4.5.3.3 Coastal Grassland Habitat

The coastal grasses habitat extends inland from the high tide mark. Amphibian species most likely to occur in this habitat include Blanchard's cricket frog (*Acris crepitans blanchardi*), Texas toad (*Bufo speciosus*), Great Plains narrowmouth toad (*Gastrophryne olivacea*), and bullfrog (*Rana catesbiana*). Terrestrial reptiles that may occur in this habitat include the western glass lizard (*Ophisaurus attenuatus attenuatus*), six-lined racerunner (*Cnemidophorus sexlineatus sexlineatus*), keeled earless lizard (*Holbnookiapropinqua propinqua*), Texas spotted whiptail (*Cnemidophonus gulanis*), western coachwhip (*Masticophis flagellum tesaceus*), ground snake (*Sonora semiannulata*), and western diamondback rattlesnake (*Crotalus atrox*). The coastal grasslands provide habitat to many raptor and songbird species including crows, kites, vultures, gulls, Carolina wren (*Thryothorus ludovicianus*), starlings, northern cardinal (*Cardinalis cardinalis*), orioles, warblers, sparrows, American kestrel (*Falco sparverius*), indigo bunting (*Passerina cyanea*), hawks, owls, blue jay (*Cyanocitta cristata*), woodpeckers, thrushes, black tern (*Chlidonias niger*), and plovers. Mammals commonly associated with this habitat type include black-tailed jackrabbit (*Lepus californicus*), Gulf Coast kangaroo rat (*Dipodomys* *compactus*), marsh rice rat (*Onyzomys palustnis*), fulvous harvest mouse, common raccoon, striped skunk, and coyote.

4.5.3.4 Scrub/Shrub Habitat

Scrub/shrub habitat is found on uplands at both the proposed LNG terminal site and on portions of the pipeline right-of-way. Amphibian species most likely to occur in this habitat include Blanchard's cricket frog, Texas toad, Great Plains narrowmouth toad, and bullfrog. Terrestrial reptiles that may occur in this habitat include the western glass lizard, six-lined racerunner, keeled earless lizard, Texas spotted whiptail, western coachwhip, ground snake, and western diamondback rattlesnake. Mammals commonly associated with this habitat type include black-tailed jackrabbit, Gulf Coast kangaroo rat, marsh rice rat, fulvous harvest mouse, common raccoon, striped skunk, and coyote.

4.5.3.5 Grassland/Upland Pasture/Agricultural Land

Grassland/upland pasture/agricultural habitat is crossed by much of the proposed pipeline right-of-way. This habitat type has been altered from its original vegetation community structure and diversity as a result of crop production and livestock grazing. Agricultural crops provide an important food source for a variety of songbirds, waterfowl, and game birds. Species typical of scrub/shrub and coastal grassland habitats are also found in this habitat type.

4.5.3.6 Palustrine Wetland Habitat

Palustrine wetland habitat includes forested and emergent wetlands that are associated with perennial and intermittent streams and isolated, depressional wetlands, or other nontidal wetlands. Wetlands are discussed in detail in section 4.4 of this EIS. Common mammals associated with palustrine wetlands include the American beaver (*Castor Canadensis*), marsh rice rat, and swamp rabbit (*Sylvilagus aquaticus*). Some of the bird species commonly found in this habitat type include kites, American crow (*Corvus brachyrhynchos*), gulls, vultures, Carolina wren, starlings, orioles, warblers, sparrows, northern cardinal, owls, cuckoos, hawks, plovers, killdeer (*Charadrius vociferous*), terns, tree swallow (*Tachycineta bicolor*), sandpipers, osprey (*Pandion haliaetus*), ibis, and numerous species of ducks. Reptiles and amphibians commonly associated with freshwater wetlands include American alligator, bullfrog, cottonmouth (*Agkistrodon piscivorus*), eastern mud turtle (*Kinosternon subrubrum*), yellow mud turtle (*Kinosternon flavescens*), cricket frog, plainbelly water snake (*Nerodia erythrogaster*), snapping turtle (*Chelydra serpentine*), and green frog (*Rana clamitans*).

4.5.3.7 Potential Project Impacts on Terrestrial Wildlife

The impact of construction and operation of the proposed Project on terrestrial wildlife and wildlife habitats would vary depending upon the timing of construction and types of construction techniques used, as well as on the requirements of each species and the habitat present where various Project components would be constructed. In general, impact on terrestrial wildlife would be short term and minimal because no sensitive habitats would be affected, and much of the area affected by construction would be allowed to revert to the pre-construction habitat type following construction.

Acreages of habitat that would be affected by initial clearing and construction activities are described in section 4.4. Some smaller, less mobile wildlife, such as small mammals, amphibians and reptiles, would likely experience direct mortality during clearing and grading activities. Other wildlife, such as birds and larger mammals, would leave the immediate construction area when construction activities approach, and would move to similar habitats nearby. Wildlife would return to much of the Project area following construction and restoration. Operation of the Project would result in the permanent conversion of about 155.3 acres of upland habitat to industrial use, of which 151 acres would be within the LNG terminal site and the remaining 4.3 acres would be within the aboveground facilities associated with the pipeline. This conversion to industrial use would represent a loss of wildlife habitat. Impact of this habitat loss would be minimal, however, because the majority of the loss would be from the LNG terminal site where existing habitat is highly disturbed, and because large areas of suitable habitat are available adjacent to the Project site.

4.6 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

Section 7 of the ESA requires a Federal agency to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of a federally listed endangered or threatened species or result in destruction or adverse modification of the designated critical habitat of a federally listed species. The agency is required to consult with the FWS and NOAA Fisheries to determine whether any federally listed or proposed species or any critical or proposed critical habitat may occur in the project area, and to determine the proposed action's potential effects on these species or critical habitats. If the project would affect a listed species, the agency must report its findings to the FWS and NOAA Fisheries in a BA.

To comply with Section 7 of the ESA, Cheniere consulted with the FWS and the NOAA Fisheries regarding the presence of federally listed threatened or endangered species and their critical habitats in the Project area. Cheniere initiated informal consultation with the FWS on Section 7 and consulted with the TPWD. The FERC staff also contacted FWS and NOAA Fisheries for assistance in determining which species under NOAA Fisheries' jurisdiction would have the potential to be affected by the proposed Project.

We have requested that the FWS and NOAA Fisheries consider this draft EIS as our BA for the Project. The draft EIS has been provided to the appropriate FWS and NOAA Fisheries field offices for their review. An assessment of potential effects of the Cheniere Corpus Christi LNG Project on federally listed endangered or threatened species is included below. We will address FWS and NOAA Fisheries' comments on the draft EIS and/or conservation recommendations in the final EIS.

4.6.1 Federally Listed or Proposed Threatened and Endangered Species

The FWS and NOAA Fisheries identified federally listed species under their jurisdiction that may potentially occur within the area affected by the proposed Cheniere Corpus Christi LNG Project. The following sections describe the ecological requirements of the federally listed and proposed-for-listing threatened and endangered species that potentially occur in the Project area.

Based on the consultations described above, 23 federally listed endangered or threatened species potentially occur within the Project area. The 23 species include eight mammals (five whales, ocelot, Gulf Coast jaguarundi, and West Indian manatee), six birds (Eskimo curlew, brown pelican, bald eagle, whooping crane, piping plover, and least tern), five marine reptile species (loggerhead sea turtle, green sea turtle, leatherback sea turtle, Atlantic hawksbill sea turtle, and Kemp's ridley sea turtle), two fish (smalltooth sawfish and Gulf sturgeon), and two plants (South Texas ambrosia and slender rush-pea).

Cheniere conducted field surveys during July and August 2003 and February and April 2004, and filed the results with the FERC and FWS. We reviewed information submitted by Cheniere and developed our analysis of species effects in this EIS. Of the 23 species that could potentially occur in the Project area, 8 have a low probability of occurrence because suitable habitat was not identified in the vicinity of, or within, Cheniere's proposed Project area or the species current or protected range is believe to be outside the project area (table 4.6.1-1).

TABLE 4.6.1-1

Federally Listed Endangered and Threatened Species Eliminated From Further Consideration for the Cheniere Corpus Christi LNG Project

Species	Status a/	Reason for Elimination from Further Consideration b/	Determination
Mammals			
Ocelot (*Leopardus pardalis*)	F- E TX - E	Inhabits dense, thorny brush, mesquite-oak and oak forests, and partially cleared land. No ocelots or suitable habitat encountered during surveys.	No effect
Gulf Coast Jaguarundi (*Herpailurus yagouaroundi*)	F- E TX - E	Inhabits areas that are similar to the ocelot, dense, thorny brush, and chaparral. No jaguarundi or suitable habitat encountered during surveys.	No effect
Birds			
Eskimo Curlew (*Numenius borealis*)	F- E TX – E/NL	Thought to be extinct.	No effect
Least Tern (*Sterna antillarum athalossos*)	F- E TX – E	Protection under the ESA and state regulation is restricted to "interior" populations. Project is outside of the protected range.	No effect
Fish			
Smalltooth Sawfish (*Pristis pecinata*)	F-E	Project is within historic range of this species, but not within current range.	No effect
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	F-T	Range includes Gulf of Mexico east of Mississippi River. Project is outside of range.	No effect
Plants			
South Texas Ambrosia (*Ambrosia cheiranthifolia*)	F- E TX - E	Grows on flat, deep, generally undisturbed, clay soils and windblown clay dunes along streams. No plants or suitable habitat encountered during surveys.	No effect
Slender Rush Pea (*Hoffmanseggia tenella*)	F- E TX - E	Grows on calcareous, clayey soils with short- and mid-grasses and woody plants such as honey mesquite, huisache, and prickly pear. No plants or suitable habitat encountered during surveys.	No effect

a/ *Status: F = Federal, TX = Texas, E = Endangered, T = Threatened, NL = No Listing.*
b/ Cheniere conducted vegetation and habitat surveys during July and August 2003 and February and April 2004.

We believe that construction and operation of the Cheniere Corpus Christi LNG Project would have no effect on these species and we have eliminated them from further discussion in this EIS. The remaining 15 species have a potential to occur within the Project area (table 4.6.1-2).

Based on May 13, 2004 letters from the FWS, Corpus Christi Field Office, the proposed LNG terminal and pipeline would have no effect on federally listed threatened or endangered species.

The following section provides additional information on the 15 species with potential to occur in the Project area or that could be affected by LNG ships calling on the Project.

TABLE 4.6.1-2

Federally Listed Endangered, Threatened Species Potentially Occurring In the Cheniere Corpus Christi LNG Project Area

Species	Status a/	Preferred Habitat	Determination
Mammals			
Blue Whale (*Balaenoptera musculus*)	F- E TX – E	Deep waters off the continental shelf.	Not likely to adversely affect
Fin Whale (*Balaenoptera physalus*)	F- E TX – E	Deep waters off the continental shelf.	Not likely to adversely affect
Humpback Whale (*Megapetra novaeangliae*)	F - E	Deep waters off the continental shelf.	Not likely to adversely affect
Sei Whale (*Balaenoptera borealis*)	F - E	Deep waters off the continental shelf.	Not likely to adversely affect
Sperm Whale (*Physeter macrocephalus*)	F- E TX – E	Deep waters off the continental shelf.	Not likely to adversely affect
West Indian Manatee (*Trichechus manatus*)	F- E TX – E	Warm, shallow coastal waters, estuaries, bays, rivers, and lakes with water depths between 3 and 6 feet deep. Along the coast they may be found in water 9 to 15 feet deep.	Not likely to adversely affect
Birds			
Brown Pelican (*Pelecanus occidentalis*)	F- E TX – E	Shallow coastal waters within 20 miles or less of the shoreline and in depths up to 80 feet.	Not likely to adversely affect
Bald Eagle (*Haliaeetus leucocephalus*)	F – T TX – NL	Coastal areas, rivers, and large bodies of water.	No effect
Whooping Crane (*Grus americana*)	F- E TX – E	Winter habitat in Texas consists of brackish bays, marshes, and salt flats and upland areas with oak motties, grassland swales, and ponds.	No effect
Piping Plover (*Charadrius melodus*)	F – T TX – T	Ocean, river, and inland lake shorelines, sandy beaches, sandbars, dunes, and silty flats.	Not likely to adversely affect
Reptiles (Sea Turtles)			
Loggerhead Sea Turtle (*Caretta caretta*)	F – T TX – T	Open seas over the continental shelf, bays, estuaries, lagoons, creeks, and mouths of rivers.	Not likely to adversely affect
Green Sea Turtle (*Chelonia mydas*)	F – T TX – T	Lagoons, bays, inlets, shoals, and estuaries, as well as coral reefs, rocky outcrops, and high-energy beaches.	Not likely to adversely affect
Leatherback Sea Turtle (*Dermochelys coriacea*)	F- E TX – E	Open sea, coastal waters, and sandy beaches with a deepwater approach.	Not likely to adversely affect
Atlantic Hawksbill Sea Turtle (*Eretmochelys imbricata*)	F- E TX – E	Coastal reefs, bays, rocky areas, estuaries, lagoons at depths of 70 feet or less, and open sea.	Not likely to adversely affect
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	F- E TX – E	Shallow coastal and estuarine waters over sand or mud bottoms.	Not likely to adversely affect

a/ Status: F = Federal, TX = Texas, E = Endangered, T = Threatened, NL = No Listing.

4.6.1.1 Marine Mammals

Whales

Five federally protected species of whales may be found in the Gulf of Mexico off of the waters of Texas, off the continental shelf (see table 4.6.1-2). The distribution of the blue whale (*Balaenoptera musculus)* and sei whale (*Balaenoptera borealis*) are uncommon in the Gulf of Mexico. The blue whale's range extends from the Arctic Ocean to mid-latitude waters and is often sighted off of eastern Canada. There are only two records of the blue whale from the Gulf of Mexico, both from strandings, and both records have been questioned (TPWD, 2004f). The sei whale's range is in northern waters. The southern limits of its spring and summer range include the Gulf of Maine and Georges Bank. It is often found in the deeper waters of the continental shelf edge (NOAA Fisheries, 2004d).

The fin whale (*Balaenoptera physalus*) is common from Cape Hatteras north to the Gulf of Maine. In this area, fin whales may be the dominant large cetacean species year round, with the largest standing stock, food requirements, and impact on the marine ecosystem. It is likely that fin whales occurring in the eastern Atlantic undergo migrations into Canadian waters, open-ocean areas, and subtropical or tropical regions (NOAA Fisheries, 2004d). There is only one record of a fin whale in Texas waters (TPWD, 2004f).

Humpback whales (*Megaptera novaeangliae*) can be found at their feeding grounds in the Gulf of Maine, Gulf of St. Lawrence, Newfoundland Labrador, and western Greenland during the spring, summer, and fall (NOAA Fisheries, 2004d). Although humpback whales migrate to the West Indies for the winter, significant numbers of whales can be found in mid- and high-latitude regions. A number of wintering humpbacks occur in coastal waters of the southeastern U.S. (NOAA Fisheries, 2004d).

Sperm whales (*Physeter macrocephalus*) are found throughout the world's oceans in deep waters to the edge of the ice at both poles. It has also been documented in the northern Gulf of Mexico during all seasons. Based on year-round occurrence of strandings, sightings, and catches, it is believed that sperm whales in the Gulf of Mexico may represent a distinct population (NOAA Fisheries, 2004d). Sperm whales generally occur in waters greater than 590 feet and prefer continental margins, sea mounts, and areas of upwelling where food is abundant.

Although the whale species listed usually do not occur in relatively shallow waters such as near the Project, they could potentially be impacted by collisions with LNG vessels that are transiting to and from the terminal in the open Gulf. The probability of these species encountering LNG carries in the open ocean would be inherently low given their ability to avoid on coming vessels coupled with their overall rarity.

West Indian Manatee (*Trichechus manatus*)

The West Indian manatee is federally and state listed (in Nueces County) as endangered. Collisions with boat and ship hulls and/or propellers; entrapment in floodgates, navigation blocks, fishing nets, and water pipes; poaching; vandalism; ingestion of marine debris; and hunting have all contributed to the population decline of manatees. The low reproductive rate and loss of habitat have made it difficult for manatee populations to recover (COE, 2003b).

Manatees prefer rivers or estuaries to marine habitats and inhabit warm, shallow coastal waters, estuaries, bays, rivers, and lakes. They prefer water depth between 3 and 6 feet, and along the coast they may be found in water that is 9 to 15 feet deep. They primarily feed on submerged, emergent, and floating vegetation. Manatee populations in the U.S. primarily occur in Florida, where they are isolated from other populations due to the cooler water of the northern Gulf of Mexico and the deeper waters of the straits of Florida. Manatees are extremely rare in Texas; however, during September 2001, a single manatee was observed in the inlet between the Texas Aquarium and the Lexington Museum (COE, 2003b), about 13 miles southwest of the Project area. A manatee was reported in La Quinta Channel from June to August 2004 (FWS, 2004d). Occurrence of a manatee in the Project area is possible but rare.

Marine Mammal Conclusion

The possibility of the Project affecting a protected marine mammal is very remote. The greatest potential for impact would be as a result of a strike by an LNG vessel. To reduce the risk associated with vessel strikes or disturbance of protected species, Cheniere would include the NOAA Fisheries *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* policy as part of its Terminal Use Agreement with LNG Ship operators. NOAA Fisheries recently issued this policy to address vessels involved in the transport of LNG in the Gulf of Mexico. This policy includes six recommendations for vessel strike avoidance that include attempting to maintain certain distances from marine mammals and turtles, attempting to maintain parallel courses to the animal's direction, and reducing vessel speeds when these animals are sighted. In addition, the policy requires that crews report sightings of any injured or dead protected species. We believe that construction and operation of the Cheniere Corpus Christi LNG Project is not likely to adversely affect protected marine mammals.

4.6.1.2 Birds

Brown Pelican *(Pelecanus occidentalis)*

The brown pelican is federally and state listed as endangered. This species was listed throughout its range as chlorinated hydrocarbon residues from pesticide use and loss of habitat due to human disturbance resulted in population declines. The 1972 ban on DDT use and efforts to conserve and improve remaining populations have resulted in an increase in the numbers of this species (National Wildlife Federation, 2004a).

Brown pelicans inhabit shallow coastal waters with depths up to 80 feet. They are rarely found inland and do not venture more than 20 miles out to sea except to take advantage of exceptional foraging conditions. They are colonial nesters with a preference to nest in small bushes and trees on undisturbed offshore islands that are free from human disturbance, flooding, and terrestrial predators. Occasionally, they do nest on the ground. Brown pelicans will loaf and roost on beaches, sandbars, sandpits, mudflats, and man-made structures such as piers, wharves, pilings, oil/gas platforms, and docks (COE, 2003b).

Brown pelicans are a common resident along the Texas Gulf coast. Pelican Island, in Corpus Christi Bay, is a known brown pelican nesting area. Pelican Island is located about 6 miles southeast of the Project area. Brown pelican nest sites were not identified within the Project area during Cheniere's habitat surveys; however, these birds were observed loafing on old pilings and tidal flats and floating on the open bay. They would be expected to occur in the vicinity of the Project area during construction and operation of the Project. Since brown pelicans are considered a highly mobile species and there is an abundance of foraging and nesting habitats within Corpus Christi Bay, we believe that construction and operation of the Cheniere Corpus Christi LNG Project is not likely to adversely affect this species.

Bald Eagle *(Haliaeetus leucocephalus)*

The bald eagle is currently classified as a federally threatened species but it is proposed for delisting in the near future. Several factors such as shooting, habitat alteration, and organochloride pesticide effects on breeding biology were responsible for population declines of this species. Over the recent years, bald eagle populations have been on the rise given that mortality through shooting is on the decline; new wintering and non-nesting habitats have been, and continue to be, created by reservoir construction; and the use of DDT and other organochloride pesticides has been banned since 1972 (COE, 2003b).

Bald eagles inhabit coastal areas, rivers, and large bodies of water. Because fish and waterfowl comprise the majority of the bald eagle's diet, nest sites are rarely far from these types of water habitats. Bald eagles generally build their nests in trees in woodlands, woodland edges, or open areas. They have been known to nest on cliffs, rock pinnacles, and although rare, on man-made structures. The bald eagle winters near lakes and major river systems or, if there is an abundant supply of terrestrial prey, they may winter in areas where there is little or no water (COE, 2003b).

The bald eagle ranges over the U.S. and Canada. Two subspecies are recognized, northern and southern bald eagle, based on size and weight. The northern population nests from central Alaska to northern U.S. and many migrate south for the winter. The southern population nests from New Jersey to California and tend to be more resident during the winter; however, some northward migration during the summer has been documented. The southern subspecies nests along the Texas Gulf coast. A 1999 bald eagle nesting survey conducted for the TPWD identified 82 statewide nesting areas with the southernmost area in Refugio, Goliad, Victoria, and Matagorda Counties (COE, 2003b). These counties are between 30 and 100 miles north-northwest of the Project area. Wintering bald eagles have been noted as far south as Cameron County, about 100 miles south of the Project area, and they are a rare permanent resident in Coastal Bend. Bald eagle nest sites were not identified within the Project area during Cheniere's habitat surveys. If the bald eagle were to occur in the Project area, it would be as a rare migrant or post-nesting visitor. Therefore, we believe that construction and operation of the Cheniere Corpus Christi LNG Project would not affect bald eagles.

Whooping Crane (*Grus americana*)

The whooping crane is federally and state listed as endangered. Conversion of critical habitat to agriculture, disturbance to nesting areas by humans, uncontrolled hunting, and powerline collisions all contributed to a decline in whooping crane populations. Delayed sexual maturity and small clutch size prevent rapid population recovery of this species. Risks to the main population while in Texas include chemical spills along the Gulf Intracoastal Waterway, contaminated food on their wintering grounds, and severe weather events (COE, 2003b).

Designated critical habitat occurs in Aransas National Wildlife Refuge (NWR) in Aransas, Calhoun, and Refugio Counties, which are between 30 and 60 miles northeast of the Project area. This habitat is used during the winter and consists of brackish bays, marshes, and salt flats that provide a variety of plant and animal foods such as blue crabs, clams, and berries. Whooping cranes may use upland areas with oak mottles, grassland swales, and ponds that provide foods such as snails, crayfish, and insects. Other habitats used by whooping cranes are located in Matagorda Island, Isla San Jose, parts of the Lamar Peninsula, and Welder Point on the east side of San Antonio Bay, located about 50 miles northeast of the Project area. The central and eastern Panhandle provide a major stopover area for migrating birds. Whooping cranes in south Texas are generally restricted to the Aransas NWR (COE, 2003b). San Patricio and Nueces Counties are located outside of the whooping crane migration range. We believe that construction and operation of the Cheniere Corpus Christi LNG Project would not affect whooping crane.

Piping Plover *(Charadrius melodus)*

The piping plover is federally and state listed as threatened. Decline in the piping plover population has resulted from over-hunting during the early 1900s, habitat loss or modification due to human development, alteration of river and wetland systems, and predation. Piping plovers inhabit shorelines of oceans, rivers, and inland lakes and nest on a variety of sites including sandy beaches, sandbars, dunes, and silty flats. During the winter, they utilize beaches, mud and sand flats, and offshore spoil islands. The piping plover breeds on the northern Great Plains, in the Great Lakes, and along the mid- to north- Atlantic coast, and winters on the Atlantic and Gulf of Mexico coasts from North Carolina to Mexico. They arrive at their Texas wintering grounds during mid- to late-July and spend a majority of their time on sand and mud flats near sandy beaches. They feed on tidal flats during low tide and Gulf beaches during high tide (COE, 2003b).

San Patricio and Nueces Counties are 2 of the 12 counties in Texas where concentrations of piping plover occur. Four sites in Corpus Christi Bay have been found to harbor wintering piping plover populations: Port Aransas (15 miles east of the Project area), Fish Pass (13 miles southeast of the Project area), Oso Bay (13 miles southwest of the Project area), and sites along the Gulf Intracoastal Waterway (COE, 2003b). Several sites around Corpus Christi Bay have also been designated as critical habitat for the wintering piping plover, with the closest designated critical habitat being Indian Point about 4 miles west of the LNG terminal site. Potential piping plover habitat (tidal flats) was noted within the Project area during Cheniere's habitat surveys conducted during July and August 2003 and February and April 2004; however, no birds were observed. Piping plover could potentially rest and forage on or near the proposed Project site. The near-shore marine habitat and terrestrial wetland types that would be affected by the LNG terminal include about 6.3 acres of estuarine tidal flat that occurs as a narrow band between the coastal marsh and upland. Of this amount, about 1.3 acres of tidal flats would be permanently affected by operation of the LNG terminal. To mitigate for lost aquatic resources, including tidal flats, Cheniere prepared an Aquatic Resources Mitigation Plan that includes the construction of new and preservation of existing habitats (see appendix D). We believe that construction and operation of the Cheniere Corpus Christi LNG Project is not likely to adversely affect piping plover.

4.6.1.3 Sea Turtles

While sea turtles are well known from the Gulf of Mexico, their occurrence in the Project area is incidental. Nesting sea turtles are improbable in the Project area and impacts during nesting are unlikely. With this in mind, we believe that the Project would not adversely impact sea turtles. The most likely affect on sea turtles from the proposed Project, albeit minimal, is for LNG tankers to strike a swimming turtle. This potential impact is discussed further below.

Loggerhead Sea Turtle (*Caretta caretta*)

The loggerhead sea turtle is federally and state listed as threatened. The greatest threats to this sea turtle are coastal development, commercial fisheries, and pollution. Loggerhead sea turtles inhabit continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. In the Atlantic, their range extends from Newfoundland to as far south as Argentina. The primary nesting sites in the Atlantic are along the east coast of Florida. Additional sites occur in Georgia, the Carolinas, and the Gulf Coast of Florida. In the eastern Pacific, loggerheads are reported as from Alaska to the Chile (NOAA Fisheries, 2004a; COE, 2003b).

Mating takes place in late March-early June, and eggs are laid throughout the summer. After hatching, loggerhead hatchlings move to the sea and commonly float on sargassum masses for 3 to 5 years. Subadults occupy near-shore and estuarine habitats, whereas adults occupy a variety of habitats that range from turbid bays to clear water. Loggerhead sea turtles feed on a variety of benthic and pelagic food. The young feed on prey such as gastropods, crustacean fragments, and sargassum, while adults mainly forage on the bottom but will feed on jellyfish from the surface. Loggerhead sea turtles nest on open, sandy beaches above the high tide mark and seaward of well-developed dunes. They prefer steeply sloped beaches with gradually sloped offshore approaches (NOAA Fisheries, 2004a; COE, 2003b).

In Texas, loggerheads are considered to be the most abundant sea turtle, favoring shallow inner continental shelf waters. It has been recorded in Nueces County and Corpus Christi Bay. They may be present in Texas marine waters year-round; however, they are most noticeable during the spring when Portuguese-Man-of-War are abundant (COE, 2003b). Suitable nesting habitat for this species is not available on the proposed Project site.

Green Sea Turtle (*Chelonia mydas*)

The green sea turtle is federally and state listed as threatened. Commercial harvest of eggs and food is the greatest threat to this species, as well as collection for body parts used for leather and jewelry, and stuffing of whole small turtles. Population recovery is hindered by the incidental take of green sea turtles during shrimp harvests, and epidemic outbreaks of tumor infections have caused a severe threat to the population. Green sea turtles inhabit shallow habitats with an abundance of marine algae and seagrass such as lagoons, bays, inlets, shoals, and estuaries. They use coral reefs and rocky outcrops near feeding areas to rest, and they feed on marine plants, mollusks, sponges, crustaceans, and jellyfish. They tend to nest on their natal beach (NOAA Fisheries, 2004a; COE, 2003b).

Green sea turtles are circumglobal species in tropical and subtropical waters. In the U.S., they are found from the Virgin Islands and Puerto Rico, to the continental U.S. from Massachusetts to Texas. In Texas, small numbers of green sea turtles can been found in Matagorda Bay, Aransas

Bay, and the lower Laguna Madre. Although this species has been recorded in Nueces County and Corpus Christi Bay, green sea turtle nests in Texas are rare (NOAA Fisheries, 2004a; COE, 2003b). Preferred nesting and foraging areas for this species are not found on the proposed Project site.

Leatherback Sea Turtle (*Dermochelys coriacea*)

The leatherback sea turtle is federally and state listed as endangered. Overexploitation by man and incidental mortality due to shrimping and fishing activities have contributed to a decline in the population, as has degradation and disruption of nesting habitat and egg collection. Leatherback sea turtles spend most of their time in the open sea and come to land to nest. They may be found in coastal waters only when nesting or following jellyfish concentrations. They feed mainly on jellyfish and sea squirts as well as sea urchins, crustaceans, fish, and floating seaweed and prefer sandy beaches with a deepwater approach for nesting (NOAA Fisheries, 2004a; COE, 2003b).

Leatherback sea turtles are one of the widest-ranging sea turtles; its range extends from Cape Sable, Nova Scotia, south to Puerto Rico and the U.S. Virgin Islands. To optimize both foraging and nesting opportunities, they will migrate between boreal, temperate, and tropical waters. Although leatherback sea turtle sightings have been recorded in Nueces County, this species is rare along the Texas coast and no nest sites have been recorded in more than 60 years (NOAA Fisheries, 2004a; COE, 2003b). Suitable nesting habitat for this species is not available on the proposed Project site.

Atlantic Hawksbill Sea Turtle (*Eretmochelys imbricata*)

The Atlantic hawksbill sea turtle is federally and state listed as endangered. The greatest threat to this population has been the harvest of turtles to supply the tortoise shell market and stuffed turtle curios. It is also used to manufacture leather, oil, perfume, and cosmetics. This species inhabits coastal reefs, bays, rocky areas, estuaries, and lagoons at depths of 70 feet or less. Hatchlings may be found in the open sea floating on masses of marine plants while juveniles, subadults, and adults may found near coral reefs, their primary foraging area. They prefer to feed on invertebrates such as sponges, mollusks, and sea urchins, even though they are omnivorous. Atlantic hawksbill come to land to nest and prefer undisturbed, deep sand beaches, from high-energy beaches to small pocket beaches bounded by crevices of cliff walls with woody vegetation near the waterline (NOAA Fisheries, 2004a; COE, 2003b).

Atlantic hawksbill sea turtle are circumtropical and occur in the tropical and subtropical areas of the Atlantic, Pacific, and Indian Oceans. This species is widely distributed in the Caribbean Sea and western Atlantic Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf of Mexico, especially Texas. Post-hatchlings and juveniles are seen with some regularity in Texas and Florida, in areas primarily associated with stone jetties (NOAA Fisheries, 2004a). Although Atlantic hawksbill sea turtle sightings have been recorded in Nueces County and Corpus Christi Bay, they are unlikely to occur in the Project area. Suitable nesting habitat for this species is not available on the proposed Project site.

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

The Kemp's ridley sea turtle is federally and state listed as endangered. Collection of eggs, capture for meat and other products, direct take for indigenous use, ingestion of man-made materials, collision with boats, and disturbance or destruction of nesting areas are all factors that have contributed to the decline of this species. Despite these factors, the population appears to be in the early stages of recovery. Kemp's ridley sea turtle inhabit shallow coastal and estuarine waters over sand or mud bottoms. Juveniles feed on sargassum while adults are largely shallow-water benthic feeders. Food items include shrimp, snails, bivalves, jellyfish, and marine plants (NOAA Fisheries, 2004a; COE, 2003b).

Juvenile Kemp's ridley sea turtle may range throughout the Atlantic Ocean, while adults are restricted to the Gulf of Mexico. The majority of this species nests along an 11-mile stretch of coastline near Rancho Nuevo, Tamaulipas, Mexico, about 190 miles south of the Rio Grande and 315 miles south of the Project area, and a secondary nesting area occurs at Tuxpan, Vera Cruz. Sporadic reports of nesting areas from Mustang Island, Texas south to Isla Aquada, Campeche have been documented as well. This species occurs in Texas in small numbers and has been recorded in Nueces County and Corpus Christi Bay. It may be transient between crustacean-rich feeding areas in the northern Gulf of Mexico and breeding grounds in Mexico (NOAA Fisheries, 2004a; COE, 2003b). Preferred nesting and foraging areas for this species are not found on the proposed Project site.

Offshore Sea Turtle Impacts

Sea turtles would be a rare visitor to the Project area. Many of the sea turtles discussed have feeding, swimming, or resting behaviors that keep them near the surface, where they can be vulnerable to boat strikes. In the open waters of the Gulf, the LNG tankers would represent an incrementally small increase in boat traffic over current conditions, relative to the area traversed by sea turtles. Several hundred more transits of the Gulf per year by LNG tankers, when compared to the tens of thousands of vessel transits per year under current conditions, represents a miniscule increase in potential boat strike risk for sea turtles in the Gulf. On approach to the Corpus Christi Channel, vessel speeds are minimal so that boat strike hazards are reduced, even when considering the additional vessel traffic posed by the LNG tankers. The addition of several hundred vessel transits to the Port each year represents a small percentage increase when compared to the thousands of current vessel transits. If there are no current turtle strike concerns for the Corpus Christi area, the LNG tankers would not measurably raise the potential for turtle strikes.

NOAA Fisheries recently issued a policy titled *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* that pertains to vessels involved in the transport of LNG in the Gulf of Mexico. This policy includes six recommendations for vessel strike avoidance that include attempting to maintain certain distances from marine mammals and turtles, attempting to maintain parallel courses to the animal's direction, and reducing vessel speeds when these animals are sighted. In addition, the policy requires that crews report sightings of any injured or dead protected species. To help reduce the risk associated with vessel strikes or disturbance of protected species, Cheniere would include the NOAA Fisheries *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* policy as part of its Terminal Use Agreement with LNG Ship operators.

If the rare occurrence of the species were to overlap with the rare incidence of a spill, a turtle could be at risk due to effects of respiration, skin, blood chemistry, and salt gland function (NOAA Fisheries, 2004a). Implementation of Cheniere's SPCC Plan would protect turtles from this potential impact. The Project would not include water intake or discharge that could pose an entrainment risk or directly impact sea turtles. Dredging could result in habitat destruction by disrupting nesting or foraging grounds. Dredging activities during construction would be temporary and local in nature because dredging would be confined to the proposed turning basin and maintenance dredging would only occur periodically. Noise disturbance associated with pile driving activities could expose sea turtles to damaging sound waves; however, suitable nesting or foraging grounds are not present on the proposed Project site. Artificial lighting could cause disorientation of adults and hatchlings thereby increasing the chances of death or injury for some individuals. Female turtles looking for nesting sites tend to avoid intensely lit and highly developed areas, whereas turtle hatchlings tend to be attracted to light and orient themselves toward a light source (NOAA, 2004a). Lighting from the proposed LNG terminal and LNG ships would not adversely impact sea turtles since the occurrence of sea turtles in the Project area is incidental, and suitable nesting areas are not present on the Project site. For these reasons, we believe that the Project is not likely to adversely affect sea turtles.

4.6.2 State Listed Threatened or Endangered Species

Cheniere consulted with the TPWD to determine the potential for occurrence of state listed species within the vicinity of the proposed Project. The protected species list for the State of Texas includes any species that is federally listed (described in section 4.6.1, above) and additional species discussed below.

Eight birds, two mammals, one fish, three amphibians, six reptiles, and two plants are listed by the TPWD as threatened or endangered in San Patricio and Nueces Counties. The TPWD indicated that two endangered plant species, south Texas ambrosia and slender rush-pea, occur within Nueces County. No suitable habitat was identified for these two species during the habitat surveys conducted by Cheniere. Therefore, we eliminated them from further consideration.

Suitable habitat is present within or near the proposed construction areas for eight of the listed birds, two of the listed mammals, the single listed fish, three of the listed amphibians, and six of the listed reptiles. These species are listed in Table 4.6.2-1 and discussed in the following sections.

4.6.2.1 Birds

Reddish Egret *(Egretta rufescens)*

The reddish egret is a common permanent resident along the Texas central lower coast and is uncommon along the upper coast. It breeds locally along the Florida and Gulf state coasts and areas to the south. It inhabits shallow tidal pools, saltwater bays, and marshes; wades in shallow waters and forages for small fishes and crustaceans; and commonly nests in colonies with other herons, egrets, and cormorants. Reddish egret nest in brushy thickets of yucca and prickly pear on dry coastal islands of Texas and among mangroves in Florida (TGLO, 2004).

TABLE 4.6.2-1

State Listed Species with Potential to Occur in San Patricio and Nueces Counties

Species	State Status in San Patricio County a/	State Status in Nueces County a/
Birds		
Reddish egret (*Egretta rufescens*)	T	T
White-faced ibis (*Plegadis chihi*)	T	T
White-tailed hawk (*Buteo albicaudatus*)	T	T
American peregrine falcon (*Falco peregrinus anatum*)	E	T
Arctic peregrine falcon (*Falco peregrinus tundris*)	T	T
Sooty tern (*Sterna fuscata*)	T	T
Texas Botteri's sparrow (*Aimophila botteri texana*)	NL	T
Wood stork (*Mycteria americana*)	T	T
Mammals		
Southern yellow bat (*Laiurus ega*)	T	T
Red wolf (*Canus rufus*)	E	NL
Fish		
Opossum pipefish (*Microphis brachyurus*)	NL	T
Amphibians		
Black-spotted newt (*Notophthalmus variolosus*)	T	T
Sheep frog (*Hypoachus variolosus*)	T	T
South Texas siren (*Siren sp.*)	T	T
Reptiles		
Texas horned lizard (*Phrynosoma cornutum*)	NL	T
Texas scarlet snake (*Cemophota coccinea lineri*)	NL	T
Indigo snake (*Drymarchon corais*)	NL	T
Texas tortoise (*Gopherus berlandieri*)	T	T
Timber/Canebrake rattlesnake (*Crotalus horridus*)	T	NL
Smooth green snake (*Liochlorophis vernalis*) b/	NL	NL

a/ Status: E = Endangered, T = Threatened, NL = No Listing.
b/ The smooth green snake was identified by TPWD as a state listed threatened species that would potentially occur in the project area, although it is not included on the Annotated County Lists of Rare Species for Nueces or San Patricio Counties.

The proposed Project area is located within the reddish egret's breeding range and potential nesting habitat does exist in the Project area. In addition, shallow open bay, coastal marsh, tidal flat, and seagrass habitats are potential foraging areas for the reddish egret. However, Cheniere did not observe this species during habitat surveys.

White-Faced Ibis (*Plegadis chihi*)

The white-faced ibis is declining throughout North America due to the continued draining of wetland ecosystems and pesticides use. White-faced ibis inhabit freshwater wetland areas, including marshes and swamps and areas along certain waterways such as ponds and rivers.

They feed on a variety of small aquatic prey such as insects, annelids, gastropods, crustaceans, amphibians, and fish. The nesting range of this species includes most of the western U.S. and Mexico, and it over-winters in south Texas, southwest Louisiana, Mexico, and areas to the south. The white-faced ibis is a colonial nester and prefers to build its nest in large reed beds lined with grasses (TPWD, 2004b).

The proposed Project is located within the white-faced ibis' breeding range, but Cheniere reported that the species is not nesting within the Project area and that the presence of a nesting or breeding colony in the vicinity of the proposed Project is not known to occur. Shallow open bay, coastal marsh, tidal flat, and seagrass habitats are potential foraging areas for the white-faced ibis. Cheniere did not observe this species during its habitat surveys.

White-Tailed Hawk *(Buteo albicaudatus)*

In Texas, population declines of white-tailed hawk are primarily due to grassland habitat conversion to agriculture and an increase in brushy cover within remaining open grasslands. Over the past four decades, brush removal efforts have produced more favorable habitats for this species. In the southern and central counties of Texas, and north towards Galveston, white-tailed hawk inhabit coastal grasslands. They prefer saltgrass flats near the Gulf of Mexico and dry grassy mesquite-live oak savannahs inland (USGS, 2004a). They perch on bushes, dead trees, fence posts, and utility structures and prey on small mammals, lizards, and insects. Their breeding season is from March to May, and their nest consists of grass-lined sticks in low bushes or small trees or cactus (National Wildlife Federation, 2004c).

Although the presence of white-tailed hawk was not observed during Cheniere's habitat surveys, there is a potential for this species to occur in the Project area.

American Peregrine Falcon (*Falco peregrinus anatum*) and **Arctic Peregrine Falcon** (*Falco peregrinus tundris*)

These two falcon subspecies have been delisted by the FWS; however, they remain listed in Texas as endangered and threatened, respectively. The decline in peregrine falcon populations coincided with the use of DDT; however, since DDT was banned in 1972 there has been a slow recovery of peregrine falcon populations. The American peregrine is a resident of the Trans-Pecos region of west Texas, while the Artic peregrine migrates through Texas, using coastal areas to feed twice a year to reach their nesting grounds in Alaska, Canada, and Greenland. Peregrine falcons nest on cliff ledges and feed on a variety of birds such as blackbirds, jays, swifts, doves, shorebirds, and songbirds (TPWD, 2004c). These species could potentially occur in the Project area as occasional transients during spring and fall migration.

Sooty Tern *(Sterna fuscata)*

The sooty tern is considered a rare local summer resident along the central and lower coast, and is a wide-ranging, pelagic seabird that spends most of its time in flight. It primarily nests on the Dry Tortugas, Florida; however, it also nests irregularly on islands off the coasts of Louisiana and Texas (Florida Fish and Wildlife Conservation Commission, 2004). Cheniere reported that in Texas, six nests were discovered on Pelican Island in May of 1967. During the breeding season (which occurs during May in Texas), these colonial nesters are found on coral cays, atolls, sand banks, rock stack, cliffs, or other offshore islets. They feed on fish and squid taken from the surface of the water. Because the sooty tern is mostly pelagic, there is a low potential of this species occurring in Project area. Sooty terns utilize coastal areas for nesting purposes. Cheniere did not identify suitable nesting habitat in the Project area during habitat surveys.

Texas Botteri's Sparrow (*Aimophila botteri texana*)

Grassland conversion has resulted in local declines of Texas Botteri's sparrow. This species is an occupant of subtropical grasslands; its breeding range is primarily in Mexico, but it reaches the extreme southern portion of Texas and southeastern Arizona. Cheniere reported that in south Texas, breeding pairs may be found in tall bunchgrass and there is a high potential for this species to occur in scrub/shrub, coastal grasses and forbs, and coastal marsh habitat types. It prefers tall, dense grasses with scattered structures used for perches such as bushes and fence posts (Sauer *et al.*, 2003). The Texas Botteri's sparrow is considered an uncommon to locally common summer resident on the lower coastal plain, with isolated breeding records from Duval, Jim Wells, and San Patricio Counties. Cheniere reported that although the proposed LNG terminal may provide suitable habitat for transient residents, the existing disturbed industrial setting reduces suitability of habitat for the Texas Botteri's sparrow.

Wood Stork *(Mycteria americana)*

Loss of suitable feeding habitat is thought to be one of the main reasons for the decline of wood stork populations. Breeding is currently restricted to Florida, Georgia, and South Carolina; however they historically were known to breed throughout most of the southwestern U.S. and Texas. This species prefers freshwater and brackish wetlands, and nests in cypress or mangrove swamps. They feed in marshes, tidal creeks, and depressions where fish and other small aquatic organisms are concentrated (FWS, 2004a). This species is considered an uncommon to common post-breeding visitor to the central and upper coastal prairies, and a regular visitor to lakes and reservoirs in central and east Texas.

Although the proposed Project area is located within the wood stork nesting range, Cheniere reported that nesting on the proposed Project site is unlikely because no nesting or breeding colonies exist near the Project area. Shallow open bay, coastal marsh, tidal flat, and seagrass habitats are potential foraging areas for the wood stork; however, this species was not observed during habitat surveys.

4.6.2.2 Mammals

Southern Yellow Bat (*Laiurus ega*)

The southern yellow bat is a neotropical bat that has been recorded from southern California, southern Arizona, and southern Texas in Cameron, Kleberg, and Nueces Counties. Its range may be increasing in Texas due to the increased ornamental palm tree plantings. Southern yellow bat utilizes trees as daytime roosting sites and feeds on insects captured in flight. In the south Texas area, the southern yellow bat breeds during late winter (Davis and Schmidly, 1997).

Based on the habitat surveys conducted by Cheniere, there is a moderate potential of this species roosting in scrub/shrub habitat type in the Project area and low potential of this species foraging for insects over the coastal grasses and forbs and coastal marsh habitat types. However, construction and operation of the Project would not affect this species given its high mobility.

Red Wolf (*Canus rufus*)

Wild populations of the red wolf are considered extinct. Captive wolves have been introduced in certain areas of North Carolina and Mississippi. They used to occupy the eastern portion of Texas, but increasing pressure on land uses has resulted in a severe decline in population. Red wolfs inhabit brushy and forested areas and coastal prairies (Davis and Schmidly, 1997). There is a very low potential of this species occurring in the vicinity of the proposed Project.

4.6.2.3 Fish

Opossum Pipefish *(Microphis brachyurus)*

Habitat alteration is the main reason for the decline of opossum pipefish populations. It is a circumtropical fish that has been reported from the Rio Grande River, and in *Spartina* marshes as well as *Sargassum* mats in the Gulf of Mexico. Brooding adults are found in fresh to low-salinity waters, while the young move into more saline environments. Cheniere indicated that there is a moderate potential of the opossum pipefish occurring in coastal marsh and seagrass habitats, and a low potential of occurrence in open bay and tidal flat habitats found near the Project area. However, the Project would not affect this species given its ability to swim away from construction and operational activities.

4.6.2.4 Amphibians

Black-Spotted Newt (*Notophthalmus variolosus*), **Sheep Frog** (*Hypoachus variolosus*), and **South Texas Siren** (*Siren sp.*)

Black-spotted newts are found along the coastal plains of south Texas and Mexico. They reside in quiet waters of streams with submerged vegetation, ponds, and ditches and breeding is dependent on the amount of water available. If the water source dries up, young and adult black-spotted newts will seek shelter on land under rocks or rocky ledges (National Wildlife Federation, 2004c). Sheep frogs are found from southeastern Texas into Mexico and prefer moist places in arid areas such as pond and irrigation ditch edges, marshes, mammal burrows, and under vegetative debris (National Wildlife Federation, 2004b). South Texas siren inhabit areas that are similar to the black-spotted newt, but require year-round sources of open water for aestivation, a state of dormancy to assist in water regulation during the hottest parts of the day.

Amphibians in general are sensitive to climatic factors (*e.g.*, drought), habitat changes, and environmental pollutants including pesticides, petroleum hydrocarbons, and heavy metals. These factors combined with the predatory influences of non-native fish species and bullfrogs have contributed to population declines (TPWD, 2004e). Cheniere reported that although irrigation ditches, creeks, and wetland habitats exist on and near the Project area, they are located in highly disturbed areas of industrial and agricultural lands. There is a low potential for these species to occur in the Project area.

4.6.2.5 Reptiles

Texas Horned Lizard (*Phrynosoma cornutum*)

The Texas horned lizard ranges from the south-central U.S. to northern Mexico. This species historically occurred throughout Texas in arid and semiarid habitats with flat, open terrain, scattered vegetation, and sandy or loamy soils (TPWD, 2004e). Cheniere reported that habitats in the Project area include scrub/shrub, coastal grasses, and forbs that are potentially suitable habitats for this species; however, because Texas horned lizard has not been documented in eastern Texas, there is a low potential that it would be found in the Project area.

Texas Scarlet Snake *(Cemophota coccinea lineri)*

The Texas scarlet snake occurs in extreme eastern and south Texas. It prefers hardwood, mixed, or pine forest and adjacent open areas with loose, sandy soils that support thickets of live oaks, honey mesquite, huisache and prickly pear, and watermelon patches (National Wildlife Federation, 2004b). Cheniere indicated that similar vegetative characteristics occur in the Project area, suggesting a moderate potential for this species to occur; however, there is a low potential for the Texas scarlet snake to occur in coastal grasses and forbs habitat that are more typical of the proposed Project site.

Indigo Snake *(Drymarchon corais)*

Loss of habitat is the main threat to the indigo snake. It is primarily a resident of Mexico, but occurs peripherally in the U.S., where it prefers the vast mesquite grassland savannah near streams, ponds, and windmill seeps (Texas Tech University, 2004). Cheniere reported that habitats exist in the upland portion of the Project area; however, this habitat is located in San Patricio County, where the species is not listed. Indigo snake is listed as threatened in Nueces County and, although portions of the Project area extend into this county, the habitat consists of open bay and sea grass, which does not support the indigo snake. There is a low potential for its occurrence in the Project area.

Texas Tortoise *(Gopherus berlandieri)*

Over the years, this species of tortoise has been heavily collected for the pet trade. It is found from south Texas into Mexico and inhabits scrub woodlands with sandy soils and chaparral and mesquite habitats. To protect itself from the midday sun, Texas tortoise will modify existing animal burrows or create a vegetative cover by scraping at the base of vegetation. This species nests from April to September and lays its eggs deep under overhanging bushes (National Wildlife Federation, 2004c). Cheniere reported that there is a low potential for Texas tortoise to occur in the Project area because upland portions of the area are heavily grazed and contain clayey soils. Although scrub/shrub and open grassland habitats may occur in the Project area, they are sporadic and isolated from larger tracts of similar habitat. No Texas tortoises were observed during Cheniere's habitat surveys.

Timber/Canebrake Rattlesnake (*Crotalus horridus*)

This species is wide-ranging throughout the U.S. In Texas, it is found in the central part of the state and prefers swampy areas, canebrake thickets, and floodplains. They are active from April to October and breed during the autumn (National Wildlife Federation, 2004c). Cheniere reported that there is a low potential for Timber/Canebrake rattlesnake to occur in the Project area because potential habitat is of low quality. Cheniere did not observe timber/canebrake rattlesnake during its habitat surveys.

Smooth Green Snake *(Liochlorophis vernalis)*

This species is wide-ranging throughout North America and is found in southeast Texas. It prefers meadows, grassy marshes, and moist grassy fields adjacent to woodlands. They breed during late spring and early summer and are active during the day (National Wildlife Federation, 2004c). Cheniere reported that there is a low potential for Smooth green snake to occur in the Project area because potential habitat is not available on the Project site.

4.6.3 Conclusions and Recommendations for Threatened, Endangered, and Other Special Status Species

A variety of measures have been proposed by Cheniere that would minimize environmental impacts to federally and state listed species, including following our Plan and Procedures, locating most of the permanent aboveground facilities in areas previously distributed, and implementing a SPCC Plan. These measures would reduce the loss of vegetated habitats, minimize marine sediment disturbance and resulting water quality impacts, and minimize delay in restoration of areas temporarily disturbed during construction, such as along the pipeline route. While beneficial to general wildlife, fisheries, and vegetation in the area, these measures would also benefit listed species with the potential to occur in the Project vicinity.

Except for areas underlying permanent aboveground facilities and about 12.2 acres of seagrass, coastal marsh, and tidal flats, all areas disturbed by construction would be returned to pre-construction conditions, which would restore habitat value of these temporarily disturbed areas. Those areas converted for use as permanent aboveground facilities are currently in agriculture or previously disturbed industrial areas with minimal wildlife habitat value. Implementation of the mitigation measures proposed to protect wildlife, aquatic resources, and habitat as described in section 4.5 - Wildlife and Aquatic Resources, would be sufficient to prevent significant adverse effects on threatened, endangered, or other species of concern. Therefore, we believe that the Project would have no effect or would not be likely to adversely affect any federally or state listed threatened or endangered species. However, because consultation with NOAA Fisheries and FWS has not yet been completed for the LNG terminal site, we recommend that:

- **Cheniere should not begin construction activities for the LNG terminal until:**
  - **a. The staff receives comments from FWS and NOAA Fisheries regarding the proposed action;**
  - **b. The staff completes formal consultation with FWS and NOAA Fisheries, if required; and**
  - **c. Cheniere has received written notification from the Director of OEP that construction or use of mitigation may begin.**

In addition we recommend that:

- **If facilities are not constructed within one year from the date of issuance of the authorization from the Director of OEP that construction may begin, Cheniere should consult with the appropriate offices of the FWS and NOAA Fisheries to verify that previous consultations and determinations of effect are still current.**

4.7 LAND USE, RECREATION, AND VISUAL RESOURCES

The Cheniere Corpus Christi LNG Project would be located along the northern shoreline of Corpus Christi Bay in San Patricio and Nueces Counties, Texas. The LNG terminal would be about 2 miles south of the city of Gregory, about 2 miles east of the city of Portland, and about 2 miles northwest of the city of Ingleside. It would be adjacent to the west of the Sherwin plant, situated on land formerly used for industrial purposes, including bauxite ore storage, disposal of treated bauxite residue, and recreation.

The proposed 48-inch-diameter pipeline would extend from the LNG terminal and run in a northwesterly direction for about 23 miles and end less than 5 miles north of the city of Sinton. Between MPs 2.0 and 2.5 the pipeline would be to the west of the city of Gregory, and between MPs 9.2 and 10.5 it would be on the west side of the city of Taft. About 21 miles of the pipeline route (91 percent) would be directly adjacent to existing utility or road rights-of-way. For about 2 miles between MPs 7.8 and 9.8, the pipeline would create a new right-of-way, off-set about 500 feet south of Boykin Road (see table 2.2.2.1-1). About 83 percent of the pipeline route would cross agricultural land.

4.7.1 Land Use

4.7.1.1 LNG Terminal

Existing land uses at the proposed LNG terminal site include a mixture of industrial, open water, and open land. A total of about 1,025 land and water acres would be required for the construction and operation of the LNG terminal (see table 2.2.1-1). About 78 acres would be open water, 79 acres would be open land, and the remainder is industrial land. Table 4.7.1.1-1 shows acreage, ownership, and land use for the proposed terminal site. Onshore portions of the terminal facilities would be located on 212.2 acres of land owned by Cheniere.

The onshore portion of the terminal south of the existing La Quinta Road (proposed docks, transfer pipeline, road to the tug boat docks, helicopter pad, and administrative building) is currently open land. This area covers about 79 acres and consists of tidal flats, coastal marsh, coastal grasslands, and shrub/scrub vegetation (see section 4.4 of this EIS). This parcel includes the former location of the La Quinta mansion, headquarters for the Taft Ranch between about 1906 and 1938. (Its remains were recorded as archaeological site 41SP35; see section 4.10 of this EIS.) Since the 1950s, employees at the alumina plant have utilized this area for informal recreation, including a pier that was once a part of the La Quinta mansion complex. This area also contains an existing natural gas pipeline and tank battery, which would be removed (see section 2.9.3 of this EIS). Construction and operational impacts on this parcel would be limited to the land needed for the docks, new permanent road to the tugboat berth, transfer pipeline, administrative building, and a helicopter pad. The remainder of this tract would be left as open land.

TABLE 4.7.1.1-1

Ownership and Land Use of Parcels within the LNG Terminal Site

LNG Terminal Component	Ownership (acres)	Current Land Use	Construction Requirements (acres)	Operation Requirements (acres)
Offshore marine basin. Maneuvering area, and berths	Cheniere – 26 U.S. – 52	Open water	78	78
On-shore docks, road to tug berth, LNG unloading, transfer pipeline, and administrative office	Cheniere – 78	Open land	5	5
DMPA 1, southern exclusion zone, and contractor yard 3	Alcoa – 112	Industrial	80	112
LNG storage tanks and dikes, processing area for vaporization, holding pond, compressor and generator, control room, shop, firewater tanks, and contractor yard 2	Cheniere – 76	Industrial	41	34
Northern and eastern exclusion zones	Sherwin – 136 Alcoa – 117	Industrial	0	253
DMPA 2	Alcoa – 385	Industrial	385	385
Power line, electric substation, and water line	Alcoa – 9	Industrial	9	9
Contractor Yard 1	PCCA – 6	Open land	6	0

There are two bauxite residue beds on the north side of La Quinta Road, referred to as Beds 22 and 24. Together with the southern exclusion zone, this parcel of industrial land covers about 105 acres, excluding the transfer pipelines. This tract is owned by Alcoa, as the successor to Reynolds, which formerly operated the adjacent alumina plant (owned by Sherwin since 2000). Between 1954 and 1969, Reynolds deposited about 1.6 mcy of waste material from alumina manufacturing in this area. Cheniere has acquired an easement for this property, and intends to use Beds 22 and 24 and the V-ditch as DMPA 1, where it would place about 1.2 mcy of sediment dredged during the creation of the LNG marine basin (see sections 2.1.1.1 and 4.2.2 of this EIS).

North of the bauxite residue beds, Cheniere intends to place its LNG storage tanks and dikes, the vaporization and processing area (including BOG compressor, vapor blowers, and air compressor), pipelines and meter station, vaporization water holding pond, storm water pumps, electric substation and generators, control room, warehouse and shop building, and firewater tanks. Excluding the transfer pipelines, this tract, owned by Cheniere, encompasses about 76 acres of industrial land. This was the previous location of three U.S. government stockpiles of bauxite ore (see section 4.2 of this EIS).

There is an existing raw water reservoir, owned by Alcoa but currently used by Sherwin, located north of the proposed LNG storage and processing area. This 117-acre tract of industrial land is part of the northern exclusion zone for the LNG terminal. On the east side of the LNG storage and processing area is a 136-acre tract of industrial land owned by Sherwin, which would be the eastern exclusion zone for the LNG terminal.

North of the raw water reservoir, east of La Quinta Road and south of Highway 361, is a tract of industrial land owned by Alcoa, which Alcoa calls Facility 200. Between 1954 and 1969, Reynolds deposited at least 7.5 mcy of bauxite residue from its alumina plant at this location. Cheniere intends to use the area for its DMPA 2, covering 385 acres, where it would place about 3.2 mcy of sediments dredged during construction of the marine basin. This area would also be used to place materials from maintenance dredging of the La Quinta Channel. (See sections 2.1.1.1, 2.3.1.1, and 4.2.2 of this EIS for more details about bauxite residue and dredged material disposal.)

The LNG storage and processing area would be accessed by the existing La Quinta Road. Use of this road up to the LNG terminal gatehouse would be non-exclusive. On the east side of the La Quinta Road, Cheniere has acquired an easement from Alcoa, covering a total of about 4 acres, for the non-jurisdictional electric powerline and water line (see section 2.9 of this EIS). The main electric substation would be located on a 5-acre tract of industrial land owned by Alcoa north of the raw water reservoir.

During construction of its LNG terminal, Cheniere would temporarily use three construction yards. Yard 1, covering about 6 acres of open land, would be located west of La Quinta Road on property owned by the PCCA. In the future, this tract would become part of the proposed La Quinta Container Terminal complex. Yard 2 would encompass about 7 acres of industrial land owned by Cheniere, between the proposed LNG storage tanks and the vaporization and processing area. This was also the former location of a U.S. government stockpile of bauxite ore, which has been removed. Yard 3 would be located on about 8 acres of industrial land owned by Alcoa, north of bauxite residue Bed 22 and south and west of Cheniere's proposed location for its LNG storage tanks, within an area that would became part of the southern exclusion zone for the LNG terminal.

Construction and operation of the LNG terminal would have minimal impacts on land use. For the majority, existing industrial land would be used for another industrial purpose. About 78 percent of the land that would encompass the LNG terminal, including exclusion zones and DMPAs, is already industrial land associated with the adjacent alumina plant. The open water in La Quinta Channel that would be utilized for the LNG marine basin would remain open water, only it would be dredged to a deeper depth. The construction of the marine basin and berthing facilities would affect coastal marsh and wetlands, and aquatic vegetation. The mitigation of those impacts is discussed in section 4.4.1 of this EIS. The only land that would be converted to a different use would be the open land where the onshore portions of the docks, transfer pipelines, administrative building, and helicopter pad would be built. In total, approximately 6 percent of the open land on this property would be permanently converted from open land to industrial land for the operation of the LNG terminal.

4.7.1.2 Pipeline

Construction of Cheniere's 48-inch-diameter pipeline would affect a total of about 354 acres of land, including the pipeline construction right-of-way and additional temporary extra workspaces (see table 4.7.1.2-1). Construction of the channel and FGT 30-inch-diameter laterals would affect about 2.3 acres total. No additional land would be affected by construction of the 0.6-mile-long, 30-inch-diameter Gulf South Lateral because it would be co-located within the 120-foot-wide construction right-of-way of the 48-inch-diameter pipeline. Construction of the eight proposed meter stations would affect about 5 acres. The five new access roads to be improved or constructed by Cheniere would affect a total of about 14.3 acres (see table 2.2.2.3-1). Cheniere identified one pipe storage and contractor yard that would be used during construction, a 30-acre parcel of agricultural land located on the northeast side of the city of Odem adjacent to Highway 234.

TABLE 4.7.1.2-1

Land Use Affected by Construction and Operation of the Proposed Cheniere Corpus Christi Pipeline a/

Facility	Agricultural		Open		Industrial		Total	
	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation
Corpus Christi Pipeline	269.6	111.6	52.0	21.9	10.2	4.6	333.1	138.1
Channel Pipeline Lateral	1.6	1.1	-	-	-	-	1.6	1.1
Florida Gas Pipeline Lateral	0.7	0.5	-	-	-	-	0.7	0.5
Pig Launcher and MLV b/	-	-	-	-	0.6	0.6	0.6	0.6
Tetco Pipeline Interconnect	0.5	0.5	-	-	-	-	0.5	0.5
Gulf South Pipeline Interconnect	0.5	0.5	-	-	-	-	0.5	0.5
Channel Pipeline Interconnect	0.5	0.5	-	-	-	-	0.5	0.5
Florida Gas Pipeline Interconnect	0.5	0.5	-	-	-	-	0.5	0.5
Tejas Pipeline Interconnect	0.5	0.5	-	-	-	-	0.5	0.5
Transco Pipeline Interconnect	0.4	0.4	-	-	-	-	0.4	0.4
NGPL Pipeline Interconnect	0.4	0.4	-	-	-	-	0.4	0.4
Tennessee Gas Pipeline Interconnect	0.6	0.6	-	-	-	-	0.6	0.6
Pig Receiver and MLV c/	0.5	0.5	-	-	-	-	0.5	0.5
Access Roads	0.0	0.0	-	-	14.3	11.4	14.3	11.4
Additional Temporary Workspace	14.2	0.0	3.8	-	1.4	0.0	19.4	0.0
Contractor and Pipe Yards	30.0	0.0	-	-	-	-	30.0	0.0
Project Total	**320.5**	**117.6**	**55.8**	**21.9**	**26.5**	**16.6**	**404.1**	**156.1**

a/ Construction impacts include construction right-of-way and temporary workspace. Operational impacts include new permanent right-of-way and aboveground facilities.
b/ The pig launcher and mainline valve (MLV) would be within the LNG terminal boundaries.
c/ The pig receiver and MLV would be co-located with the Tennessee Gas Pipeline Interconnect. Acreage is included under the Tennessee Gas Pipeline Interconnect.

Agricultural lands would be the primary land use affected by construction of the pipelines and associated aboveground facilities (320.5 acres, 79.3 percent). The remaining land uses that would be affected consist of open lands (55.8 acres, 13.8 percent), and industrial lands (26.5 acres, 6.5 percent).

Typical crops grown in the Project area include sorghum, cotton, corn, and soybeans. No special crops or orchards were identified along the pipeline route that would require unique construction techniques. To accommodate deep tilling in the agricultural fields, Cheniere would bury the pipeline to achieve a minimum of 4 feet of land. Cheniere estimates that about 18.7 miles of the pipeline would be buried to 4 feet (see table 4.7.1.2-2). Cheniere would also provide for additional depth of cover where requested by the landowner during right-of-way negotiations, within reason. Elsewhere, the pipeline would be buried a minimum of 3 feet deep.

TABLE 4.7.1.2-2

Depth of Burial for the Pipeline

Mileposts	Depth of Burial (feet of cover)
0.0 to 0.8	3
0.8 to 9.8	4
9.8 to 10.1	3
10.1 to 18.0	4
18.0 to 21.2	3
21.2 to 23.0	4

Land use impacts associated with the pipeline and associated aboveground facilities include disturbance of existing land use, creation of new easements, and conversion of some land to another use. About 156 acres of land would become part of the permanent right-of-way for Cheniere's pipeline and related facilities (see table 2.2.2-1). About 4.4 acres of agricultural land would be permanently converted to industrial use for the operation of the meter stations and MLVs. The NRCS does not consider this to be a significant impact, and we agree, because the surrounding land remains agricultural. About 250 acres of land would be temporarily affected during construction of the pipeline and related facilities. However, after construction these lands would be restored to their previous condition and use. In the case of agricultural lands, outside of aboveground facilities, crops could be planted over both the permanent pipeline right-of-way and the temporary workspace.

About 91 percent of Cheniere's pipeline route would be directly adjacent to existing utility or road rights-of-way. In situations where Cheniere's pipeline would abut an existing pipeline or waterline, about 25 feet of the existing easement would be utilized as part of Cheniere's temporary construction right-of-way. About 2.3 miles of route, including 2 miles along Cheniere's proposed 48-inch-diameter pipeline; the 0.2-mile-long, 30-inch-diameter Channel Lateral; and the 0.1-mile-long, 30-inch-diameter FGT Lateral, would be new green field rights-of-way, with the creation of a new permanent easement covering a total of about 14 acres.

Cheniere would obtain an easement from the landowner in order to construct the pipeline. An easement would be used to convey both temporary (for construction) and permanent rights-of-way to Cheniere. The easement would give Cheniere the right to construct, operate, and maintain the pipeline, and establish a permanent right-of-way. In return, Cheniere would compensate the landowner for use of the land. The easement agreement between the company and the landowner typically specifies compensation for the loss of use during construction, loss of nonrenewable or other resources, and allowable uses and restrictions on the permanent right-of-way after construction. These restrictions can include prohibition of construction of aboveground structures, including house additions, garages, patios, pools, or any other object not easily removable; roads or driveways over the pipeline; or the planting and cultivating of trees or orchards within the permanent easement. The areas used as temporary construction right-of-way and temporary extra workspace would be allowed to revert to pre-construction uses with no restrictions. The acquisition of an easement is a negotiable process that would be carried out between Cheniere and individual landowners.

Cheniere would construct and maintain the pipeline in accordance with measures contained in our Plan and Procedures. Our Plan addresses pre-construction planning, construction, restoration, and right-of-way vegetation maintenance for upland areas, including agricultural lands. Our Plan is discussed in more detail in section 4.2.1 of this EIS. Our Procedures address pre-construction planning, construction, restoration, and vegetation maintenance for wetlands and waterbodies. Our Procedures are discussed in more detail in sections 4.3 and 4.4.1 of this EIS.

4.7.2 Existing Residences and Planned Developments

4.7.2.1 LNG Terminal

The nearest existing residences to the property boundary of the proposed LNG terminal are approximately 1.6 miles west of the terminal within the Northshore Country Club, and approximately 1.6 miles northwest of the terminal within the Bayridge Subdivision. Both of these residential areas are continuing to be developed, and additional residences will likely be constructed within the same general distance from the proposed terminal. The nearest road currently under construction within the Bayridge Subdivision is about 1.5 miles from the proposed terminal property boundary. The next closest residences are approximately 1.9 miles northwest of the proposed LNG terminal property boundary at the southeast edge of Gregory. These residences are also approximately 0.6 mile west of the northern end of the existing Alcoa Facility 200, located at the junction of La Quinta Road and SH 361 that would be used during construction of the LNG terminal for Cheniere's DMPA 2.

Potential impact on these residences as a result of construction and operation of the proposed LNG terminal could include temporary construction-related impacts, and long-term impacts associated with operation. Temporary construction impacts could include inconvenience caused by noise and dust generated by construction equipment. The primary potential impact from noise would include noise generated during pile-driving for installation of LNG ship docks. Potential impact of noise from pile-driving would be minimal for those residences located 1.6 miles from the construction site. Additional discussion of noise impacts is included in section 4.11.2 of this EIS.

Cheniere proposes to implement dust control measures during construction, and we have recommended that Cheniere modify its proposed dust control measures to be more protective (see section 4.11.1 of this EIS). Given the distance between proposed construction activity and the nearest residences, Cheniere's proposed dust control measures, and our recommended modifications to those measures, we believe impact on residences from dust generated during construction would not be significant.

The residences south of Gregory could potentially be affected during the temporary placement of dredged material into the existing Alcoa Facility 200. Potential odors from natural organic matter in the dredged sediment could potentially affect these residences while the sediments are being pumped into the retention ponds. The odors would be limited as long as the dredged material is below the surface of water in the ponds; however, as the dredged material is dewatered there may be some odors generated. If odors are generated, it would be a temporary and localized impact and would be eliminated once the surface of the dredged material is fully dried which should be within several weeks of placement. The potential for odors generated from dredged material disposal is expected to be minimal because the majority of material to be dredged would be deep sediments with little or no organic matter present.

It is also a possibility that dust from the DMPAs could be a nuisance to nearby residences during operation of the LNG terminal. Cheniere indicated that dust from the DMPAs should not be problem, because during the placement of the dredged materials the sediments would be contained in a slurry, and would sit underwater in the ponds. Once the DMPAs have been dewatered, and the sediments are dry, the areas would be seeded and revegetated. Before vegetation can be successfully established, and the DMPAs stabilized, if dust becomes a problem, Cheniere would wet the areas as necessary.

The primary impact to those residences discussed above during operation of the proposed LNG terminal would be visual. The LNG storage tanks would be approximately 175 feet tall and would be visible from points west and northwest of the terminal site. Cheniere prepared visual simulations of the tanks from the residential areas west and northwest of the terminal site. While the proposed tanks would be visible from the nearest residential areas, they would be viewed against the existing backdrop of the Sherwin plant and visual impact would be minimal (see visual simulations and additional discussion below). In addition, the PCCA has proposed to construct the La Quinta Container Terminal between Cheniere's proposed LNG terminal and Northshore County Club and Bayridge Subdivision. The PCCA plans include a planted berm along its western site boundary to create a visual buffer. If constructed, the PCCA's new container terminal would partially obscure any view of Cheniere's LNG storage tanks.

In addition to those occupied residences discussed above, an unoccupied residence is located on PCCA property on the west side of La Quinta Road approximately 0.5 mile north of the northwest corner of the LNG terminal site. This farmstead is leased, and although the house is sometimes occupied on a temporary basis, it is currently abandoned and used as a staging area to store equipment and supplies. According to the PCCA, there is a clause in the lease that allows 30-day notice of termination. The PCCA has informed the lessee that the complex may not be used as a residence if Cheniere should commence construction of its facilities prior to lease termination. Therefore, the Project would not have any adverse impacts on this house.

4.7.2.2 Pipeline

No residences are located within 50 feet of the proposed construction work areas for the pipeline. One house is within 150 feet of the proposed pipeline at MP 16.9. Between MPs 2.0 and 3.0 the pipeline would be about 0.5 mile southwest of the city of Gregory. In this segment there are about 51 houses located between 2,200 and 2,600 feet northeast of the pipeline. Between MPs 9.2 and 10.5 the pipeline would be about 500 feet southwest of the city of Taft. In this segment there are about 289 houses ranging from 378 to 2,600 feet away from the pipeline. We believe that the pipeline would be far enough away from these residences to avoid significant impacts.

In residential areas, the two most significant impacts associated with construction and operation of a natural gas pipeline are disturbance during construction and encumbrance of property for future uses (*e.g.*, the limitation on future permanent structure within the permanent pipeline right-of-way). In our analysis, we consider residences within 50 feet of construction work areas as the most likely to experience the effects of pipeline construction. Temporary construction impacts on residential areas could include inconvenience caused by noise and dust generated by construction equipment; trenching through roads or driveways; ground disturbance of lawns; removal of landscaping or natural vegetative screening; potential damage to existing septic systems or wells; and removal of aboveground structures, such as sheds or trailers, from within the right-of-way.

No residential areas would be affected by the proposed pipeline; therefore, potential impacts to residences during construction would be limited to dust generated during construction. Dust from the construction right-of-way could affect residences at some distance from construction; the exact distance would depend on soil conditions and wind direction. Cheniere proposes to implement dust control measures during construction, and we have recommended that Cheniere modify its proposed dust control measures to be more protective (see section 4.11.1 of this EIS). We believe Cheniere's proposed dust control measures, as modified by our recommendation, would minimize potential impact on residences from dust generated during pipeline construction.

In addition, for the residence located 150 feet from the construction right-of-way at MP 16.9, Cheniere proposes to install orange safety fencing along the side of the right-of-way closest to the residence for a distance of 600 feet. That should prevent unintended impacts on the residence during construction of the pipeline.

4.7.3 Recreation and Special Interest Areas

All of the land that would be used for the LNG terminal and pipeline is privately owned. No public lands, Indian reservations, scenic areas, developed recreational facilities, parks, forests, wildlife management areas, wilderness areas, trials, or registered natural landmarks have been identified in the vicinity of the proposed LNG terminal site or natural gas pipeline.

Portions of the LNG terminal site, south of La Quinta Road, are currently open to Sherwin employees for informal recreational use. There are no developed recreational facilities in this area of open land, but the Sherwin employees have used it for picnics, campfires, and fishing off the old La Quinta mansion pier. This area is in private ownership and is not open for public use. This area would be permanently closed to Sherwin employees at the onset of construction of the

LNG terminal. Cheniere would use this area for its docks, transfer pipelines, and administration building.

Recreational fishing occurs in the Corpus Christi Bay, in La Quinta Channel, and off piers along the shoreline in the Ingleside and Portland areas. Numerous charter fishing boats operate in Corpus Christi Bay, originating out of the communities of Corpus Christi, Ingleside, Port Aransas, Aransas Pass, and Rockport. In 1986, sport fishing in Corpus Christi Bay was a $246 million industry. Of the total fishing efforts out of Texas gulf ports between 1988 and 1998, the Corpus Christi Bay system received an average of 9.6 percent of the private boat and 17.4 percent of the party boat pressure per year. Common species sought by recreational anglers in the bay are redfish, speckled trout, drum, and flounder.

4.7.4 Visual Resources

The degree of visual impact that may result from a proposed project is typically determined by considering the general character of the existing landscape and the visually prominent features of the proposed facilities. The proposed LNG terminal would be constructed in an historically industrial area along the northern shore of Corpus Christi Bay. The LNG terminal would be adjacent to the west of the existing Sherwin plant. The PCCA has also proposed to construct the La Quinta Container Terminal immediately to the west of the LNG terminal site.

The most prominent visual feature of the proposed LNG terminal would be three LNG storage tanks, each 175-feet above the current grade (25 feet) and 145 feet in diameter. In addition to the LNG storage tanks, the proposed storage and vaporization facility would contain several additional structures of a lower profile. The jetty platform for ship unloading would be a single level, pile-supported concrete platform with a maximum nominal elevation of 36 feet. The proposed docking facilities would be lower in profile than the existing docking and unloading facilities at the Sherwin plant, and similar to those that are proposed for the La Quinta Container Terminal.

The height of the three LNG storage tanks would be 22 feet lower than the tallest structure on the adjacent Sherwin plant, which is the flue stack on the Gas Suspension Claciner (197 feet above grade). The highest operating platform at the Sherwin plant is at 167 feet above grade.

We evaluated estimated views of the proposed LNG storage tanks from several surrounding observation points to determine potential impact on the existing landscape. Observation points are shown on figure 4.7-1 and include:

- the Northshore Country Club in Portland (9,500 feet west of the LNG processing area);
- the Bayridge subdivision along Highway 181 in Portland (9,400 feet northwest of the LNG processing area); and
- Highway 35 on the south side of the city of Gregory (9,500 feet north of the LNG processing area).

Cheniere prepared photo simulations of views of the proposed LNG storage tanks from each observation point to assist us in our analysis. Potential visual impact from each observation point is discussed below.

Non-Internet Public

Page 4-66
Map

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

The clubhouse for the Northshore Country Club is about 10,400 feet west of the westernmost proposed LNG storage tank. In 2004, the Northshore Country Club totaled approximately 800 members, including the golf, social, and tennis memberships (M. Gonzalez, 2004). The simulated observation point in figure 4.7-2 is from the back patio of the clubhouse at the Northshore Country Club. As shown on the visual simulation, the LNG storage tanks would be visible on the horizon, with the Sherwin plant visible behind the storage tanks. While the LNG storage tanks would be visible, they would not dominate the landscape, and the view would be consistent with the existing view of distant industrial facilities. We believe the LNG storage tanks would not represent a significant visual impact from the Northshore Country Club.

The easternmost street currently under construction is a part of the Bayridge development Phase IV and is about 10,200 feet northwest of the westernmost proposed LNG storage tank. The simulated observation point in figure 4.7-2 is from a point along this street. This point represents the viewshed from a potential future resident in the subdivision, and is representative of the view from the subdivision in general. The Bayridge development has 43 lots planned for Phase IV (Hogan Homes, 2004). An expansion is planned for the Bayridge development, although details on the location of this expansion are not available as of July 2004.

As shown on the visual simulation, the LNG storage tanks would be visible on the horizon, with the Sherwin plant visible behind the tanks. While the storage tanks would be visible, they would not dominate the landscape and the view would be consistent with the existing view of distant industrial facilities. We believe the LNG storage tanks would not represent a significant visual impact from the Bayridge Subdivision.

In addition, the PCCA has proposed to construct the La Quinta Container Terminal between Cheniere's proposed LNG terminal and Northshore County Club and Bayridge Subdivision. The PCCA plans include a planted berm along its western site boundary to create a visual buffer. If constructed, the PCCA's new terminal would partially obscure any view of Cheniere's LNG storage tanks from the Northshore Country Club and Bayridge Subdivision.

The proposed LNG storage tanks would be visible from the south side of the City of Gregory. The two observation points selected for visual simulations from Gregory are near Interstate 35 at the eastern edge of the city. The first observation point is from a highway access road about 10,300 feet north of the westernmost tank (figure 4.7-3). From this observation point, the LNG storage tanks would be visible under the Highway 35 overpass. The second observation point from the Gregory area is from the top of the Highway 35 overpass about 9,900 feet north of the westernmost tank.

From the Gregory area, the LNG storage tanks would be visible primarily from vehicles traveling on Highway 35. The annual average daily traffic count on the Highway 35 overpass south of Gregory is 36,000 vehicles per day (vpd) (TDOT, 2004). While the LNG storage tanks would be visible from the eastern edge of the city of Gregory, they would be visible against a backdrop of the existing Sherwin, Occidental, and Dupont industrial facilities located to the east of the proposed LNG terminal. The LNG storage tanks would not dominate the landscape. We believe the LNG storage tanks would not represent a significant visual impact to viewers from Gregory.

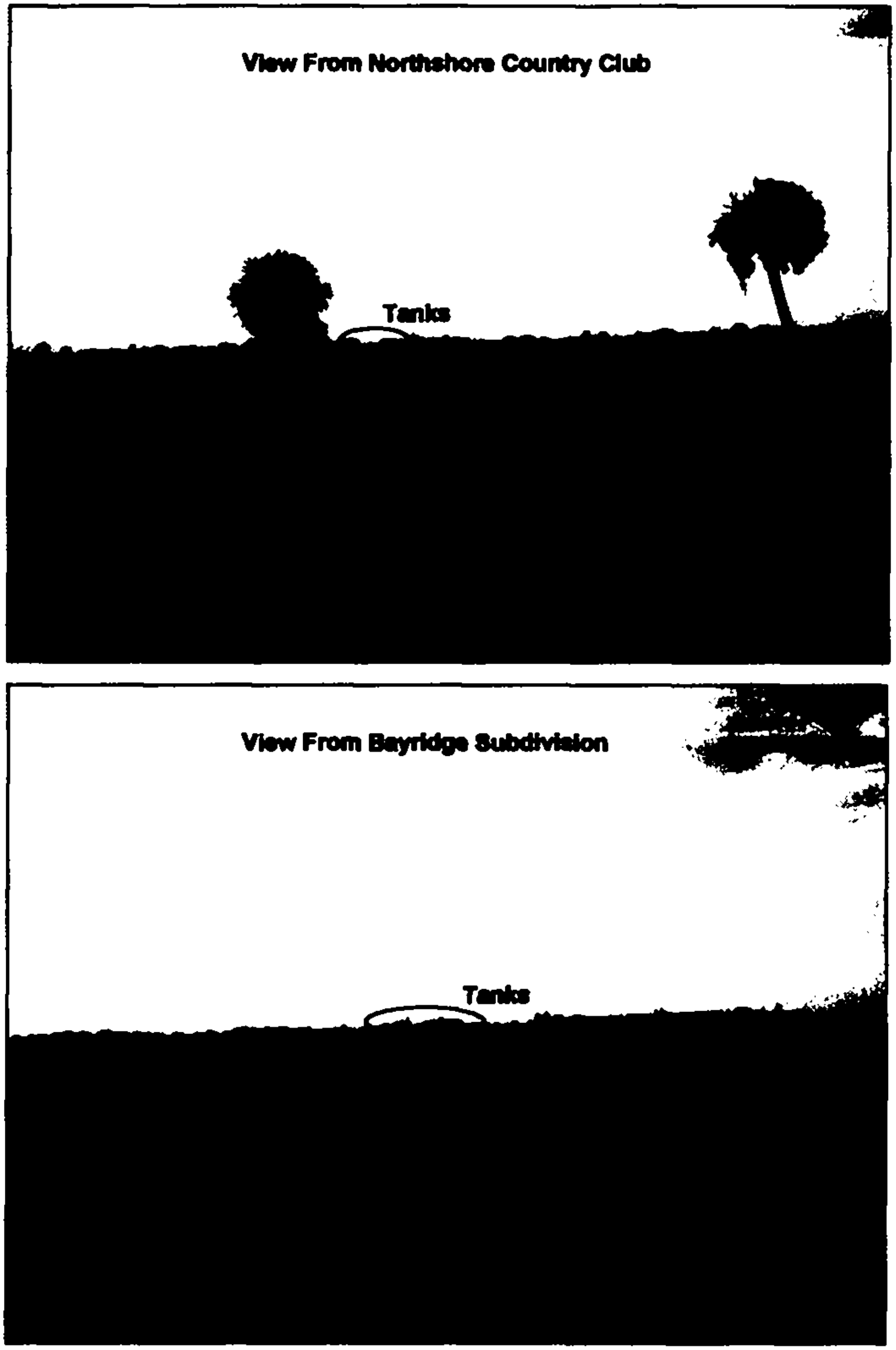
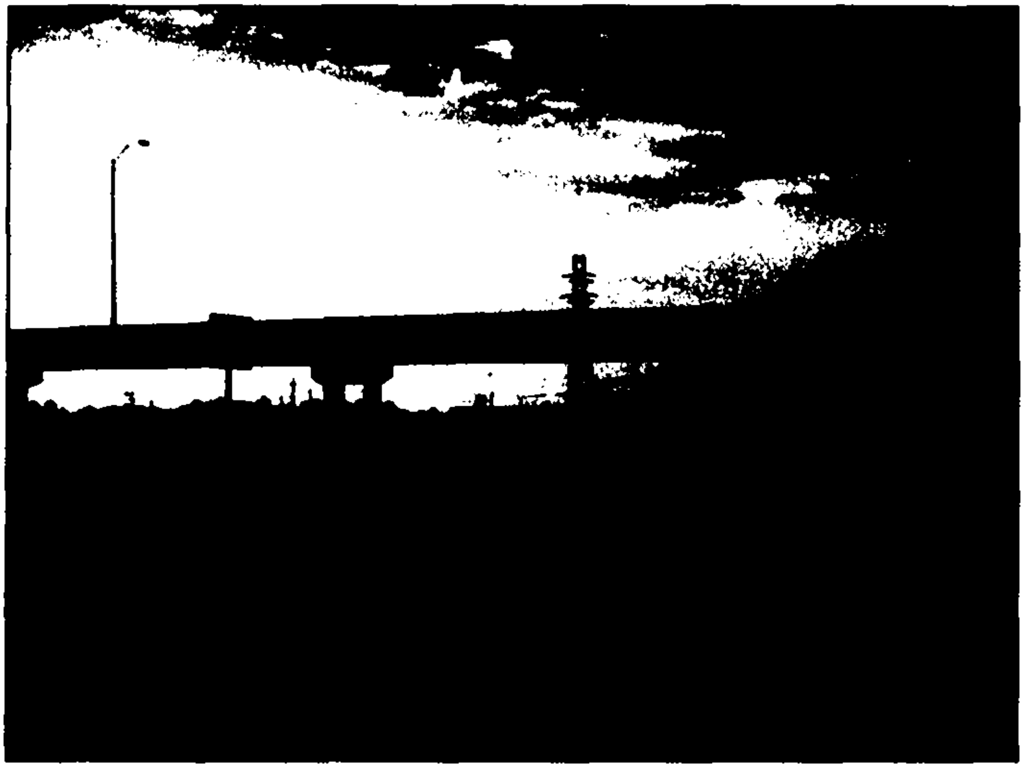


Figure 4.7-2
Cheniere Corpus Christi LNG Project
Visual Simulations of LNG Storage Tanks from
Northshore Country Club and Bayridge Subdivision



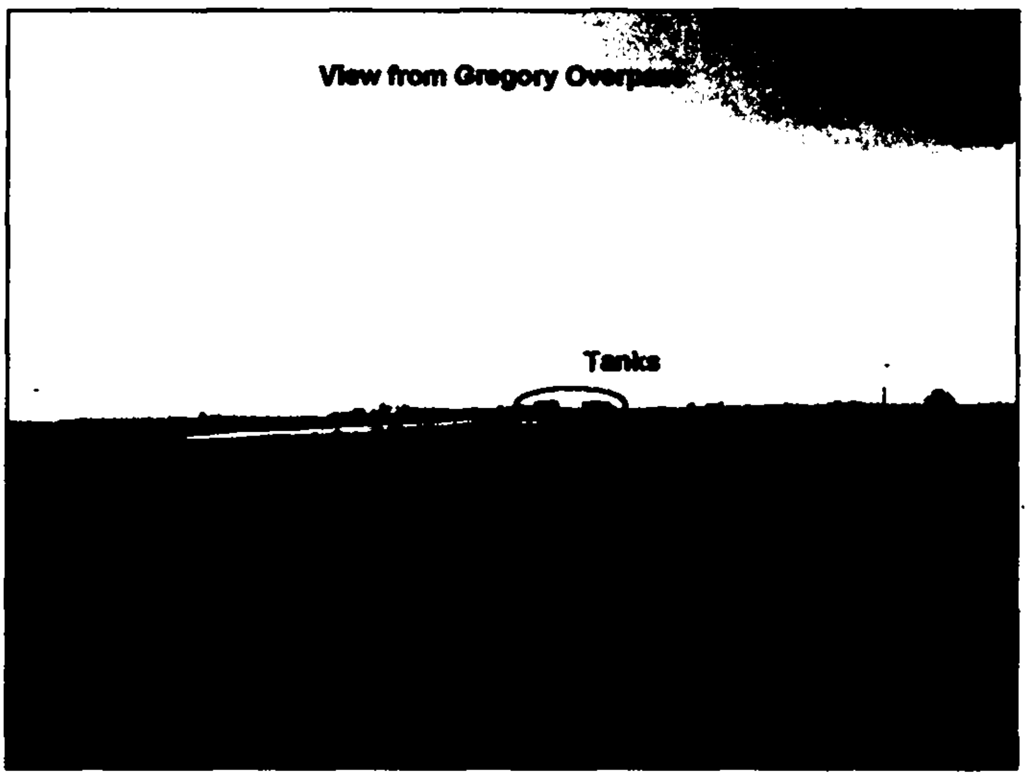


Figure 4.7-3
Cheniere Corpus Christi LNG Project
Visual Simulations of LNG Storage Tanks from City of Gregory

Cheniere also prepared a visual simulation of the proposed LNG terminal from an observation point south of the proposed terminal on Corpus Christi Bay. This simulation is shown on figure 2.1-4. From this observation point, the view of the LNG terminal, including docked LNG ships, would be consistent with the existing industrial facilities, docks, and ships at the adjacent Sherwin plant.

Construction and operation of the proposed pipeline may affect visual resources by altering the terrain and vegetation patterns during construction or right-of-way maintenance and from the presence of new aboveground facilities. The landscape setting along the proposed pipeline route is generally flat. No designated viewing locations are present in areas overlooking the proposed route. The land use is primarily agricultural. Impacts on visual resources due to the pipeline would be primarily temporary and short-term, occurring during construction. During construction, the cleared and graded right-of-way, as well as the construction equipment could be visible from any surrounding residences and local roads. Because the terrain over much of the Project area is flat, views of the construction activities may extend for some distance. Following construction, the right-of-way would be restored. Farmers would be allowed to grow crops over the pipeline. Construction work areas would normally be difficult to distinguish from surrounding areas. Therefore, no long-term visual impacts would result from construction and operation of the pipeline.

Cheniere proposes to install several aboveground facilities associated with the pipeline, including eight meter stations, three mainline valves, one pig launcher, and one pig receiver. Because some of the facilities would be co-located, aboveground facilities would be constructed at 10 separate locations along the pipeline (see section 2.1.3 of this EIS). Although site-specific designs have not been completed, a typical station would include two one-story buildings and a permanent access road. For security purposes, the stations would typically be surrounded by a chain-link fence or equivalent. In addition, the buildings would have intrusion alarms. Yard piping, with the exception of the meter station isolation valve controls, would be installed underground for aesthetic reasons. A small satellite dish would be installed for remote data acquisition and control.

The aboveground facilities would be located on rural farm roads primarily traveled by local farmers or rural residents. The landscape along the proposed pipeline route and the location of the metering stations is dominated by agriculture land uses, and in some areas, and oil or natural gas extraction wells. Four of the proposed aboveground facilities would be located within a half-mile to a mile from a residence. The aboveground facilities at these locations would not be out of character with the rural landscape in San Patricio County. No sensitive visual resources, such as schools or residential subdivisions, or public land were identified within the Project area or in the vicinity of these aboveground facilities. Therefore, the visual impact of the proposed aboveground facilities would not have a significant impact on the aesthetics of the landscape along the proposed pipeline.

4.7.5 Coastal Zone Management

The Texas CZMP boundary delineates the coastal zone. The inland limit of the boundary is a state-defined line that in Texas generally encompasses the area within several miles of the Gulf Coast. The proposed LNG terminal lies within the designated coastal zone management area.

Activities and development affecting Texas' coastal resources that involve a Federal permit or license are evaluated for compliance with the CZMA through a process called "Federal consistency." In order to obtain a consistency determination for the Project, Cheniere must first obtain a COE 404 Permit.

On June 23, 2003, Cheniere sent a letter to the TGLO, Coastal Coordination Council, informing them of the LNG terminal portion of the Project. By letter dated June 25, 2003, the Coastal Coordination Council responded that the review for the consistency determination would begin after TGLO's receipt of Cheniere's permit application to the COE.

Cheniere submitted its permit application to the COE on September 9, 2004. Cheniere included with the application a definitive statement that it believes the Project is consistent with the Texas CZMP. The application is still undergoing review and a Section 404 permit has not been issued. As a result, Cheniere has not received its consistency determination from the Coastal Coordination Council. A determination from the Coastal Coordination Council that the Project is consistent with the Texas CZMP must be received before we could issue a notice to proceed with construction of the LNG terminal.

Therefore, we recommend that:

- **Cheniere should not begin construction of any component of its LNG terminal <u>until</u> it files with the Secretary a copy of the consistency determination issued by the TGLO Coastal Coordination Council.**

A portion of Cheniere's proposed pipeline is also within the coastal zone management area. In a letter dated November 7, 2003, Cheniere informed the Coastal Coordination Council about the pipeline portion of the Project and requested documentation regarding compliance with the CZMP. On November 19, 2003, the Coastal Coordination Council signed the concurrence portion of the letter and returned it to Cheniere, indicating that no additional consultation is required for the pipeline with regards to a finding of Federal consistency.

4.7.6 Hazardous Waste Sites

Cheniere submitted to the TCEQ on May 11, 2004 a request to determine the presence of hazardous waste treatment, storage, or disposal sites, covered under the Resource Conservation and Recovery Act (RCRA), and any other types of waste management sites within 0.5 mile of the proposed LNG terminal.

Cheniere conducted an EDS to determine the presence of hazardous waste treatment, storage, or disposal sites covered under RCRA, and any other types of waste management sites within 0.5 mile of the proposed LNG terminal (TelALL Corporation, 2004). The EDS report identified one facility located within 0.5 mile from the proposed LNG terminal: the Sherwin plant.

The Sherwin plant is located immediately east of the proposed LNG terminal. The RCRA-G database lists this facility as a conditionally exempt small quantity generator. Based on the results of the EDS report, there have been several small reported spills within the Sherwin facility. However, the spills appear to have been reported for incidents on the plant property and do not appear to have occurred on Cheniere's proposed terminal site. Cheniere is currently verifying the physical location of the reported spills.

Cheniere conducted a hazardous materials EDS for the proposed pipeline on November 14, 2003. The data search identified no landfills or hazardous waste sites within 0.25 mile of the pipeline. Potential hazardous waste locations, noted in the RCRA and TCEQ records, in the vicinity of the pipeline included landfills and gasoline stations clustered around the cities of Gregory and Taft.

Prior to the start of construction, Cheniere would develop a Construction Environmental Control Plan that would be included in all construction contracts. This document would describe permit requirements and specify construction activities to be preformed. Key elements of the plan would include mitigation factors that would be implemented if any unanticipated hazards are encountered during Project construction, including the discovery of contaminated soils or buried hazardous waste.

4.8 SOCIOECONOMICS

Several potential socioeconomic effects may result from construction and operation of the proposed Project. Many of these potential effects are related to construction and include the number of local and non-local construction workers who would work on the Project; their income and local expenditures; and their impact on population, public services, and temporary housing during construction. Other potential effects related to construction include local construction expenditures by Cheniere. Potential economic benefits associated with operation of the Project include increased property tax revenue, increased job opportunities and income, and ongoing local expenditures by the company. A discussion of the effects of the proposed Project on local population, employment, the economy, housing, public services, property values, tax revenue, and environmental justice is provided below.

4.8.1 Population

The proposed Project would be located in San Patricio and Nueces Counties, Texas along the northern shoreline of Corpus Christi Bay. The Project site is part of the Corpus Christi Metropolitan Statistical Area (CCMSA), which includes San Patricio and Nueces Counties. Nearby towns and cities include Gregory, Portland, Corpus Christi, Ingleside, Ingleside-on-the-Bay, and Aransas Pass.

Table 4.8.1-1 provides a summary of selected population and socioeconomic statistics for the State of Texas, San Patricio County, Nueces County, and cities surrounding the Project area. Both San Patricio and Nueces Counties had population growth from 1990 to 2000. However, both counties grew at a much lower rate than the state, 14.3 percent and 7.7 percent, respectively. The population density in San Patricio and Nueces County continued to be higher than the state density; Nueces County has a population density of about 5 times greater than the state.

The total Project-related population change would equal the total number of non-local workers, plus any family members accompanying them. During peak construction periods, combining the LNG terminal and pipeline construction workforces, a total of about 900 people would be employed on the Project. As discussed further in section 4.8.2, Cheniere expects to utilize predominately local workers during construction, and employ a relatively small full-time operational staff at the LNG terminal. At most, about 400 non-local workers moving into the area would represent only about 0.01 percent increase in the total population of about 381,000 people in Nueces and San Patricio Counties combined. We believe Project-related effects on the regional population would be short-term and insignificant.

TABLE 4.8.1-1

Existing Socioeconomic Conditions in the Vicinity of the Proposed Cheniere Corpus Christi LNG Project

State/County/Town	Population			Population Density (persons/sq. mi.)		Per Capita Income		Civilian Labor Force (monthly average)	Unemployment Rate (percent)
	1990	2000	Percent Change	1990	2000	1989	1999	2003	2003
TEXAS	16,986,510	20,851,820	22.8%	64.9	79.6	$12,904	$19,617	11,006,017	6.4%
San Patricio County	58,749	67,138	14.3%	84.9	97.1	$9,425	$15,425	30,229	7.4%
Nueces County	291,145	313,645	7.7%	348.2	375.3	$11,396	$17,036	154,476	6.9%
City of Corpus Christi	257,453	277,454	7.8%	NA	NA	NA	NA	NA	NA
City of Portland	12,224	14,827	21.3%	NA	NA	NA	NA	NA	NA
City of Ingleside	5,696	9,388	64.8%	NA	NA	NA	NA	NA	NA
City of Aransas Pass	7,180	8,138	13.3%	NA	NA	NA	NA	NA	NA
City of Gregory	2,458	2,318	-5.7%	NA	NA	NA	NA	NA	NA
City of Ingleside-on-the-Bay	NA	659	NA	NA	NA	NA	NA	NA	NA

NA – data not available

Source: Texas State Data Center and Office of the State Demographer, 2004; Texas Workforce Commission. Labor Market Information Department, March 2004; U.S. Census Bureau, 1990, 2000.

4.8.2 Economy and Employment

For the year 2000, the government, trade/transportation/utility, education/health services, and hospitality service sectors were the largest economic sectors in CCMSA. The largest employers in the CCMSA are the petrochemical industries, health care industry, government and military, and agriculture (Texas A&M University Real Estate Center, 2002). The 1999 per capita income in San Patricio and Nueces Counties was less than the 1999 state per capita income, at $15,425 and $17,036, respectively. The 2003 unemployment rates in San Patricio and Nueces Counties are higher than the state average of 6.4 percent, at 7.4 percent and 6.9, respectively (Texas Workforce Commission, 2004).

The Cheniere Corpus Christi LNG Project would be constructed over a 35- to 38-month period. During construction of the LNG terminal, Cheniere estimated it would employ an average of about 330 workers per month. A maximum of approximately 500 workers would be employed during the peak construction period during months 19 through 22, when the LNG storage and vaporization facility, LNG ship berths, and sendout pipeline are all under construction.

Workforce requirements for pipeline and meter station construction are anticipated to peak at a combined total of approximately 400 personnel. Construction of the proposed 23-mile, 48-inch diameter pipeline would be performed by one contractor spread over a six month time period. The average workforce requirements for the pipeline spread are estimated at approximately

275 persons, peaking at about 325. Separate and/or supplemental subcontracted crews specializing in meter station construction would perform the meter station construction. The meter station construction workforce is estimated to average approximately 50 personnel, peaking at about 75 workers.

Operation of the LNG terminal would require 75 full-time positions, split between three shifts daily. No additional new full-time jobs were identified as necessary for the operation of the pipeline and meter stations. Cheniere estimates that operation of the Project would result in 87 new residents to local communities. This includes 20 facility employees expected to relocate from other areas along with their families.

Cheniere expects to utilize predominately local workers (61 percent) who reside within a 50-mile radius of the Project. The use of local workers is dependent on various factors, such as the construction contractor hired for the Project, the methods the construction contractor uses to hire subcontractors, as well as union agreements. Additional construction personnel hired from outside the Project area would include highly skilled mechanical, electrical, and instrumentation and control tradesmen who would temporarily relocate to the Project area. An estimated $198,753 would be spent monthly on temporary housing of non-local workers, generating $25,838 per month in taxes for the state, San Patricio County, and Nueces County.

During the proposed 35- to 38-month construction period, Cheniere estimates that the total Project payroll would amount to about $81 million, an average of about $2.1 million per month. During this period, some portion of the construction payroll would be spent locally for the purchase of housing, food, gasoline, entertainment, and luxury items. The dollar amount would depend on the number of construction workers in a given area and the duration of their stay.

Cheniere indicated that most of the material purchases required during construction would be made in San Patricio and Nueces Counties. The total Project expenditures for the purchase of construction supplies and equipment are estimated to be about $31 million. In addition, sales tax would be paid on all construction materials as well as any goods and services purchased with payroll monies. Direct payroll and materials expenditures would have a positive impact on local economies and would stimulate indirect expenditures within the region.

Indirect sales, jobs, and salaries would be created in new or existing businesses and organizations such as construction companies, parts and equipment suppliers, and other businesses that supply goods and services to the facility during construction and operation. In addition, jobs and salaries would be created in establishments that would supply goods and services to the facilities employees and their families, such as restaurants, retail stores, grocery stores, and banks. Cheniere estimated that an additional 90 indirect jobs would be created within the local communities as a result of Project construction and operation. Some non-locals may relocate to the Project area to take advantage of indirect job opportunities.

The PCCA, the organization responsible for the maintenance and operation of the marine channel, would be paid a "use tax" equivalent to $5,000 per LNG vessel calling on Cheniere's proposed facility. During times of maximum utilization of the LNG terminal, the PCCA may be expected to receive up to $1.5 million per year from the collection of these fees.

Following construction, the LNG terminal and natural gas pipeline would be subject to state, county, and local property taxes. The local tax rate is levied against part of the assessed value of the facility, and is based on estimated future costs and revenues for each town for the entire year. Local tax rates are determined by town officials according to estimated budget needs at the beginning of each year. Tax revenues are used to support road and bridge programs, school districts, safety, and general county administration. The assessed value of the proposed facilities would be established by the municipalities crossed by the Project.

Cheniere estimates that operation of the Project would result in an estimated net benefit to local taxing authorities of $46,644,463 over the first 10 years. Most of this estimated tax revenue (approximately 65.2 percent) would be from property taxes. Port fees would account for about 32.2 percent of the tax revenue and 2.6 percent would be sales tax or other taxes. According to the Texas Education Agency formula for state school funding, the net benefit of this project to local school districts would be approximately $5,000,000.

4.8.3 Housing

Housing statistics are presented in table 4.8.3-1. The median values of owner-occupied units in San Patricio and Nueces Counties were more than 15 percent lower than the state median value of $82,500. They also have a lower median rent than the state median, as well as a lower median value for owner-occupied housing than the state median. San Patricio and Nueces Counties had a higher percentage of vacant housing units than the state, estimated during the 2000 Census at 3,557 and 14,701 units, respectively.

TABLE 4.8.3-1

2000 Housing Characteristics in the State of Texas and San Patricio and Nueces Counties

State/County	Owner-Occupied	Renter-Occupied	Median Value, Owner-Occupied Units	Median Contract Monthly Rent	Vacancy Rate
TEXAS	63.8%	36.2%	$82,500	$490	9.4%
San Patricio County	68.2%	31.8%	$66,000	$411	11.1%
Nueces County	61.3%	38.7%	$70,100	$465	10.3%

Source: U.S. Census Bureau Census. 2000; Quick Facts; General Housing Characteristics, 2000, 2004.

Temporary housing is available in the form of daily, weekly, and monthly rentals in numerous motels, hotels, campgrounds, and RV parks located within commuting distance of the Project site, especially in the Corpus Christi area. In San Patricio and Nueces Counties combined there are about 27,000 potentially vacant housing units, including 5,393 units available for rent, and 3,805 units available for seasonal, recreational, or occasional use (table 4.8.3-2).

TABLE 4.8.3-2

Vacant Housing Units in the Corpus Christi Area

Type of Housing Unit	San Patricio County	Nueces County
For rent	774	4,619
For sale only	421	1,720
Rented or sold, not occupied	186	12,676
For seasonal, recreational, or occasional use	651	3,154
For migrant workers	21	13
Other vacant	718	2,125
Total:	**2,771**	**24,307**

Source: U.S. Census Bureau, 2000 Census of Population and Housing

Approximately 61 percent of the construction workers for Cheniere's primary construction contractor would come from within 50 miles of the Project site and would not require temporary housing. The remaining 39 percent of the workers for the primary construction contract and all of the LNG storage tank contractor workers would require temporary housing in the Project vicinity during construction. The average number of non-local workers would be 225 in any given month. Assuming double occupancy, these workers would require an average of 112 to 154 hotel rooms per month. Given that there are more than 27,000 potentially vacant units available in Nueces and San Patricio Counties combined, the influx of non-local workers for this Project would not have significant impacts on local housing.

The proposed construction schedule for the Project could coincide with other demands for housing and temporary accommodations from tourism and other unrelated construction projects. Because the demand (in both number and time) from these other users would be influenced by factors such as weather and economic conditions, such demand would be unpredictable. At present, it is reasonable to assume that the vacant or rental housing available near the Project area would be able to accommodate the expected workforce. Few new permanent employees would be anticipated for operation of the LNG terminal; therefore, no long-term major impacts on local housing are anticipated.

4.8.4 Public Services

San Patricio and Nueces Counties have well-developed infrastructure to provide health, police, fire, emergency, and social services near the Project site. Public health infrastructure in San Patricio County includes one community hospital, five health centers, and 10 private clinics (SuperPages, 2004). Nueces County offers more than 45 hospitals and medical centers in addition to 80 clinics and private health practices.

The cities of Gregory and Portland each have a police department and fire department. The Portland City Police and Fire Departments are approximately 3 miles from the proposed Cheniere Corpus Christi LNG terminal site. Both Nueces and San Patricio Counties are served by the Texas Department of Public Safety. Other law enforcement and emergency services are provided by the Nueces County Sheriff's Department (about 11 miles from the proposed terminal) and San Patricio County Sheriff's Office in Sinton, Texas.

The proposed LNG terminal facility is located in an unincorporated area that is not served by a fire department. The neighboring industries, including Sherwin, DuPont, and the Occidental plants, have private fire departments and mutual aid agreements. The same agreements are in place for ambulance services.

The closest school to the Project is Woodroe Petty Elementary School, located about 2,155 feet north of the proposed pipeline at MP 9.7 in the city of Taft. Construction and operation of the pipeline should have no adverse effects on this school.

If enrollment at local schools increases because of the Project, the cost of additional school and student services are estimated to be $700,000 over the first 10 years of operation of the proposed LNG terminal. These costs would be entirely offset by additional funding received from the State of Texas, which provides for additional funding to schools for each child that moves into the district (see section 4.8.2 of this EIS).

Project demands on local agencies could include increased enforcement activities associated with issuing permits for vehicle load and width limits, local police assistance during construction to facilitate traffic flow, and emergency medical services to treat injuries resulting from construction accidents. There are adequate providers of professional and commercial services near the project area in the communities of Corpus Christi, Portland, Gregory, Ingleside, Taft, and Sinton, capable of meeting the needs of the Project workforce. Because the non-local workforce would be small relative to the current population of the area, the Project would not have a significant impact on local infrastructure and public services.

4.8.5 Property Values

The proposed Project is not anticipated to negatively impact property values. The values of properties near the LNG terminal site may already reflect their location in an industrialized zone with existing petroleum and chemical processing and heavy manufacturing industries nearby. Based on the location of the LNG terminal on an existing industrially zoned site, the LNG terminal would not negatively affect property values in the surrounding area.

The proposed pipeline may have an impact on the property values of the surrounding area; however, valuation depends on many factors, including the size of the parcel, the values of adjacent properties, the presence of other utilities, the current value of the land, and the current land use. Similar pipeline rights-of-way are present in the surrounding area; therefore, the property values in the general area of the proposed pipeline would already reflect the presence of underground utilities.

Property taxes are generally based on the actual use of the land. Construction of the pipeline would not change the general use of the land, but would preclude construction of aboveground structures on the permanent right-of-way. If a landowner feels that the presence of a pipeline easement reduces the value of his or her land, resulting in an overpayment of property taxes, he/she may appeal the issue of the assessment and subsequent property taxation to the local property tax agency. This issue is beyond the scope of this EIS.

4.8.6 Environmental Justice

Executive Order 12898 on Environmental Justice requires that each Federal agency address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations, as well as Native Americans.

Table 4.8.6-1 presents the general ethnic mix and economic status of the State of Texas, Nueces County, and San Patricio County.

Nueces and San Patricio Counties have a lower percentage of Black, Native American, and Asian populations than the State of Texas as a whole. However, both counties have a higher percentage of people of Hispanic or Latino origin than the state. Both counties have median household incomes and per capita incomes slightly lower than the state average. Similarly, both counties have slightly higher populations living below the poverty level.

TABLE 4.8.6-1

Environmental Justice Statistics for the Project Area

	Jurisdiction		
	State of Texas	Nueces County	San Patricio County
White	71.0%	72.0%	76.8%
Black	11.5%	4.2%	2.8%
Native American and Alaskan Native	0.6%	0.6%	0.7%
Asian	2.7%	1.2%	0.6%
Persons Reporting Some Other Race	11.7%	18.7%	15.9%
Persons Reporting Two or More Races	2.5%	3.1%	3.0%
Hispanic or Latino Origins a/	32.0%	55.8%	49.4%
Median Household Income	$39,927	$35,959	$34,836
Per Capita Income	$19,617	$17,036	$15,425
Persons Below Poverty	15.4%	18.2%	18.0%

a/ Hispanics may be of any race, so also are included in applicable race categories.

Under Executive Order 12898, each Federal agency must ensure that public documents, notices, and hearings are readily available to the public. All property owners affected by the Project received notices about the Project without distinction based upon minority or income status. The NOI mailing list for this Project included local government representatives, local libraries and newspapers, and local environmental groups. The distribution list for the draft EIS includes local newspapers and libraries, and groups and individuals who provided scoping comments or asked to remain on the mailing list. The NOI and the Notice of Availability for this draft EIS were published in the FR.

The FERC held a public scoping meeting and site visit on March 23-24, 2004 to provide the general public and governmental agencies with the opportunity to comment on the Project. The date and location of this meeting was published in the NOI. Section 1.4 of this EIS further describes the public notification and participation process. Section 4.10.3 describes contacts with Native American tribes that traditionally occupied the area.

The FERC requires special analysis for all residences within 50 feet of the proposed construction work area. There are no residences within 50 feet of the construction work area for the proposed Cheniere Corpus Christi LNG Project.

The LNG terminal would be located in an existing industrial area, and the proposed pipeline would cross mostly rural agricultural land. We have not identified any minority and low-income communities or Native American groups that would be adversely affected by the Project.

4.9 TRANSPORTATION AND TRAFFIC

4.9.1 Land Transportation

The local road and highway system in the Project vicinity is well developed, consisting of U.S. highways, interstate highways, SHs, CRs, farm-to-market roads, and local streets. From Gregory, US 181 provides access to Portland (3 miles away) and Corpus Christi (about 10 miles southwest). Ingleside is located about 5 miles southeast of Gregory via SH 361. Sinton is accessible from Gregory by driving north about 18 miles along US 77. San Antonio is 150 miles northwest of Gregory via Interstate 37, and Houston is 210 miles north via US 77/59. Some of the local roads and highways are shown on figures 1-1 and 2.1-1.

Existing roads would provide land access to the LNG terminal via SH 35, SH 361, and La Quinta Road, south of Gregory. La Quinta Road, a private road currently used as access to the Sherwin plant, would provide primary access to the LNG terminal during construction and operation.

Based on the available traffic count data from the Texas Department of Transportation (TDOT), in 2002 approximately 38,000 vpd traveled the stretch of SH 35 closest to the exit point for the frontage road leading to La Quinta Road. While no official level of service rating has been assigned to roads in the Project vicinity, TDOT believes they would all be considered A or B (the highest ratings).

All traffic to the LNG terminal must come to La Quinta Road via the one-way, east bound, two-lane frontage road that parallels SH 35. Traffic coming from Aransas Pass would have to travel west on SH 35 to Portland, exit on Broadway, make a U-turn and travel back east on SH 35 to the frontage road, heading in the same direction as traffic from Corpus Christi.

The estimated daily construction traffic would be 410 trips in and out of the LNG terminal (or 810 vpd on local roads) during an average month of construction, including all worker vehicles, deliveries and construction traffic. During peak construction, Cheniere anticipates approximately 500 workers would be on site and they would generate approximately 640 daily vehicle trips in and out of the site (1,280 vehicle trips per day on local roads).

When compared to existing daily traffic, the addition of an estimated 820 to 1,280 vpd during LNG terminal construction should not significantly impact traffic flow on SH 35. This represents a daily increase in traffic of only between 2 to 3 percent. However, traffic from the east coming to the LNG terminal may have impacts on local traffic patterns because of the U-turn from the Broadway exit. Likewise, vehicles exiting the LNG terminal may impact traffic patterns at the intersection of SH 35 and State Loop 202, which is a unique and complex intersection. There may also be impacts with local traffic into and out of the Sherwin, Dupont, and Occidental chemical plants via the frontage road. Therefore, we recommend that:

- **Cheniere should consult with the TDOT and other local entities responsible for transportation issues including San Patricio and Nueces Counties and the Cities of Gregory and Portland, and determine the need for a Project-specific Construction Transportation Management Plan. Such a plan would provide specific measures that would be used to transport materials and construction workers to the proposed LNG terminal work site. Aspects of the plan may include, but are not limited to, identification of off-site vehicle parking areas, traffic control measures, traffic control personnel, and construction and delivery hours. Cheniere should file with the Secretary, prior to construction, the results of this consultation and the Construction Transportation Management Plan if recommended by the transportation authorities.**

From the existing La Quinta Road, inside the LNG terminal, Cheniere would have to build new roads around the processing area to provide all-weather access for operation and maintenance purposes. An existing dirt road would be improved to provide access to the proposed administration building. This road would be extended southward to the dock for the tugs and line boats. A new asphalt road would also be constructed parallel to the LNG transfer pipe trestle, connecting the process area to the docks. An existing access road on the east side of the terminal on Sherwin property would be available for use as an emergency exit in accordance with NFPA 59A. LNG terminal roads are shown on the site plan included on figure 2.1-2.

Operation of the Cheniere Corpus Christi LNG Project would require an estimated 75 employees at the LNG terminal, split between three daily shifts. The additional traffic generated by these employees on a daily basis would not result in a significant increase in traffic volume, and would not adversely affect traffic on area roadways.

Access to the pipeline and associated aboveground facilities would be via existing private and public roadways. The pipeline route would parallel Boykin Road (CR 1612) for about 7 miles (MPs 3.0 to 10.0). As discussed in section 2.2.2.3 of this EIS, Cheniere would improve one existing public road as permanent access to the pipeline; improve one existing private road for temporary access; and build three new permanent access roads. The pipeline would cross 14 public (U.S., state, and county) roadways, each of which would be used for access. Public roads crossed by the pipeline and the proposed crossing method for each road are listed in table 4.9.1-1.

Construction of the pipeline and associated aboveground facilities would increase traffic on local roadways for the delivery of equipment and materials, and for construction worker transportation. The roads that would be utilized during construction for the pipeline are primarily two-lane local roads traversing mostly agricultural land with interspersed residential dwellings. Traffic congestion on local roads could result when bulk equipment and materials are moved from roads onto and off of the construction right-of-way, and when equipment operating on the construction right-of-way must cross public roadways. Congestion would also occur when construction workers commute to and from the construction right-of-way. To reduce overall traffic construction workers sometimes leave personal vehicles at a contractor yard and share rides to the construction right-of-way. Appropriate traffic control measures, such as signs, barriers, flashing lights, or flagmen, would be used as necessary at road crossings to ensure safety and minimize traffic impacts.

TABLE 4.9.1-1

Public Roadways Crossed by Proposed Pipeline

Roadway Name	Milepost	Surface Type	Jurisdiction	Proposed Crossing Method
U.S. Highway 181 and State Highway 35	2.1	Paved	Federal and State	Bore
County Road 2986	3.0	Paved	County	Bore
County Road 3667	5.0	Unpaved	County	Open cut
County Road 3567	6.4	Paved	County	Bore
County Road 1612	7.4	Paved	County	Bore
County Road 75	8.7	Unpaved	County	Open cut
State Highway 893	9.8	Paved	State	Bore
State Highway 631	10.1	Paved	State	Bore
County Road 1944	10.1	Paved	County	Bore
County Road 2965	13.3	Unpaved	County	Open cut
U.S. Highway 181	15.2	Paved	Federal	Bore
County Road 1210	16.2	Unpaved	County	Open cut
State Highway 188	17.0	Paved	State	Bore
U.S. Highway 77	20.2	Paved	Federal	Bore

There may be some minor inconveniences for local traffic on unpaved CRs crossed by the pipeline that would be open cut. As indicated in section 2.3.2.2 of this EIS, Cheniere would try to keep at least one lane open, would cover the open cut with steel plates, provide traffic direction, and consult with local authorities prior to construction about the timing of such crossings.

In response to our NOI for this Project, the TDOT provided its comments in a letter dated March 24, 2004. TDOT requested that the pipeline be bored under all state roads it would cross. As indicated on table 4.9.1-1, Cheniere intends to comply with that request. In addition, TDOT requested that the pipeline be bored below the minimum required depth.

There is no passenger railroad service in the Corpus Christi area. Commercial railroad lines in the vicinity of the Project include the Texas Mexican, Union Pacific, Burlington Northern/Santa Fe, Missouri Pacific, and Southern Pacific. Cheniere indicated that while it may be possible to ship materials for the LNG terminal via rail during construction of the proposed facilities, this was not the preferred option. Concerns about the logistics of rail shipments to the offloading facilities at the Sherwin plant and trucking the materials from there to the Project reduces the viability of using rail transportation. Pipe for the pipeline, however, may be shipped by rail to the yard at Odem.

4.9.2 Marine Transportation

In its application Cheniere indicated that materials required for construction of the LNG terminal may be delivered to the site by barge. However, in response to a data request Cheniere stated that very little material could be brought to the terminal site by barge due to the lack of sufficient cargo offloading facilities. While there would be minimal water transportation impacts during construction of the terminal, operation of the terminal would result in regular LNG ship traffic in Corpus Christi Bay and the La Quinta Channel. The following sections discuss LNG ships. Discussion of marine traffic and transportation as it relates to marine safety is included in section 4.12.5 of this EIS. *In addition, two other LNG terminals and a container terminal are proposed* for locations on the La Quinta Channel. The cumulative impact on shipping of the proposed Cheniere Corpus Christi LNG Project combined with these other projects is discussed in section 4.13 of this EIS.

LNG Ship Design and Safety Systems

The LNG terminal would be designed to receive up to 300 LNG ships per year. Ships that transport LNG are specially designed and constructed. LNG ship construction is highly regulated and consists of a combination of conventional ship design and equipment, with specialized materials and systems designed to safely contain liquids stored at temperatures of -260 °F. The following section presents a brief overview of the main design and safety features of a typical LNG ship.

Profile

LNG ships have a distinctive appearance compared with other transport ships. A LNG ship has a high freeboard (*i.e.*, that portion of the ship above water) when compared with vessels such as an oil tanker, because of the comparatively low density of the cargo. Because of the high freeboard, wind velocity can adversely affect the maneuverability of the ship, particularly at slow speed, such as during docking.

Hull System

All LNG ships are constructed with double hulls while most other liquid transport ships presently in use have single-hull construction. Double-hull construction increases the structural integrity of the hull system and provides protection for the cargo tanks in case of an accident. The space between the inner and outer hulls is used for water ballast. The International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (Gas Tanker Code) and USCG regulations require that LNG ships meet a Type IIG standard of subdivision, damage stability, and cargo tank location.

The Type IIG design ensures the LNG ship could withstand flooding of any two adjacent compartments without any adverse effect upon the stability of the ship. Type IIG design also requires that the cargo tanks must be a minimum of 30 inches from the outer hull and minimum distance above the bottom of the ship equal to the beam of the ship divided by 15, or 6.5 feet, whichever is less. This distance is intended to prevent damage to the cargo tanks in case of low energy-type accidents that might occur in harbors and during docking. Most large LNG ships have a distance of 10 to 15 feet between the outer hull and cargo tank.

Containment Systems

A LNG containment system on the LNG ships consists principally of the cargo tank (sometimes called a primary barrier), the secondary barrier, and insulation. The containment system also includes cargo monitoring and control and safety systems.

Three basic tank designs have been developed for LNG cargo containment: prismatic free-standing, spherical, and membrane. The earliest form of LNG containment is the prismatic free-standing tank. It consists of an aluminum alloy or 9 percent nickel steel, self-supporting tank that is supported and restrained by the hull structure. Insulation consists of reinforced polyurethane foam on the bottom and the sides, with fiberglass on the top. The spherical tank design uses an unstiffened, spherical, aluminum alloy tank that is supported at its equator by a vertical cylindrical skirt, with the bottom of the skirt integrally welded to the ship's structure. This free-standing tank is insulated with multi-layer close-cell polyurethane panels. In the membrane containment system, the ship's hull constitutes the outer tank wall, with an inner tank membrane separated by insulation. Two forms of membrane are commonly used: the Technigaz membrane using stainless steel and the Gas-Transport membrane using Invar.

LNG tankers are of the double-hulled design regardless of the containment system used. A double bottom and double sides are provided for the full length of the cargo area and arranged as ballast tanks, independent of the cargo tanks. The double-hulled design provides greatly increased reliability of cargo containment in the event of grounding and collisions. Further, the segregated ballast tanks prevent ballast water from mixing with any residue in the cargo tanks.

Pressure/Temperature Control

A basic goal of all LNG containment systems is to maintain the LNG cargo at or near atmospheric pressure at the boiling temperature of the LNG (about -260 °F). This is accomplished using "auto-refrigeration," a phenomenon that results from the constant heat flow into the tank and the removal of the associated vapor.

The vapor generated during auto-refrigeration is known as boil-off. Typical boil-off rates of LNG ships range from 0.25 to 0.15 percent (by volume) per day. Currently, all LNG ships burn the boil-off as fuel. The USCG does not permit routine venting of BOG to the atmosphere. Thus, all LNG ships that trade in the U.S. are fitted with an internalized combustion energy system that allows the ship's boilers to consume all of the BOG to fuel the ship's steam propulsion system. As a result, LNG ships have reduced emissions when compared with conventional oil-fired ships.

Ballast Tanks

Sufficient ballast water capacity must be provided to permit the ship to return to the loading port safely under various sea conditions. LNG cargo tanks are not used as ballast tanks because these tanks must contain a minimal amount of LNG in them at all times, even when "empty" in order to keep the tanks cold in normal operation. Consequently, LNG ships must be designed to provide adequate ballast capacity in other locations.

Ballast water tanks of the LNG ships are arranged within the LNG ship's double hull. It is essential that ballast water not leak into the LNG containment system. To reduce the potential for leakage, the ballast tanks, cofferdams, and void spaces are typically coated to reduce corrosion. LNG ships are also periodically inspected to examine the coating and to renew it as necessary.

A ballast control system, which permits the simultaneous ballasting during cargo transfer operations, is also incorporated into each LNG ship. This allows the LNG ship to maintain a constant draft during all phases of its operation to enhance performance. Under normal operating conditions, ballast water would be taken onto the ship during LNG off-loading at the Cheniere Corpus Christi LNG terminal.

Ship Safety Systems

The LNG vessels proposed for use in the Cheniere Corpus Christi LNG Project would have to comply with all Federal and international standards regarding LNG shipping. As such, ships that transport LNG to the Cheniere Corpus Christi LNG terminal would be fitted with an array of cargo monitoring and control systems. These systems would automatically monitor key cargo parameters while the ship is at sea and during the remote-control phase of cargo operations at the marine terminal.

The system includes provisions for pressure monitoring and control, temperature monitoring of the cargo tanks and surrounding ballast tanks, emergency shutdown of cargo pumps and closing of critical valves, monitoring of tank cargo levels, and gas and fire detection.

The LNG ships would be fitted with many navigation and communication systems, including:

- two separate marine radar systems, including automatic radar plotting and radio direction finders;
- LORAN-C receivers;
- echo depth finders; and
- a satellite navigation system.

All LNG ships also have redundant, independent steering control systems that are operable from the bridge or steering gear room to maintain rudder movement in case of a steering system failure.

Fire Protection

All LNG ships arriving at the Cheniere Corpus Christi LNG terminal would be constructed according to structural fire protection standards contained in the International Convention for the Safety of Life at Sea (SOLAS). This would be done under the review and approval of the USCG.

The ships would also be fitted with active fire protection systems that meet or exceed design parameters in USCG regulations and international standards, such as the Gas Tanker Code and SOLAS, including:

- a water spray (deluge) system that covers the accommodation house and central room, and all main cargo control valves;
- a traditional firewater system that provides water to fire monitors on deck and to fire stations found throughout the ship;
- a dry powder extinguishing system for LNG fires; and
- a carbon dioxide system for protecting the machinery, ballast pump room, emergency generators, cargo compressors, etc.

Crew Qualifications and Training

All officers and crews of the LNG ships would comply with the International Convention Standards of Training, Certification and Watch Keeping for Seafarers. Key members of the crew must have specific training in the handling of LNG and the use of the safety equipment. Officers must receive simulator training in the handling of the ship and the cargo systems specific to the conditions at the project site. In addition, a local pilot from the port would board each ship and guide it through the Corpus Christi Channel.

Ship Selection

The specific identity of LNG ships that would off-load at the Cheniere Corpus Christi LNG terminal would depend on the commercial terms of the LNG purchase agreements. Transportation could be provided by either the LNG buyer or supplier. The different contractual arrangements for LNG transport can result in ships of different sizes and countries of origin being used to transport LNG to the LNG Terminal.

Table 4.9.2.1-1 shows the relative dimensions of two of the larger LNG ships that could be used to transport LNG to the Cheniere Corpus Christi LNG terminal: 125,000 m^3 cargo capacity typical of ships presently in service; and 165,000 m^3 potential cargo capacity of future ships.

TABLE 4.9.2.1-1

Typical LNG Ship Characteristics

Specifications	Existing Ships	Future Ships
Capacity	125,000 m^3	165,000 m^3
Length	950 feet	1,000 feet
Beam	145 feet	150 feet
Loaded Draft	38 feet	40 feet
Hull Depth	82 feet	100 feet
Loaded Displacement	95,000 Long Tons	122,000 Long Tons

Ships arriving at the Corpus Christi LNG terminal would comply with the USCG regulations for LNG ships. This compliance is demonstrated by the operator of the LNG ship having proper certificates authorizing the transport of LNG as follows:

- U.S. Flag LNG Ship – The USCG Certificate of Inspection must be valid and endorsed for the ship to transport LNG (46 CFR 154, 1979).
- Foreign Flag LNG Ship – The ship must have a valid Certificate of Compliance issued by the USCG. The certificate is issued after the ship has proved that it complies with the USCG regulations and after it has been satisfactorily inspected by a USCG Marine Safety Office (46 CFR 154, 1979).

Both U.S. and foreign flag ships must be inspected annually by the USCG and the flag state. A USCG Certificate of Inspection is required every 2 years. USCG officers from the Marine Safety Unit, Corpus Christi, Texas, may board the LNG ships arriving in the Channel to ensure safety standards are met. Cheniere would continually monitor ship operations to ensure that the operations are according to their established procedures and to ensure that the ships are maintained to all standards.

4.10 CULTURAL RESOURCES

Section 106 of the NHPA, as amended, requires the FERC to take into account the effect of its undertakings (including authorizations under Sections 3 and 7 of the NGA) on properties listed, or eligible for listing, on the NRHP and to provide the ACHP an opportunity to comment. Cheniere, as a non-Federal party, is assisting the FERC in meeting its obligations under Section 106 and the ACHP's implementing regulations at 36 CFR 800.

4.10.1 Results of Cultural Resource Surveys

Cheniere initiated consultation with the Texas Historical Commission (the State Historic Preservation Office or SHPO) on November 7, 2003, via a letter regarding the proposed pipeline. In a letter dated December 10, 2003, the SHPO stated that it looked forward to reviewing an overview report, a project-specific research design, and a subsequent cultural resources survey report. Cheniere filed an overview report with its pipeline application. The overview, provided to the SHPO on December 17, 2003, indicated that one previously recorded site (41SP86) may be located along the pipeline route, and recommended archaeological testing at three high probability areas (HPA) (Perkins and Prince, 2003).

On January 13, 2004, the SHPO requested clarifications concerning certain issues related to Cheniere's pipeline overview report. Cheniere provided clarifications on January 14, 2004, that were accepted by the SHPO on January 15, 2004.

On January 20, 2004, Cheniere filed a survey report for its original pipeline route (now considered in this EIS as a route alternative), and submitted a copy of that report to the SHPO on January 19, 2004. This report documented a pedestrian inventory of about 12.5 miles of the original pipeline route, and archaeological testing at two HPAs. No cultural resources were identified and previously recorded site 41SP86 was not relocated (Perkins and Latham, 2004). The SHPO reviewed this report in a letter dated March 25, 2004.

Cheniere filed a second survey report for its pipeline on May 11, 2004. This report documented a pedestrian inventory of 20.9 miles of the currently proposed pipeline route, and shovel testing at three HPAs. The survey also covered the pig launcher and MLV at MP 0.0; the Channel Lateral and meter station at MP 14.6; the FGT Lateral and meter station at MP 16.5; the Tennessee Gas meter station, MLV, and pig receiver at MP 23.0; the pipe storage and contractor yard at Odem; and five access roads totaling about 4.3 miles in length. Two isolated finds were recorded during this survey (Perkins, 2004). Cheniere indicated that it would survey the remaining 2.1 miles of proposed pipeline (MPs 3.1 to 5.2) when access to the property is obtained. On July 8, 2004, the SHPO accepted this report and indicated that no historic properties would be affected along the inventoried portion of the pipeline route. We concur.

On January 28, 2004, Cheniere filed a survey report covering a portion of the LNG terminal site. That report identified 11 archaeological sites within the area of potential effect (APE) (Klinger, 2004). In a letter dated March 3, 2004, we requested revisions to that report. Cheniere filed a second survey report for the LNG terminal on May 24, 2004. That report documented a pedestrian inventory of about 79 acres. Nine of the sites previously identified by Klinger were relocated, and three new archaeological sites and an isolated find were recorded

(Turner, 2004). We requested revisions to this report in a letter to Cheniere dated June 8, 2004. On June 25, 2004, the SHPO also requested that Cheniere provide additional data.

The prehistoric sites recorded within the LNG terminal are middens containing shell and faunal remains, with chipped stone artifacts and some pieces of pottery. Klinger (2004) believed that these sites may be related to the Aransas or Rockport cultures, dating between about 3,000 and 600 years before present, and recommended that further archaeological testing be done in order to evaluate their eligibility for the NRHP. One site (41SP35) contained a historic component, consisting of the archaeological remains of the La Quinta mansion, headquarters for the so-called Taft Ranch between about 1906 and 1938. In Klinger's opinion, site 41SP35 is potentially eligible for nomination to the NRHP. PBS&J (Turner, 2004a) conducted limited testing at six prehistoric sites previously recorded by Klinger. It was their opinion that none of the sites within the LNG terminal require additional work.

On July 27, 2004, Cheniere submitted to the SHPO an addendum report for the LNG terminal (Turner, 2004b). The SHPO stamped this letter "concur," on August 24, 2004. We agree with the SHPO that no historic properties would be adversely affected within the LNG terminal.

4.10.2 Native American Consultation

Our NOI for the Project, issued on February 20, 2004, was sent to Indian tribes and Native Americans who may have historically occupied or used the project area, and who may attach religious or cultural significance to sites in the region. Copies of the NOI went to the Coahuiltecan Nation, Comanche Penateka Tribe, Comanche Tribe of Oklahoma, Comecrudo Nation, Kickapoo Traditional Tribe of Texas, Kiowa Tribe of Oklahoma, People of LaJunta, Lipan Apache Band of Texas, Mescalero Apache Tribe of New Mexico, Tonkawa Tribe of Oklahoma, and the Ysleta de Sur Pueblo of Texas. Only the Comanche Penateka Tribe responded to our NOI, requesting to remain on our environmental mailing list.

Cheniere contacted the Anadarko, Oklahoma office of the U.S. Bureau of Indian Affairs via a letter dated June 23, 2003. In letters dated July 7, 2003, Cheniere contacted the Caddo Nation of Oklahoma, the Wichita and Affiliated Tribes of Oklahoma, the Alabama-Coushatta Tribe of Texas, and the Tonkawa Tribe of Oklahoma. The Comanche Tribe of Oklahoma, the Kiowa Tribe of Oklahoma, and the Mescalero Apache Tribe were contacted with letters dated November 7, 2003, to solicit any concerns about the Project with regard to potential impacts on traditional cultural properties.

The Alabama-Coushatta Tribe of Texas responded, in a letter dated August 7, 2003, that the Project falls outside of its tribal area of interest. In a letter to the FERC dated March 18, 2004, the Chitimacha Tribe of Louisiana stated that the Project was not within its aboriginal homeland. In an April 30, 2004 e-mail to Cheniere's consultant, the Tribal Historic Preservation Officer for the Caddo Nation indicated that there are no sites of significance to the tribe in the Corpus Christi area. The Tonkawa Tribe commented, in a letter dated June 14, 2004, that it has no specific sites within or around the Project area. However, they want to be notified if any inadvertent discoveries are made.

4.10.3 Unanticipated Discoveries

As part of its application for the LNG terminal, Cheniere filed a plan for handling the unanticipated discovery of human remains or cultural resources during construction. On December 17, 2003, Cheniere submitted an unanticipated discovery plan for its pipeline to the SHPO. The SHPO requested revisions to this plan on December 24, 2003. In letters to Cheniere dated March 3 and June 8, 2004, we also requested that the plan be revised. Cheniere filed a revised plan on September 13, 2004. However, Cheniere did not document that the plan was acceptable to the SHPO.

4.10.4 Compliance with the NHPA

We have not yet completed the process of complying with Section 106 of the NHPA. Cheniere needs to document a survey covering 2.1 miles along the pipeline route. The SHPO's comments on the revised unanticipated discovery plan also should be provided. Lastly, Cheniere needs to file revised final inventory reports that address our comments on draft reports.

We have fulfilled our responsibilities with regards to Section 101(d)(6) of the NHPA, and 36 CFR 800.2(c)(2). We contacted Indian tribes which may have historically occupied or used the project area, and might attach religious or cultural significance to historic properties in the APE. No tribe identified any traditional cultural properties which may be affected by the Project. Nor were any religious, cultural, or sacred sites identified by Cheniere's cultural resources consultants during their literature searches, or by the SHPO.

To ensure that the Commission's responsibilities under Section 106 of the NHPA and its implementing regulations are met, we recommend that:

- **Cheniere should defer construction and use of its proposed facilities, including related ancillary areas for staging, storage, and temporary work areas, and new or to-be-improved access roads, until:**

  a. Cheniere files with the Secretary all additional required inventory and evaluation reports, a SHPO-approved Project-specific unanticipated discovery plan, and any necessary treatment plans;

  b. Cheniere files the SHPO comments on all cultural resources investigation reports and plans;

  c. the ACHP has been given an opportunity to comment if any historic properties would be adversely effected by the Project; and

  d. the Director of OEP reviews and approves all cultural resources reports and plans, and notifies Cheniere in writing that it may proceed with treatment or construction.

  All material filed with the Commission containing location, character, and ownership information about cultural resources must have the cover and any relevant pages therein clearly labeled in bold lettering: "CONTAINS PRIVILEGED INFORMATION – DO NOT RELEASE."

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

4.11.1.1 Regional Climate

The climate of the Corpus Christi Bay area is predominantly marine, with periods of modified continental influence during the colder months, when cold fronts from the northwest sometimes reach the coast. Because of its coastal location and relatively low latitude, cold fronts that do reach the area seldom have severe temperatures. Below freezing temperatures are recorded, on average, no more than once every 3 to 4 years. Normal monthly high temperatures range from about 64°F in January to 91°F in July and August. Average monthly low temperatures range from about 50°F in January to 79°F in July and August.

The prevailing winds are from the southeast to south-southeast, except during winter months (December and January) when prevailing winds are from either the north to north-northeast or the south-southeast. Wind speeds range from 11 to 15 miles per hour (mph) throughout the year, and there is a distinct sea breeze effect occasionally increasing the wind speed by approximately 10 mph. Land breezes are normally restricted to winter months with a very light pressure gradient.

High humidity prevails throughout the year, with average dew points ranging between 48 and 74 °F. The average annual precipitation totals approximately 30 inches and is generally well distributed throughout the year. Summer rains can be strong due to local thunderstorms and storms originating in the Gulf of Mexico. Severe tropical storms or hurricanes average about one every 10 years, with storms of lesser strength about once every 5 years.

4.11.1.2 Existing Air Quality

Ambient Air Quality Standards and Attainment Status

The EPA has established National Ambient Air Quality Standards (NAAQS) for criteria pollutants for the purpose of protecting human health (primary standards) and welfare (secondary standards). The NAAQS set limits for ambient (outdoor) levels of the following criteria pollutants: NO_x, carbon monoxide (CO), ozone (O_3), SO_2, lead (Pb), and inhalable particulate matter (PM_{10}), or particles with an aerodynamic diameter less than or equal to 10 microns. (The diameter of a human hair is approximately 70 microns.) In addition, in 1997, EPA finalized new air quality standards for O_3 and $PM_{2.5}$ (particles with an aerodynamic diameter less than or equal to 2.5 microns). A series of legal challenges in the U.S. Court of Appeals ensued, culminating with the U.S. Supreme Court upholding the NAAQS for O_3 and $PM_{2.5}$ on February 27, 2001. The NAAQS are codified in 40 CFR 50 and summarized in table 4.11.1.2-1. The results of clinical and epidemiological studies established the primary NAAQS to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. The secondary NAAQS protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

TABLE 4.11.1.2-1

National Ambient Air Quality Standards for the Cheniere Corpus Christi LNG Project

Pollutant	Averaging Time	Primary Standard ($\mu g/m^3$)	Secondary Standard ($\mu g/m^3$)	Local Background d/ ($\mu g/m^3$)
SO_2	Annual a/	80 (0.030 ppm)	-	32
	24-Hour b/	365 (0.14 ppm)	-	220
	3-Hour c/	-	1,300 (0.5 ppm)	910
PM_{10}	Annual a/	50	50	35
	24-Hour b/	150	150	105
$PM_{2.5}$	Annual a/	15	15	-
	24-Hour b/	65	65	-
CO	8-Hour b/	10,000 (9 ppm)	-	7,000
	1-Hour b/	40,000 (35 ppm)	-	14,000
Ozone	8-Hour c/	157 (0.08 ppm)	157 (0.08 ppm)	-
	1-Hour b/	235 (0.12 ppm)	235 (0.12 ppm)	-
NO_2	Annual a/	100 (0.05 ppm)	100 (0.05 ppm)	35
Lead	Quarter a/	1.5	-	-

$\mu g/m^3$ = micrograms per cubic meter   ppm = parts per million

a/ Arithmetic mean.
b/ Block average.
c/ Rolling average.
d/ TCEQ Screening Background Concentrations for Nueces County.

The TCEQ has adopted the NAAQS as the ambient air quality standards within the State of Texas. In addition, the TCEQ has established property line standards that limit ambient air quality at the property line of facilities. Nueces and San Patricio Counties are both classified as attainment areas for all criteria pollutants for which the EPA has made attainment designations. (The EPA has not yet designated which areas meet the new $PM_{2.5}$ standards described above.)

Air Quality Monitoring and Existing Air Quality

The TCEQ maintains an extensive network of air quality monitors located throughout the state for a variety of purposes. At monitoring stations around the state, the four gaseous criteria pollutants (nitrogen dioxide (NO_2), SO_2, CO, and O_3) are monitored continuously, with 1-hour averages measured each hour, every day. PM_{10} and Pb are measured at least once every 6 days for a 24-hour averaging period, although some sites in Texas are monitored more frequently. The TCEQ has also instituted a new continuous monitoring network of $PM_{2.5}$ monitors around the state to measure compliance with the new $PM_{2.5}$ standard. Data from many of those monitors are reported to the EPA AirData database (AirData).

Estimates of existing ambient air quality for the proposed project area, as shown in table 4.11.1.2-1, were obtained from the TCEQ Screening Background Concentrations for Nueces County, Texas. These values represent the highest monitored values for each air pollutant in Nueces County from 1992 to 1997.

Air Quality Control Regions

Air quality control regions (AQCRs) are areas in which implementation plans describe how ambient air quality standards will be achieved and maintained. AQCRs were defined by the EPA and state agencies in accordance with Section 107 of the CAA. The proposed Project would be located in AQCR 14.

4.11.1.3 Regulatory Requirements for Air Quality

The proposed Cheniere Corpus Christi LNG Project is potentially subject to a variety of Federal, state, and local regulations pertaining to the construction or operation of air emission sources. The TCEQ is the lead agency for air permitting. The TCEQ implements its own regulations and also incorporates EPA's Federal regulatory requirements. The following sections summarize the applicability of various Federal and state regulatory programs. San Patricio and Nueces Counties do not have any additional air permit requirements beyond those in the Federal and state programs.

Federal Air Quality Requirements

The CAA of 1970, 42 USC 7401 et seq., as amended in 1977 and 1990, and 40 CFR Parts 50-99 are the basic Federal statutes and regulations governing air pollution in the U.S. We have reviewed the following Federal requirements to determine their applicability to the proposed Cheniere Corpus Christi LNG Project.

General Conformity

Section 176c of the CAA and 30 TAC require that, prior to funding, authorizing, permitting, licensing, or otherwise approving an action, the lead federal agency (the FERC in this case) must make a determination that the proposed action will not interfere with plans that a state has developed to come into or maintain compliance with air quality standards. Since the Project area is classified as in attainment for all criteria pollutants, a General Conformity Determination is not required.

New Source Review

Separate procedures have been established for Federal pre-construction review of certain large proposed projects in either attainment areas or non-attainment areas. The Federal pre-construction review for new or modified sources located in attainment areas is Prevention of Significant Deterioration (PSD). The review process is intended to prevent the new source from causing existing air quality to deteriorate beyond acceptable levels. The Federal pre-construction review for new or modified major sources located in non-attainment areas is commonly called Non-Attainment New Source Review (NNSR). NNSR only applies to the pollutants or their precursors that are classified as non-attainment. A new facility can undergo both PSD and NNSR review, depending on the emissions of various pollutants and the attainment status of the area. Nueces and San Patricio Counties are both classified as attainment areas for all criteria pollutants. Therefore, the proposed Project area is not subject to NNSR permitting.

The emission threshold for "major stationary sources" varies under PSD according to the type of facility. As defined by 40 CFR 52.21 (b)(1)(i), a facility is considered major under PSD if it emits or has the potential to emit 250 tons per year (tpy) or more of any criteria pollutant or

100 tpy for specified source categories. There are no processes at the proposed facility that are included as a specified source category; therefore, the PSD threshold for the proposed facility is 250 tpy. The proposed facility would exceed the 250 tpy threshold for NO_2 and CO, and therefore, is subject to PSD permitting requirements.

The PSD permit would contain emission limits and other operating, monitoring, record keeping, and reporting requirements based on air quality modeling. The air quality modeling includes emissions from the proposed modification and other sources in the area to ensure protection of the NAAQS and to prevent emission increases beyond a specified amount, called a PSD increment. The emission limits contained in the PSD permit are required to represent the Best Available Control Technology (BACT). BACT is determined on a case-by-case basis, taking into account energy, environmental, and economic impacts and costs.

PSD regulations also provide special protection for visibility and other air quality-related values in specially designated areas such as National Parks and Wilderness Areas, designated as "Class I" areas. The Cheniere Corpus Christi LNG Project would not be located in a Class I area, nor would it be located within 100 kilometers of a Class I area. Therefore, a full Class I analysis is not required for the permit application. The closest Class I area to the project site is the Big Bend National Park, located in west Texas, approximately 400 miles west-northwest of the Project site.

Cheniere has applied to the TCEQ for a PSD Air Quality Permit, and their application includes a description of the proposed facility and its emissions, a BACT analysis, and an air quality modeling analysis. The TCEQ has preliminarily reviewed and approved the air quality modeling analysis that shows that the NAAQS would not be violated and emissions would not increase above the PSD increment (Linville, 2004). Upon completion of the Draft PSD Permit for the proposed facility, the TCEQ will proceed with public and EPA review requirements before issuing the Final PSD Permit.

New Source Performance Standards

New Source Performance Standards (NSPS), codified at 40 CFR 60, establish emission limits and associated requirements for monitoring, reporting, and recordkeeping for specific emission source categories. NSPS apply to new, modified, or reconstructed sources. The following NSPS requirements were identified as potentially applicable to the specified sources at the facility.

Subpart Db of 40 CFR 60, Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units. Subpart Db lists affected emission sources as fuel-fired steam-generating units with a heat input capacity of 100 million British thermal units (MMBTU) per hour to 250 MMBTU per hour. The definition of an applicable unit includes sources that produce steam or heat water or any other heat transfer medium. The SCVs are each rated at 108 MMBTU per hour heat input, and thus, are subject to the requirements of Subpart Db.

Subparts Ka and Kb of 40 CFR 60, Standards of Performance for Volatile Organic Liquid Storage Vessels. These subparts list affected emission sources as storage vessels containing volatile organic liquids. Regulatory applicability depends on the construction date of the storage vessel. The proposed facility would have LNG and water storage vessels. However, the Project would not operate volatile organic liquid storage tanks greater than 10,566 gallons in capacity that meet the applicability requirements listed in 40 CFR 60.110b. Therefore, these regulations are not applicable.

National Emissions Standards for Hazardous Air Pollutants

National Emissions Standards for Hazardous Air Pollutants (NESHAPs), codified at 40 CFR 61, apply to emissions of specific Hazardous Air Pollutants (HAPs) from certain source categories. The proposed Cheniere Corpus Christi LNG Project would not emit any of the HAPs included in the NESHAP rules. Therefore, the NESHAPs in 40 CFR 61 do not apply.

Maximum Achievable Control Technology

Under 40 CFR 63, Maximum Achievable Control Technology (MACT) standards apply to major sources of HAPs in certain source categories. Emissions of HAPs from the proposed Cheniere Corpus Christi LNG Project would not exceed the associated major source thresholds under 40 CFR 63 (10 tpy of any individual HAP and 25 tpy for all HAPs). Therefore, no MACT standards apply to the proposed facility.

Chemical Accident Prevention Provisions

40 CFR 68, Chemical Accident Prevention Provisions, is a Federal regulation designed to prevent the release of hazardous materials in the event of an accident and minimize impacts when releases do occur. The regulation contains a list of substances and threshold quantities for determining applicability of the rule to a facility. If a facility stores, handles, or processes one or more substances on this list and at a quantity equal to or greater than specified in the regulation, the facility must prepare and submit a risk management plan (RMP). If a facility does not have a listed substance on site, or the quantity of a listed substance is below the applicability threshold, the facility does not have to prepare a RMP. However, it still must comply with requirements of the general duty provisions in Section 112(r)(1) of the CAA 1990 Amendments if it has any regulated substance or other extremely hazardous substance on site. The general duty of the provision is as follows:

> "The owners and operators of stationary sources producing, processing, handling and storing such substances have a general duty ... To identify hazards which may result from such releases using appropriate hazard assessment techniques, to design and maintain a safe facility taking such steps as are necessary to prevent releases, and to minimize the consequences of accidental releases which do occur."

With the exception of natural gas constituents (*e.g.*, methane, ethane, propane, etc.), no regulated substance would be handled or stored in quantities greater than the applicability threshold. Natural gas pipelines are not covered if they are regulated by the DOT or an equivalent state natural gas program certified by the DOT in accordance with 49 CFR 6010.5. In addition, storage of natural gas incidental to transportation (*e.g.*, gas taken from a pipeline during non-peak periods and placed in storage, then returned to the pipeline when needed) is not covered. Consequently, an RMP is not required for this Project. The facility will maintain awareness of hazard issues and meet the goals of the above-listed general duty provisions.

Title V Operating Permit

The Title V Operating Permit Program, as described in 40 CFR 70, requires major sources of air emissions and certain affected non-major sources to obtain a Federal operating permit. In Texas, authority to issue Title V operating permits has been delegated by the EPA to the TCEQ. The major source emissions thresholds for determining the need for a Title V operating permit are: 100 tpy of any regulated air pollutant, 10 tpy of any individual HAP, or 25 tpy for all HAPs. Emissions from the proposed Cheniere Corpus Christi LNG Project would exceed 100 tpy; therefore, a Title V Operating Permit would be required.

Control of Air Pollution from Marine Compression-Ignition Engines

Regulation 40 CFR 94 (FR, 2/28/03, 9746-9789) imposes regulations on marine compression-ignition engines manufactured on or after January 1, 2004. This standard does not apply to engines rated <37 kilowatts (kW), or engines on foreign vessels. Cheniere would require that U.S. flagged or registered vessels equipped with affected compression ignition engines manufactured after January 1, 2004 meet all applicable requirements of this subpart. It should be noted that most, if not all, LNG carriers are foreign flagged vessels, and not subject to this regulation.

Applicable State Air Quality Requirements

The TCEQ is the lead air permitting authority for the proposed Project. The TCEQ's air quality regulations are codified in Section 30 of the TAC Chapters 100 - 122. They incorporate the Federal program requirements listed in 40 CFR 50-99 and establish permit review procedures for all facilities that can emit pollutants to the ambient air. Any new facility is required to obtain an air quality permit prior to initiating construction. Facilities can trigger additional review by the EPA if emissions exceed the major source thresholds listed in 40 CFR Part 52.21(b)(1)(i). The proposed project will exceed these thresholds for NO_2 and CO. Therefore, the EPA will be reviewing the permit application and TCEQ's proposed permit to ensure all Federal program requirements are met (see discussion of PSD requirements above).

Protection of Public Health and Welfare - 30 TAC 116.111(a)(2)(A)

The emissions and plant operations from the proposed new facility would comply with all rules and regulations of the TCEQ and with the intent of the Texas Clean Air Act (TCAA), including the protection of the health and physical property of the people. A summary discussion on compliance with each applicable rule is included below.

The proposed facility would not be located within 3,000 feet of an elementary, junior high/middle, or senior high school; therefore, no additional analysis is required to be performed regarding short-term or long-term side effects that an air contaminant or nuisance odor from the facility may have on individuals attending such schools. The closest school is approximately 2.5 miles from the LNG terminal.

Chapter 101 – General Rules. Chapter 101 includes the general rules that are applicable to all sources. The Project would comply with applicable requirements of this chapter. The applicable sections within this chapter include: 101.3 – Circumvention; 101.4 – Nuisance; 101.5 – Traffic Hazards; 101.6 – Upset Reporting and Recordkeeping Requirements; 101.7 – Maintenance, Start-up and Shutdown Reporting, Recordkeeping, and Operational Requirements; 101.8 – Sampling; 101.9 – Sampling Ports; 101.10 – Emissions Inventory Requirements; 101.11 – Exemptions from Rules and Regulations; 101.12 – Temporary Exemptions During Drought Conditions; 101.13 – Use and Effect of Rules; 101.14 – Sampling Procedures and Terminology; 101.16 – Effect of Acceptance of Variance or Permit; 101.17 – Transfers; 101.18 – Remedies Cumulative; 101.19 – Severability; 101.20 – Compliance with EPA Standards; 101.21 – The National Primary and Secondary Ambient Air Quality Standards; 101.22 – Effective Date; 101.24 – Inspection Fees; and 101.27 – Emission Fees.

It should be noted that the majority of the general rules would not apply until the facility has started operation. Cheniere would minimize off-site impacts during the construction process as intended by the TCAA.

Chapter 106 – Exemptions from Permitting. Cheniere has not claimed an exemption from permitting for any of the emission units at this facility.

Chapter 111 – Control of Air Pollution from Visible Emissions and Particulate Matter. Cheniere would comply with all applicable sections of this chapter. Applicable sections include: 111.111 – Visible Emissions, Requirements for Specified Sources; 111.153 – Emission Limits for Steam Generators; and 111.155 – Ground Level Concentrations. Cheniere would conduct ambient air quality dispersion modeling to show compliance with Section 111.155.

Chapter 112 – Control of Air Pollution from Sulfur Compounds. Cheniere would comply with all applicable sections of this chapter. Applicable sections include: 112.2 – Sulfur Dioxide, Compliance Reporting and Recordkeeping; 112.3 – Sulfur Dioxide Net Ground Level Concentrations; 112.9 – Allowable Emission Rates – Combustion of Liquid Fuels; 112.31 – Hydrogen Sulfide Allowable Emissions – Residential, Business or Commercial Property; 112.33 – Hydrogen Sulfide Calculation Methods; 112.41 – Sulfuric Acid Emission Limits; and 112.42 – Sulfuric Acid Calculation Methods. Cheniere would conduct ambient air quality dispersion modeling to show compliance with Section 112.3.

Chapter 114 – Control of Air Pollution from Volatile Organic Compounds (VOCs). Cheniere would comply with all applicable sections of this chapter. Applicable sections include: Subchapter B – General VOC Sources, Division I – Storage of VOCs and Division 2, Vent Gas Control; Subchapter C – VOC Transfer Operations, Division I – Loading and Unloading of VOCs; and Subchapter J – Administrative Provisions, Division I – Alternative Means of Control and the provisions therein, 115.112 – Control Requirements, 115.113 – Alternate Control Requirements, 115.114 – Inspection Requirements; 115.115 – Approved Test Methods; 115.116 – Monitoring and Recordkeeping Requirements, 115.117 – Exemptions, 115.119 – Counties and Compliance Schedules, 15.120 – Vent Gas Definitions, 115.121 0 Emission Specifications, 115.122 – Control Requirements, 115.123 – Alternate Control Requirements, 115.125 – Testing Requirements, 115.126 – Monitoring and Recordkeeping Requirements, 115.127 – Exemptions, 115.129 – Counties and Compliance Schedules, 115.211 – Emission Specifications, 115.212 – Control Requirements, 115.213 – Alternate Control Requirements, 115.214 – Inspection Requirements, 115.215 – Approved Test Methods, 115.216 – Monitoring and Recordkeeping Requirements, 115.217 – Exemptions, 115.219 – Counties and Compliance Schedules.

Cheniere would control VOC emissions from tanks and vent stacks in accordance with the regulations and conduct the applicable inspections, testing, monitoring and recordkeeping as required. Since the facility would be storing the natural gas as a cryogenic liquid (LNG), a majority of the provisions do not apply.

Chapter 116 – Control of Air Pollution by Permits for New Construction of Modification. Cheniere is complying with this chapter by applying for and obtaining a permit to construct prior to initiating construction of the proposed facility.

Chapter 118 – Control of Air Pollution Episodes. Cheniere would operate the facility in compliance with the applicable sections of this chapter. An Emission Reduction Plan, pursuant to 118.5, is not required to be prepared because the facility does not exceed the emission threshold presented in this chapter.

Chapter 122 – Federal Operating Permits. The facility would have greater than 100 tpy of emissions of a single criteria pollutant and would be considered a major source; therefore, a Federal Title V Operating Permit would be required. In Texas, authority to issue Title V operating permits has been delegated by EPA to the TCEQ.

Measurement of Emissions – 30 TAC 116.(a)(2)(B)

Cheniere would comply with all provisions associated with measuring the emissions of significant air contaminants. This can include performing fuel sampling, installing predictive and/or continuous emission monitors, performing stack emission testing, and performing the appropriate reporting and record keeping to demonstrate compliance.

Best Available Control Technology (BACT) – 30 TAC 116.111 (a)(2)(C)

Cheniere would utilize BACT for primary pollution control at the facility. A detailed BACT analysis is included in the facility's PSD Permit application, which considers the technical practicability and economic reasonableness for reducing or eliminating the emissions for each major source pollutant generated by the facility. Section 4.11.1.6 contains a summary of the facility's proposed BACT limits.

New Source Performance Standards (NSPS) – 30 TAC 116.111(a)(2)(D)

The TCEQ incorporates the NSPS, codified at 40 CFR 60, by reference. The SCVs would be subject to NSPS Subpart Db: Standards of Performance for Industrial – Commercial – Institutional Steam Generating Units. As previously mentioned, Subpart Db lists affected emission sources as fuel-fired steam-generating units with a heat input capacity of 100 MMBTU per hour to 250 MMBTU per hour. The definition of an applicable unit includes sources that produce steam or that heat water or any other heat transfer medium. The SCVs are each rated at 108 MMBTU per hour heat input; therefore, these units would be subject to the requirements of Subpart Db. All applicable requirements of this regulation would be implemented by Cheniere.

Performance Demonstration – 30 TAC 116.111(a)(2)(G)

The proposed facility would achieve the performance specified in the permit application. This demonstration may include requests for additional engineering data and stack testing, and additional air quality dispersion modeling. All such demonstrations would be performed as required to maintain facility compliance.

Prevention of Significant Deterioration (PSD) Review – 30 TAC 116.111(a)(2)(I)

Based on emission calculations provided in the facility's PSD Permit application, the proposed Cheniere Corpus Christi LNG Terminal and Pipeline Project would generate emissions that exceed the PSD threshold for two pollutants, NO_x and CO. Refer to the discussion of Federal Air Quality Requirements above regarding the status of the proposed Project's PSD Permit application.

Air Dispersion Modeling – 30 TAC 116.111(a)(2)(J)

An ambient air quality dispersion modeling impacts analysis is required to demonstrate compliance with the TCEQ impact thresholds. Refer to the discussion of Federal Air Quality Requirements above regarding the status of the proposed Project's PSD Permit application that includes air quality dispersion modeling.

Ozone Flex Agreement

The TCEQ has designated Corpus Christi as "near nonattainment" of the NAAQS based on past near violations of the O_3 standard. State and local officials are working on voluntary programs to reduce emissions of NO_x and VOCs, both O_3 precursor pollutants. Corpus Christi signed a Flexible Attainment Region agreement with the EPA to give the city more flexibility to comply with the standards, and later signed a similar Ozone Flex Agreement with the EPA. Employers and citizens in the Corpus Christi area have agreed to implement various voluntary control measures to reduce the emission of O_3 precursor pollutants in an effort to maintain the attainment status of the area. Because the facility is proposed, there is no opportunity to reduce existing emissions as part of this program.

4.11.1.4 Air Quality Impacts and Mitigation

Construction Air Pollutant Emissions

Construction of the Cheniere Corpus Christi LNG Project would occur over a period of approximately 36 months. Air emissions would result from non-road sources such as construction and dredging equipment operating within the terminal facilities' property boundary, the La Quinta Channel, and the pipeline right-of-way. Air emissions would also be generated from delivery vehicles bringing supplies and equipment to the facility site, construction workers commuting in their personal vehicles, and other construction trucks that travel on roads. In addition, construction activities could generate an increase in fugitive dust (airborne dust that escapes from a construction site) from earthmoving and other construction vehicle movement.

Air emissions generated during construction are not subject to any permitting requirements and are not included as part the proposed Project's emissions for its PSD Permit. Air emissions during construction are only subject to state regulations limiting nuisance conditions (30 TAC Section 101.4, Nuisance) such as fugitive dust.

The estimated construction emissions over the construction period 2005-2008 are shown in table 4.11.1.4-1, excluding fugitive dust emissions (see further explanation below). The construction emission calculations are based on 10-hour workdays, 5 workdays per week, and 4.5 weeks per month. The majority of construction emissions would occur in 2006 and 2007.

TABLE 4.11.1.4-1

Estimated Emissions from LNG Terminal and Pipeline Construction

Emission Source a/	NO_x (tons)	VOC (tons)	CO (tons)	SO_2 (tons)	PM_{10} (tons)
Non-Road Sources					
LNG Marine Terminal b/	418.8	37.17	104.40	72.03	37.23
LNG Tanks	79.10	6.09	16.91	12.74	6.21
Pipeline	9.63	0.61	1.94	1.50	0.73
Commute and Delivery	25.9	24.4	321.0	0.63	0.90
On-Road Mobile Sources	1.34	0.18	1.90	0.01	0.04
Total Construction Emissions	***534.15***	***68.45***	***446.15***	***86.91***	***45.11***

a/ All emission sources are summed over the construction period, which would be 2004-2007 for the LNG terminal and storage tanks, and 2006 for the pipeline.
b/ LNG marine terminal construction emissions are broken down by year in table 4.11.1.4-2.

The primary air pollutants during the construction period would be NOx and CO. The primary source of emissions would be from non-road sources utilized during the construction of the marine terminal, because this phase would take the longest period of time to complete and would involve the largest number of sources. The emissions from non-road sources for construction of the marine terminal are shown in table 4.11.1.4-2. Construction equipment would include marine construction equipment; cranes; earthmoving equipment; forklifts and man-lifts; air compressors; welding machines; tractors, trailers, and trucks (*e.g.*, for fuel and water); generator and light sets; and concrete, structural excavation, and mechanical/piping equipment. The pipeline construction would also include welding trucks, boring machine, small engines and pumps, and fill and test pumps. The non-road sources are primarily diesel-fueled units. Cheniere would install electrical power supply lines to the site so that self-generation (*e.g.*, from on-site diesel generators) would be minimal.

TABLE 4.11.1.4-2

Sample Breakdown by Year of Marine Terminal Construction Emissions a/

Year	NO_x (tons)	VOC (tons)	CO (tons)	SO_2 (tons)	PM_{10} (tons)
2005	48.99	4.13	11.83	8.00	4.32
2006	172.33	14.62	42.14	29.40	14.98
2007	170.83	15.54	42.88	30.14	15.26
2008	26.03	2.88	7.55	4.48	2.68
Total (tons)	**418.18**	**37.17**	**104.4**	**72.02**	**37.24**

a/ Construction estimated to start late 2005 through early 2008.

Cheniere would follow the dredging plan pending approval by the COE, RRC, and TCEQ. Vehicular and marine vessel exhaust and crankcase emissions from gasoline and diesel engines would comply with applicable EPA mobile source emission regulations (40 CFR 85) by using equipment manufactured to meet these specifications.

Diesel engine emission standards and mandatory reductions in diesel fuel sulfur content have been adopted that would reduce emissions from heavy-duty construction vehicles. However, the diesel sulfur fuel reductions are not required until mid-2006, and the engine emission standards would be implemented in two stages that are not scheduled to be completed until 2007. To decrease emissions in the immediate future, the EPA created a voluntary diesel retrofit program to encourage the use of various technologies such as diesel particulate filters and oxidation catalysts. These controls require all construction equipment with diesel engines greater than or equal to 60 horsepower (hp) in size that are on the Project for more than 30 days to be outfitted with emission control devices (such as oxidation catalysts) and/or use clean fuels. These controls also limit the idling of diesel vehicles to 3 minutes or less. Cheniere has stated that it would take all reasonable measures to reduce air emissions at the construction site. Cheniere stated these measures may include use of low sulfur diesel fuel if it is available in the local area and equipment engines are designed for its use, as well as use of idling limits and construction vehicle augmentation such as catalysts and filters. Cheniere, in conjunction with its construction contractor, would evaluate all feasible options for reducing emissions during construction.

Fugitive Dust

Fugitive dust would be produced from equipment operating during construction of the proposed LNG terminal and tank. Cheniere states that fugitive dust generated is not anticipated to be any greater than the current level of dust generation from existing activities in the area. If construction of the proposed LNG terminal and tank generates dust that causes a nuisance, then a surface wetting system would be implemented to minimize dust generation. The Project equipment schedule includes water trucks that could be used for dust suppression; however, there are no permanent residences located within one mile of the proposed LNG terminal.

Dust from the DMPAs is not anticipated to be a nuisance because they would be covered by water. Once the dredged material dries and is stable enough to manipulate with equipment, the areas would be seeded with grasses for temporary and permanent stabilization. Until the DMPAs are revegetated, if dust generation becomes a nuisance, the areas would be wetted as necessary. Cheniere indicates that it would implement dust control measures throughout construction to minimize generation of nuisance dust as well as mitigate for nuisance dust conditions if they occur.

Fugitive dust would also be produced from equipment operating during construction of the proposed pipeline. Cheniere's contractor would attempt to control airborne dust levels during construction via wetting with water where the work site or access routes approach dwellings and farm buildings or are near an existing highway. Cheniere's contractor would employ water trucks, sprinklers, calcium chloride or other environmentally approved products as necessary to reduce dust to acceptable levels. Calcium chloride would only be used on CRs in compliance with environmental permits and only after the contractor requests and receives approval from the appropriate county authority.

Air Pollutant Emissions from Operation

LNG Terminal Stationary Sources

New stationary air emissions sources associated with operation of the proposed LNG terminal include:

- sixteen 108 MMBTU SCVs;
- one 1,500-kW standby diesel generator;
- one 500-kW diesel-fired firewater pump; and
- fugitive emission sources (valves, flanges, sampling ports, and marine vessel offloading equipment).

Anticipated annual emission levels for operation of the proposed LNG storage tanks, vaporization equipment, piping, firewater pump, and emergency diesel generator are shown in table 4.11.1.4-3. The emission data presented in table 4.11.1.4-3 are based on manufacturer-supplied emission factors supplemented with EPA default emission factors. The SCVs could be used continuously throughout the year, and the firewater pump and emergency generator would each be limited to 100 hours of operation per year. Operation of stationary sources at the LNG terminal would result in a maximum of 418.08 tpy of NO_x, 505.22 tpy of CO, and smaller amounts of other pollutants as listed in table 4.11.1.4-3.

TABLE 4.11.1.4-3

Air Emission Estimates For Operation of the Cheniere Corpus Christi LNG Project

Source	NO_x tons/yr	CO tons/yr	SO_x a/ tons/yr	$PM_{10}/PM_{2.5}$ tons/yr	VOC tons/yr	HAPs tons/yr
SCV's b/	415.57	504.58	9.28	4.69	43.45	5.74
Standby Diesel Generator c/	1.90	0.61	0.22	0.05	0.08	0.04
Firewater Pump c/	0.61	0.03	0.07	0.06	0.00	0.01
Fugitive Emissions d/					4.93	
Facility Total	**418.08**	**505.22**	**9.57**	**4.8**	**4.93**	**5.79**
PSD Thresholds	250.00	250.00	250.00	250.00	250.00	NA
Title V Threshold	100.00	100.00	100.00	100.00	100.00	10/25

a/ So_x emissions are based on the presence of sulfur in the fuel. Most LNG has no detectible sulfur; however, LNG from certain regions might contain a nominal amount. Because Cheniere would not limit its LNG source to any specific region, a nominal amount of sulfur (0.5 grains per 100 scf) was assumed to be present.
b/ *Total emissions are based on 16 SCVs operating continuously, 24 hours per day, 365 days per year.*
c/ Annual emissions for standby equipment are based on the following operating hour limitations: Standby Diesel Generator and Firewater Pump – 100 hours per year.
d/ Fugitive emissions are VOCs associated with minor equipment leaks at the valves, flanges, and seals.
VOC = Volatile Organic Compounds HAP = Hazardous Air Pollutants NA = Not Applicable

Best Achievable Control Technology Analysis. As part of the PSD Permit application, Cheniere conducted a top-down BACT analysis for the SCVs, the standby diesel generator, and the firewater pump. Cheniere submitted a BACT analysis to the TCEQ; the conclusion and requirements of this analysis are described below.

For the SCVs, the use of recirculated bath water for water injection to the burner flame and good combustion practices requiring the use of natural gas in the burners and limiting NO_x emissions from the SCVs to 94.9 pounds per hour and 415.6 tpy total from all 16 units is proposed as BACT. Good combustion control, which would limit CO emissions to 80 parts per million on a volume basis (ppmvb) corrected to 5 percent O_2 and 7.2 pounds per hour is proposed as BACT. Good combustion practices and the use of natural gas are proposed as BACT for VOC, SO_2, PM_{10}, and $PM_{2.5}$ emissions.

The standby diesel generator would use low sulfur diesel fuel and would only be used to operate critical facility systems during periods when external electrical power is not available, and for regular maintenance. The standby generator would be limited to 100 hours per year of annual operation. Timing retardation (controlling fuel injection) would result in an estimated NO_X emission rate of 37.96 pounds per hour and is proposed as BACT for NO_X. Good combustion practices are proposed as BACT for CO, VOC, and PM_{10} emissions. The use of low sulfur fuel is proposed as BACT for SO_2 emissions.

The firewater pump would use low sulfur diesel fuel and would only be used in the event of a fire, and for regular maintenance. The firewater pump would be limited to 100 hours per year of annual operation. Timing retardation (controlling fuel injection) would result in an estimated NO_X emission rate of 12.19 pounds per hour and is proposed as BACT for NO_X. Good combustion practices are proposed as BACT for CO, VOC, and PM_{10} emissions. The use of low sulfur fuel is proposed as BACT for SO_2 emissions.

The PSD Permit application did not include a state property line air quality impact analysis. However, the TCEQ will verify prior to PSD Permit issuance that Texas state property line limits for particulate matter and sulfur oxides would not be violated by the proposed Project.

LNG Carriers and Tugboats

Operation of the proposed Project would result in emissions from LNG carrier ships during receiving and handling, and from the tugboats used to assist in the docking of the LNG carriers. It is anticipated that approximately 300 LNG carriers per year would be unloaded at the proposed facility. At least three tugboats would be available to assist each LNG carrier, although up to seven tugboats may be used as needed. LNG unloading would be conducted using electric-driven submerged pumps powered by an onboard diesel generator. Each LNG carrier would take approximately 22.1 hours to turn around. This includes 4.1 hours of LNG carrier transit time (round-trip from the local pilot pickup/dropoff point before approaching the Corpus Christi Ship Channel to the dock at the proposed facility), and 18 hours for hoteling and off-loading of LNG.

The LNG carriers would be fueled with LNG and/or residual oil to provide steam to turbines, and there may also be diesel fueled auxiliary power generators on the carriers to provide power during hoteling operations. The carriers would be fueled primarily with LNG while in transit from the LNG production point to the proposed terminal, although carrier propulsion would be switched primarily to residual oil when a carrier nears the docking area.

The primary pollutant that LNG carriers and tugboats would emit is NO_x, along with slightly smaller amounts of SO_2, CO, PM_{10}, and VOCs, as shown in table 4.11.1.4-4. Based on the estimated transit distances and ship power settings, each LNG carrier would emit approximately

0.097 tons of NO_x per call during transit. The hoteling/offloading of the LNG carrier would result in approximately 1.55 tons of NO_x per call. At 300 calls per year, the NO_x emissions from LNG carriers would be approximately 493.8 tpy, and the emissions from tug boats working with the LNG carriers would be approximately 44.2 tpy, for a total of 538 tpy. (Note that emissions from mobile sources such as LNG carriers or tugboats are not required to be addressed in the PSD Permit for the proposed facility, per Texas air regulation 30 TAC 116.12[17] defining secondary emissions.)

TABLE 4.11.1.4-4

Estimated Annual Emissions from LNG Carriers and Tugboat Operations Associated with the Proposed Project

Emission Source	NO_x (tpy)	CO (tpy)	PM_{10} (tpy)	VOC (tpy)	SO_2 (tpy)
300 LNG carriers each year	493.8	60.5	28.3	23.4	264.4
Maximum of 7 tugboats for each LNG carrier	44.2	5.7	1.7	2.1	13.3
Total (tpy)	**538**	**66.2**	**30**	**25.5**	**277.7**

Pipeline

Cheniere's application and supporting documentation do not provide any information specific to air quality for operation of the proposed pipeline. Operation emissions from the pipeline would be expected to be limited to fugitive dust generated by an occasional (weekly) maintenance vehicle driving on pipeline access roads. Impact on air quality from operation of the pipeline would be insignificant.

4.11.2 Noise

Noise would affect the local environment during both the construction and operation of the proposed Cheniere Corpus Christi LNG Project. At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of the day and throughout the week. This variation is caused in part by changing weather conditions and the effects of seasonal vegetative cover. Two measures used by Federal agencies to relate the time-varying quality of environmental noise to its known effect on people are the 24-hour equivalent sound level ($L_{eq(24)}$) and the day-night sound level (L_{dn}). The $L_{eq(24)}$ is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period. The L_{dn} is the $L_{eq(24)}$ with 10 decibels on the A-weighted scale (dBA) added to the nighttime sound levels between the hours of 10 p.m. and 7 a.m., to account for the greater sensitivity of people to sound during the nighttime hours.

In 1974, the EPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA, 1974). This publication evaluates the effects of environmental noise with respect to health and safety. The document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has determined that in order to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed an L_{dn} of 55 dBA. The FERC has adopted this criterion for new compression and associated pipeline facilities, and it is used here to evaluate the potential noise impact from operation of the Cheniere

LNG terminal. An L_{dn} of 55 dBA is equivalent to a continuous noise level of 48.6 dBA for facilities that operate at a constant level of noise. Because neither the State of Texas nor San Patricio County has noise regulations that would limit noise from the Cheniere LNG Terminal, the FERC criterion is the basis for determining the acceptability of expected facility noise levels at the noise sensitive areas (NSAs).

4.11.2.1 Existing Noise Levels

Cheniere determined, through a review of aerial photography and a site visit, that there were no existing NSAs near the Cheniere Corpus Christi LNG terminal. The nearest NSAs are in the cities of Portland and Gregory to the west and northwest, respectively. These NSAs are depicted on figure 4.11-1 and consist of the following:

- NSA 1 - 9,850 feet west of the center of the terminal site. Several residences on the eastern edge of Portland.
- NSA 2 - 12,600 feet northwest of the center of the terminal site. Several residences on the southeastern edge of Gregory.

Cheniere conducted an ambient noise monitoring program at each of the two NSAs over the course of two days (May 3-4, 2004), which included the late night hours, to establish the existing ambient noise levels. The measured daytime and nighttime L_{eq} levels were then used to calculate the L_{dn} levels. In addition to noise level measurements, Cheniere identified and recorded the contributing noise sources, along with the prevailing meteorological conditions. Wind speed and direction, temperature, humidity, and sky conditions were recorded at the locations.

Existing noise sources at NSA 1 included traffic on nearby US 181, SH 35, and SH 361. At NSA 2, ambient sounds included birds, insects, neighborhood traffic, and distant industrial noise from the Sherwin plant to the east. The temperature ranged from 58 to 78°F, relative humidity from 30 to 97 percent, winds were from the SSE at 0 to 3 mph, and the sky was clear. The measured daytime and nighttime ambient L_{eq} levels and the calculated L_{dn} levels are summarized in table 4.11.2.1-1.

TABLE 4.11.2.1-1

Existing Noise Levels at Nearest Noise Sensitive Areas

NSA	Distance and Direction from Terminal Site	Daytime L_{eq} (dBA)	Nighttime L_{eq} (dBA)	L_{dn} (dBA)
# 1	9,850 feet West	59.3	59.6	65.9
# 2	12,600 feet Northwest	45.4	41.1	48.5

Construction and Operational Impacts

Potential impacts from the Project could be caused by short-term increases in noise during construction and increases in noise due to operation of the Project in the long term.

Cheniere evaluated potential noise impacts by performing a noise impact evaluation. The noise impact evaluation included calculating expected increases in noise associated both with Project construction and operation and comparing these levels with the FERC standard for permissible noise at NSAs.

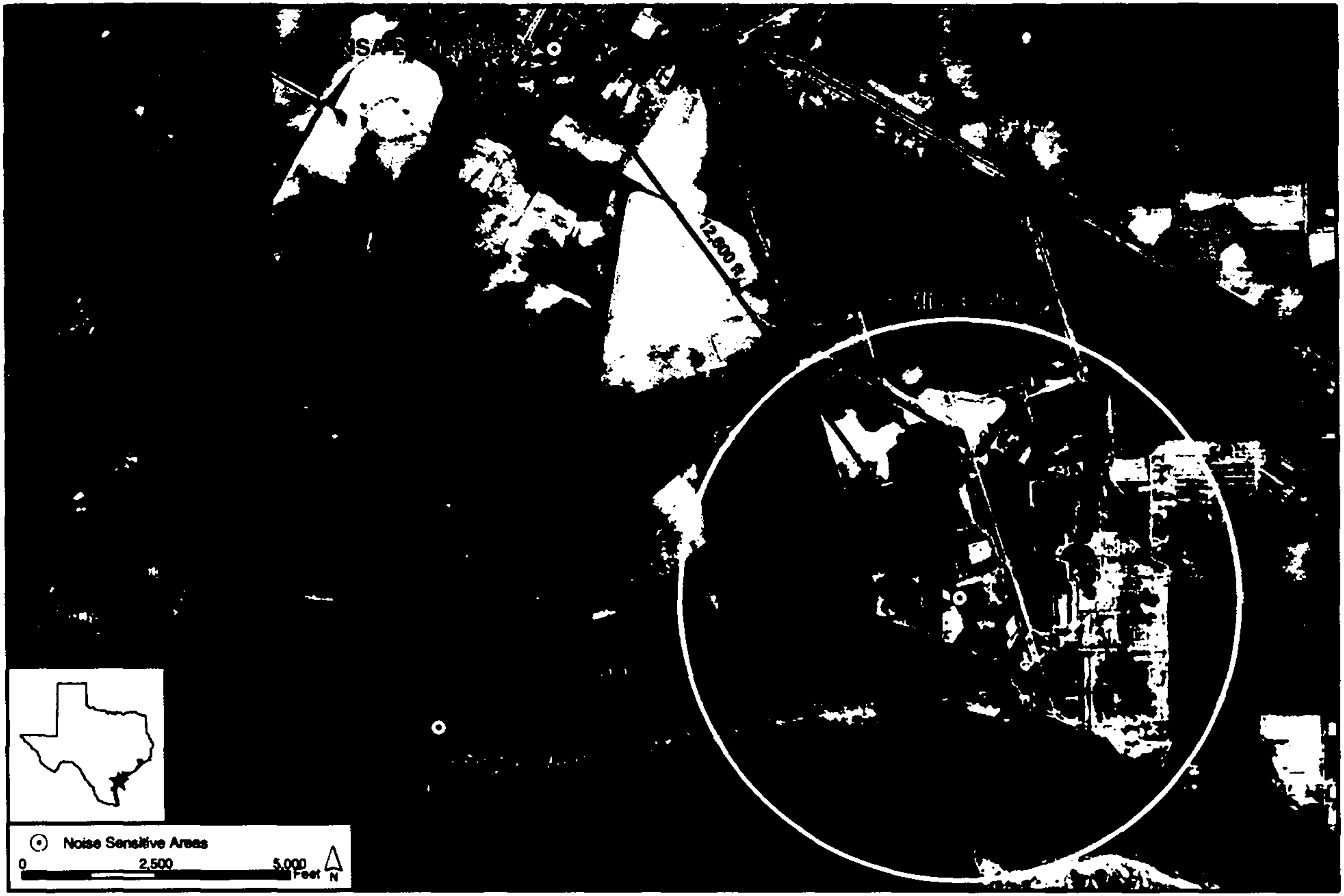


Figure 4.11-1
Cheniere Corpus Christi LNG Project
Noise Sensitive Areas

Construction Noise

Construction activities at the proposed LNG terminal would generate short-term increases in sound levels over an approximate 3-year period, predominately during the day. Construction activity would vary depending on the phase of construction in progress. The first phase (consisting of excavation, filling and grading using heavy earth-moving equipment, pile driving for docks, and dredging), would generate the highest sound levels. The second phase is foundation preparation and concrete pouring. The third phase would consist of erection of buildings, structures, and the storage tanks; and the fourth is installation of mechanical and electrical equipment.

The construction equipment utilized would differ during each phase of construction, but in general, heavy equipment (bulldozers, loaders, dump trucks) would be used during the excavation phase. Noise is generated during construction primarily from diesel engines that power the equipment. Exhaust noise is usually the predominant source of diesel engine noise. Pile drivers would also be used during preparation of the berth docks.

The actual sound levels that would be experienced at the NSAs would be a function of distance from the site. Cheniere utilized the approximate distances from each location to the center of the site in order to quantify the level of average construction noise at each NSA. The calculated levels assume that construction is limited to the hours of 7 a.m. to 10 p.m., and as such, the L_{eq} and L_{dn} levels would be the same. Because the quantities of equipment and locations of operation vary throughout the construction period, it is not possible to accurately calculate expected noise levels at the NSAs. An alternative and conservative approach is to use the results from a large-scale study of powerplant construction noise where measurements were taken at many powerplants during the different phases of construction (Barnes et al., 1976). The results represent an average for each phase at a standardized reference distance. Noise levels during construction of the LNG terminal would be lower due to the smaller level of construction activity. The predicted levels at the two NSAs based on this study and the actual distances between the site and the two NSAs are presented in table 4.11.2.1-2.

TABLE 4.11.2.1-2

Average Anticipated L_{dn} Noise Levels by Construction Phase

NSA	Excavation	Concrete Pouring	Steel Erection	Mechanical Installation	Dredging of Slip	Pile Driving
# 1	43	32	41	41	51	47
# 2	41	30	39	39	48	35

The dredging activity is expected to take 6 months and the total daily activity work time will vary from 16 to 20.5 hours, with some of this work taking place during the late night hours, if necessary. Thus, the levels above in table 4.11.2.1-2 for dredging include the nighttime penalty for calculation of the L_{dn} levels. Also, the loudest dredge type, which is a cutterhead dredge, was assumed in the analysis along with one tugboat.

The pile driving activity is expected to take from 4 to 6 months, with work occurring up to 24 hours per day, 7 days per week. Cheniere provided estimated noise contribution from pile driving activity at the NSAs based on sound data from typical pile driver sources at LNG terminal installations with steel pilings driven using drop hammers, although the drop hammer weight was not given. From these calculations, noise contributions at the NSA from pile driving activity would be below the existing daytime and nighttime sound levels.

Pile driving noise could also affect marine organisms. Potential impact from pile driving noise on marine organisms is discussed in section 4.5.1.5 of this EIS.

At NSA 1, the expected construction noise levels for all phases of construction are well below the existing ambient noise level of 69.5 dBA for the L_{dn} level. At the quieter NSA 2, the expected construction noise levels are closer to the ambient level of 48.5 dBA L_{dn} but still well below it, except for the dredging activity where it is about the same. It is expected that local NSAs will notice a slight increase in noise at the quietest times during the evening and at night; however, the construction noise levels are below the FERC criterion of 55 dBA L_{dn}.

Operational Noise

Cheniere performed computer modeling in order to calculate noise levels that would be generated by operation of the proposed LNG terminal. The model receptors are the same NSA locations where ambient noise monitoring was performed to allow a direct comparison with existing noise levels. The commercially available CadnaA model developed by Datakustik GmBH was used for the analysis. The software takes into account spreading losses, ground and atmospheric effects, shielding from barriers and buildings, and reflections from surfaces. The software is standards based and the International Organization for Standardization (ISO) 9613 standard was used for air absorption and other noise propagation calculations (ISO, 1989).

The ground surface was considered to be primarily reflective, which is conservative. A temperature of 68 °F and relative humidity of 89 percent were used as typical weather conditions. No wind was assumed in the calculations.

Sound level data for the proposed equipment were obtained either from vendors or calculated using empirical formulas based on process and mechanical equipment data (table 4.11.2.1-3). The Instrument Air Packages would be enclosed in acoustical enclosures to permit them to meet near-field noise level specifications for Occupational Safety and Health Administration (OSHA) noise exposure requirements. The vapor return blowers and the SCV blowers would also be enclosed to meet near-field noise specifications.

TABLE 4.11.2.1-3

Equipment Quantities and Sound Power Levels Used in Noise Modeling For Proposed LNG Terminal

Equipment	Source of Data	Noise Mitigation	Number In Use	Sound Power Level per Item (dBA)
Transformers	Similar Unit	None	4	86
BOG Compressors	Similar Unit	None	3	112
BOG Compressor Motors	Calculated	None	3	108
Nitrogen Package	Similar Unit	None	1	113
Instrument Air Packages	Similar Unit	Std Mfg Enclosure	2	98
Vapor Return Blowers	Black & Veatch	Enclosure	2	91
Submerged Combustion Vaporizer Blower	T-thermal	Enclosure	15	105
Sendout Pump Motors	Black &Veatch	None	15	100

Table 4.11.2.1-4 presents the results of the modeling along with a comparison with existing ambient levels, the expected future noise levels after adding the facility noise to the ambient, and the increase in ambient levels as a result of adding the facility.

TABLE 4.11.2.1-4

Average Range of Anticipated L_{dn} Noise Levels During Operation

NSA	Distance and Direction (feet)	Existing Ambient L_{dn} (dBA)	Predicted Facility Contribution (dBA)	Ambient + Facility (dBA)	Predicted Increase in Ambient (dBA)
# 1	9,850	65.9	37.6	65.9	0.0
# 2	12,600	48.5	34.2	48.5	0.0

In general, noise from the terminal should be inaudible at most times; however, during periods of relative quiet, such as evenings or nighttime, the facility noise would be perceptible. The predicted facility contributions of 37.6 and 34.3 dBA for NSA 1 and 2, respectively, are significantly below the existing average ambient level. The predicted levels are approximately 20 dBA below the FERC criterion of 55 dBA. To ensure that there would be no significant impact to noise quality at the nearest NSAs we recommend that:

- **Cheniere should make all reasonable efforts to assure its predicted noise levels from the LNG terminal are not exceeded at the NSAs and file noise surveys showing this with the Secretary <u>no later than 60 days</u> after placing the LNG terminal in service. However, if the noise attributable to the operation of the LNG terminal exceeds 55 dBA L_{dn} at an NSA or the noise increase exceeds 10 dBA L_{90} at an NSA, Cheniere should file a report on what changes are needed and should install additional noise controls to meet the level <u>within one year</u> of the in-service date. Cheniere should confirm compliance with these requirements by filing a second noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.**

4.12 RELIABILITY AND SAFETY

The operation of the proposed Cheniere Corpus Christi LNG terminal poses a potential hazard that could affect the public safety without strict design and operational measures to control potential accidents. The primary concerns are those events that could lead to an LNG spill of sufficient magnitude to create an offsite hazard. However, it is also important to recognize the stringent requirements for the design, construction, operation and maintenance of the facility as well as the extensive safety systems to detect and control potential hazards.

During the operating history of most existing LNG facilities, there has never been an LNG safety-related incident where LNG was spilled or otherwise mishandled, resulting in adverse effects to operations personnel, the public, or the environment. However, an operational accident occurred in 1979 at the Cove Point LNG facility in Lusby, Maryland, when a pump seal failed, resulting in gas vapors entering an electrical conduit and settling in a confined space. When a worker switched off a circuit breaker, the gas ignited, resulting in heavy damage to the building and a fatality. Lessons learned from this accident resulted in changing the national fire codes, with the participation of the FERC, to ensure that the situation would not occur again. The proposed facilities would be designed, constructed, and operated in compliance with these codes.

On January 19, 2004, a blast occurred at Sonatrach's Skikda, Algeria LNG liquefaction facility that killed 27 and injured 56 workers. No members of the public were injured. Preliminary findings of the accident investigation suggest that a cold hydrocarbon leak occurred at Liquefaction Train 40 and was introduced to the high-pressure steam boiler by the combustion air fan. An explosion developed inside the boiler fire box, which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and LPG separation equipment of Train 40, and spread to Trains 20 and 30.

Although there are major differences between the equipment involved in the accident and that of the proposal by Cheniere (*i.e.*, high-pressure steam boilers that power refrigerant compressors would not be used here nor are they used at any LNG facility under the FERC's jurisdiction), the sequence of cascading events identifies potential failure modes that warrant further evaluation. As a result, we recommend that:

- **Cheniere should provide a technical review of its facility design that:**

  a. Identifies all combustion/ventilation air intake equipment and the distance(s) to any possible hydrocarbon release (LNG, flammable refrigerants, flammable liquids, and flammable gases).

  b. Demonstrates that these areas are adequately covered by hazard detection devices and indicates how these devices would isolate or shut down any combustion equipment whose continued operation could add to or sustain an emergency.

  Cheniere should file this review with the Director of OEP for review and approval prior to construction.

A discussion of the principal properties and hazards associated with LNG is presented in section 4.12.1 of this EIS. A summary of our preliminary design and technical review of the cryogenic aspects of the LNG terminal is presented in section 4.12.2. Storage and retention systems are discussed in section 4.12.3. An analysis of the thermal radiation and flammable vapor cloud hazards resulting from a credible land-based LNG spill is presented in section 4.12.4, while the safety aspects of LNG transportation by ship is discussed and summarized in section 4.12.5. A discussion on security awareness related to terrorism is presented in section 4.12.6. The reliability and safety issues related to the natural gas pipeline are discussed in section 4.12.7.

4.12.1 LNG Hazards

LNG's principal hazards result from its cryogenic temperature (-260°F), flammability, and vapor dispersion characteristics. As a liquid, LNG will neither burn nor explode. Although it can cause freeze burns and, depending on the length of exposure, more serious injury, its extremely cold state does not present a significant hazard to the public, which rarely, if ever, comes in contact with it as a liquid. As a cryogenic liquid, LNG will quickly cool materials it contacts, causing extreme thermal stress in materials not specifically designed for ultra cold conditions. Such thermal stresses could subsequently subject the material to brittleness, fracture, or other loss of tensile strength. These hazards, however, are not substantially different from the hazards associated with the storage and transportation of liquid oxygen (-296°F) or several other cryogenic gases that have been routinely produced and transported in the U.S.

Methane, the primary component of LNG, is colorless, odorless and tasteless, and is classified as a simple asphyxiant. Methane could, however, cause extreme health hazards, including death, if inhaled in significant quantities within a limited time. At very cold temperatures, methane vapors could cause freeze burns. Asphyxiation, like freezing, normally represents a negligible risk to the public from LNG facilities.

When released from its containment vessel and/or transfer system, LNG will first produce a vapor or gas. This vapor, if ignited, represents the primary hazard to the public. LNG vaporizes rapidly when exposed to ambient heat sources such as water or soil, producing 620 to 630 standard cubic feet of natural gas for each cubic foot of liquid. LNG vapors in a 5 to 15 percent mixture with air are highly flammable. The amount of flammable vapor produced per unit of time depends on factors such as wind conditions, the amount of LNG spilled, and whether it is spilled on water or land. Depending on the amount spilled, LNG may form a liquid pool that will spread unless contained by a dike.

Once a flammable vapor-air mixture from an LNG spill has been ignited, the flame front will propagate back to the spill site if the vapor concentration along this path is sufficiently high to support the combustion process. An unconfined methane-air mixture will burn slowly, tending to ignite combustible materials within the vapor cloud, whereas fast flame speeds tend to produce flash burns rather than self-sustaining ignition.

LNG is not explosive as it is normally transported and stored. However, LNG vapors (primarily methane) can explode if contained within a confined space, such as a building or structure, and ignited. There is no evidence, however, suggesting that LNG is explosive in unconfined open areas. Experiments to determine if unconfined methane-air mixtures will explode have been conducted and, to date, have all been negative. Unconfined methane-air mixtures will burn but will not explode. Nevertheless, a number of experimental programs have been conducted to determine the "amount of initiator charge" required to detonate an unconfined methane-air mixture.

Over the years, various parties have occasionally expressed the energy content of an LNG storage tank or LNG ship in equivalent tons of TNT, as an implied measure of its explosive potential. However, such a simplistic analogy fails to consider that explosive forces are not just a function of the total energy content but also of the rate of energy release. For an explosion to occur, the rate of energy release must be nearly instantaneous, such as with a TNT charge initiated by a blasting cap. Unlike TNT or other explosives that inherently contain an oxidizer, an unconfined vapor cloud must be mixed with oxygen within the flammability range of the fuel for combustion to occur. For a large unconfined vapor cloud, the flammability range tends to exist at the mixing zone at the edges of the cloud. When ignited, flame speeds about 20-25 meters per second (m/sec) (66-82 feet per second [ft/sec]) and local over pressures up to 0.2 psig have been estimated for hydrocarbon vapor clouds, well below the flame speeds and over pressures associated with explosion.

4.12.2 Cryogenic Design and Technical Review

The cryogenic design and technical review emphasizes the engineering design and safety concepts and the projected operational reliability of the proposed facilities. The principle areas of coverage include: materials in cryogenic environments; insulation systems; cryogenic safety; thermodynamics; heat transfer; instrumentation; cryogenic processes; and other relevant safety systems.

Study and evaluation of information for the proposed design and installation of the Cheniere LNG terminal has been performed by the FERC staff. The design and specifications to be incorporated in the proposed facility are considered to be preliminary for the proposed operation. Cheniere is continuing to proceed with the design in accordance with the basis of design and specifications submitted, which will be incorporated in the selection of equipment and final design. A significant amount of the basic design involving final selection of equipment manufacturers, process conditions, and safety related issues will be completed in the next phase of the project and submitted to staff for review.

As a result of the technical review of the information provided by Cheniere in the submittal documents, a number of concerns were raised by staff, relating to features incorporated in the proposed design to enhance reliability, operability, and safety of the facility. Outstanding issues that require resolution before construction of the project, as well as post-construction requirements, are listed below as specific recommendations. Specific recommendations (which must be addressed prior to construction, unless otherwise noted) are as follows. We recommend that:

- **Cheniere should file a copy of the contingency plan for outer containment failure with the Secretary <u>prior to commissioning</u>.**

- **Cheniere should file a copy of the criteria for horizontal and rotational movement of the inner vessel for use during and after cool down with the Secretary before construction.**
- **Cheniere should notify the FERC on a timely basis in the event the temperature of any region of any storage tank outer containment vessel becomes less than the minimum specified operating temperature for the material, and should specify procedures for corrective action.**
- **Cheniere should file final drawings and specifications of the spill protection system to be applied to the LNG tank roofs with the Secretary before construction.**
- **Cheniere should file final drawings of the storage tank piping support structure with the Secretary before construction.**
- **Cheniere should file differential tank tilt settlement limits and differential movement limits between LNG tank and piping, and procedures to be implemented in the event that limits are exceeded with the Secretary before construction.**
- **Cheniere should file a complete list of the type, number, and location of all hazard detection equipment with the Secretary before construction.**
- **Cheniere should equip flammable gas and UV/IR hazard detectors with local instrument status indication as an additional safety feature, and document this in a filing with the Secretary prior to commissioning.**
- **Cheniere should install all hazard detectors with redundancy and fault detection and fault alarm monitoring in all potentially hazardous areas and enclosures, and document this in a filing with the Secretary prior to commissioning.**
- **Cheniere should file a copy of the fire protection evaluation carried out in accordance with the requirements of NFPA 59A, chapter 9.1.2, with the Secretary before construction.**
- **Cheniere should file a complete list of the type, number, and location of all hazard control equipment with the Secretary before construction.**
- **Cheniere should file a copy of the facility security plan with the Secretary before commissioning.**
- **Cheniere should file security personnel requirements for prior to and during LNG carrier unloading with the Secretary before commissioning.**
- **Cheniere should develop procedures for offsite contractors' responsibilities, restrictions, limitations, and supervision of contractors by Cheniere staff, and file a copy of these procedures with the Secretary before construction.**
- **Cheniere should file Operation and Maintenance procedures and manuals, as well as emergency plans and safety procedure manuals, with the Secretary before commissioning operations. In addition, copies of the Security Manual, Transit**

Operations Manual, and the Emergency Response Manual prepared for the USCG should be filed with the Secretary.

- Cheniere should notify the FERC staff of any proposed revisions to the security plan and physical security of the facility before commissioning the proposed facilities.
- Cheniere should file monthly progress reports on the proposed construction project with the Secretary. Details should include a summary of activities, problems encountered, and remedial actions taken. Problems of significant magnitude should be reported to the FERC on a timely basis. Additional site inspections and technical reviews would be held by the FERC staff prior to commencement of operation.
- The facility should be subject to regular technical reviews and site inspections by the FERC staff on at least a biennial basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Cheniere should respond to a specific data request including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Cheniere should also provide up-to-date detailed piping and instrumentation diagrams reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted annual report.
- Cheniere should file semi-annual operational reports with the Secretary to identify changes in facility design and operating conditions, abnormal operating experiences, activities (including ship arrivals, quantity and composition of imported LNG, vaporization quantities, boil-off/flash gas, etc.), plant modifications including future plans and progress thereof. Abnormalities should include, but not be limited to: unloading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tanks, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, vapor or liquid releases, fires involving natural gas and/or from other sources, negative pressure (vacuum) within a storage tank and higher than predicted boil-off rates. Adverse weather conditions and the effect on the facility also should be reported. Reports should be submitted within 45 days after each period ending June 30 and December 31. In addition to the above items, a section entitled "Significant plant modifications proposed for the next 12 months (dates)" should be included in the semi-annual operational reports. Such information would provide the FERC staff with early notice of anticipated future construction/maintenance projects at the LNG facility.
- Cheniere should report significant non-scheduled events, including safety-related incidents (*i.e.*, LNG or natural gas releases, fires, explosions, mechanical failures, unusual over pressurization, and major injuries) to the FERC staff within 48 hours. In the event an abnormality is of significant magnitude to threaten public or

employee safety, cause significant property damage, or interrupt service, notification should be made immediately, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. This notification practice should be incorporated into the LNG facility's emergency plan. Examples of reportable LNG-related incidents include:

a. fire;

b. explosion;

c. property damage exceeding $10,000;

d. death or injury requiring hospitalization;

e. free flow of LNG for five minutes or more that results in pooling;

f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of an LNG facility that contains, controls, or processes gas or LNG;

g. any crack or other material defect that impairs the structural integrity or reliability of an LNG facility that contains, controls, or processes gas or LNG;

h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes gas or LNG to rise above its maximum allowable operating pressure (or working pressure for LNG facilities) plus the build-up allowed for operation of pressure limiting or control devices;

i. a leak in an LNG facility that contains or processes gas or LNG that constitutes an emergency;

j. inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank;

k. any safety-related condition that could lead to an imminent hazard and cause (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility that contains or processes gas or LNG;

l. safety-related incidents to LNG trucks or LNG vessels occurring at or in route to and from the LNG facility; or

m. the judgment of the LNG personnel and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan.

In the event of an incident, the Director of OEP has delegated authority to take whatever steps are necessary to ensure operational reliability and to protect human

life, health, property or the environment, including authority to direct the LNG facility to cease operations. Following the initial company notification, the FERC staff will determine the need for a separate follow-up report or follow-up in the upcoming semi-annual operational report. All company follow-up reports should include investigation results and recommendations to minimize a reoccurrence of the incident.

4.12.3 Storage and Retention Systems

LNG storage tanks come in a variety of categories:

- Single containment cylindrical metal tanks (predominately used in the U.S. The proposed Cheniere LNG storage tanks are this design);
- Spherical storage tanks (predominately used in LNG carriers);
- Double containment cylindrical metal inner tank and metal or concrete outer tank (commonly thought of as an LNG tank with a high wall dike);
- Full containment cylindrical metal inner tank and metal or concrete outer tank (Cameron/Hackberry was the first project proposing this design in the U.S., and Freeport LNG Project was the second);
- Pre-stressed cylindrical concrete tank with an internal metal membrane (membrane tank). (None in the U.S.); and
- Cryogenic cylindrical concrete tank; internal cryogenic tank and prestressed concrete outer tank (one operational in the U.S.; the remainder worldwide).

These tank categories are described in Annex H of the European Standard for LNG facilities (EN 1473) and other publications that are reproduced and/or summarized below for information purposes. Some of the terminology is new to the U.S.; *e.g.*, the terms "double containment" and "full containment" are not used in any U.S. code or standard associated with LNG facilities.

H.1 Single Containment Tank

A single primary container and generally an outer shell designed and constructed so that only the primary container is required to meet the low temperature ductility requirements for storage of the product.

The outer shell (if any) of a single containment storage tank is primarily for the retention and protection of insulation and to contain the purge gas pressure, but is not designed to contain refrigerated liquid in the event of leakage from the primary container.

An above ground single containment tank shall be surrounded by a bund (dike) wall to contain any leakage. Examples of single containment are given in figure H.1.

H.2 Spherical Storage Tank

A spherical single containment system consists of an unstiffened sphere supported at the equator by a vertical cylinder. The cylinder is monolithically connected to the tank by a profile in the tank wall. Both sphere and outer shell are normally made of aluminum alloy.

For spherical onshore tanks, the lower part of the support cylinder is made of concrete and the tank is protected by a domed concrete cover (roof). The land application is shown in figure H-2.

An aboveground spherical tank shall be surrounded by a dike wall to contain any leakage.

H.3 Double Containment Tank

A double containment tank is designed and constructed so that both the inner self supporting primary container and the secondary container are capable of independently containing the refrigerated liquid stored. To minimize the pool of escaping liquid, the secondary container should be located at a distance not exceeding 6 meters from the primary container.

The primary container contains the refrigerated liquid under normal operating conditions. The secondary container is intended to contain any leakage of the refrigerated liquid, but it is not intended to contain any vapor resulting from this leakage.

Examples of double containment tanks are given in figure H.3. Figure H.3 does not imply that the secondary container is necessarily as high as the primary container.

H.4 Full Containment Tank

A tank designed and constructed so that both self supporting primary container and the secondary container are capable of independently containing the refrigerated liquid stored and for one of them its vapor. The secondary container can be 1 or 2 meters distance from the primary container.

The primary container contains the refrigerated liquid under normal operating conditions. The outer roof is supported by the secondary container. The secondary container shall be capable both of containing the refrigerated liquid and of controlled venting of the vapor resulting from product leakage after a credible event. Examples of full containment tanks are given in figure H.4.

H.5 Membrane Tank

A membrane tank should be designed and constructed so that the primary container, constituted by a membrane, is capable of containing both the liquefied gas and its vapor under normal operating conditions and the concrete secondary container, which supports primary container, should be capable of containing all the liquefied gas stored in the primary container and of controlled venting of the vapor resulting from product leakage of the inner tank.

The vapor of the primary container is contained by a steel roof liner which forms with the membrane an integral gastight containment. The action of the liquefied gas acting on the primary container (the metal membrane) is transferred directly to the prestressed concrete secondary container through the load bearing insulation. Examples of membrane tanks are given in figure H.5.

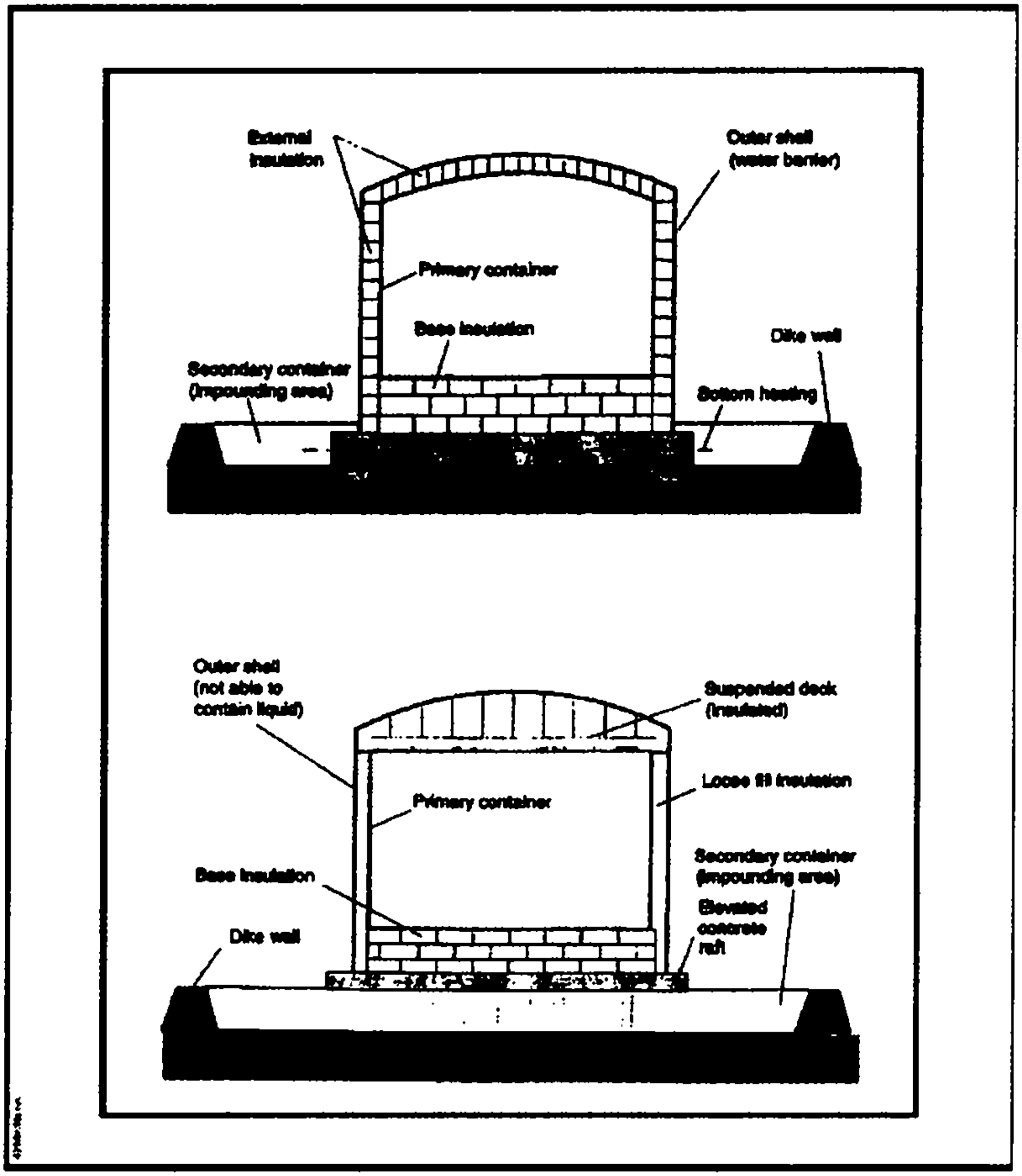


Figure H-1
Examples of Single Containment Tanks

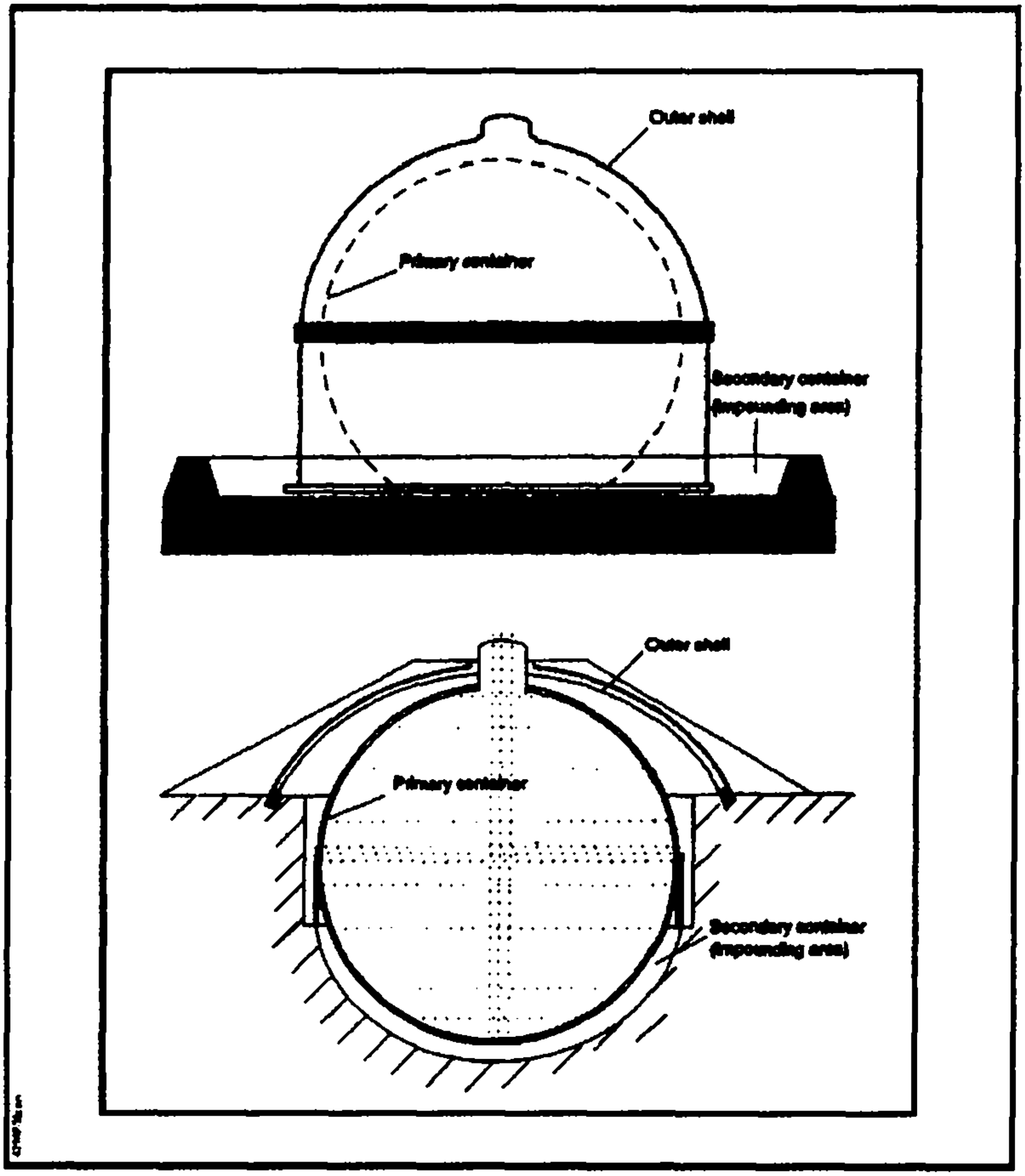


Figure H-2
Examples of Spherical Storage Tanks

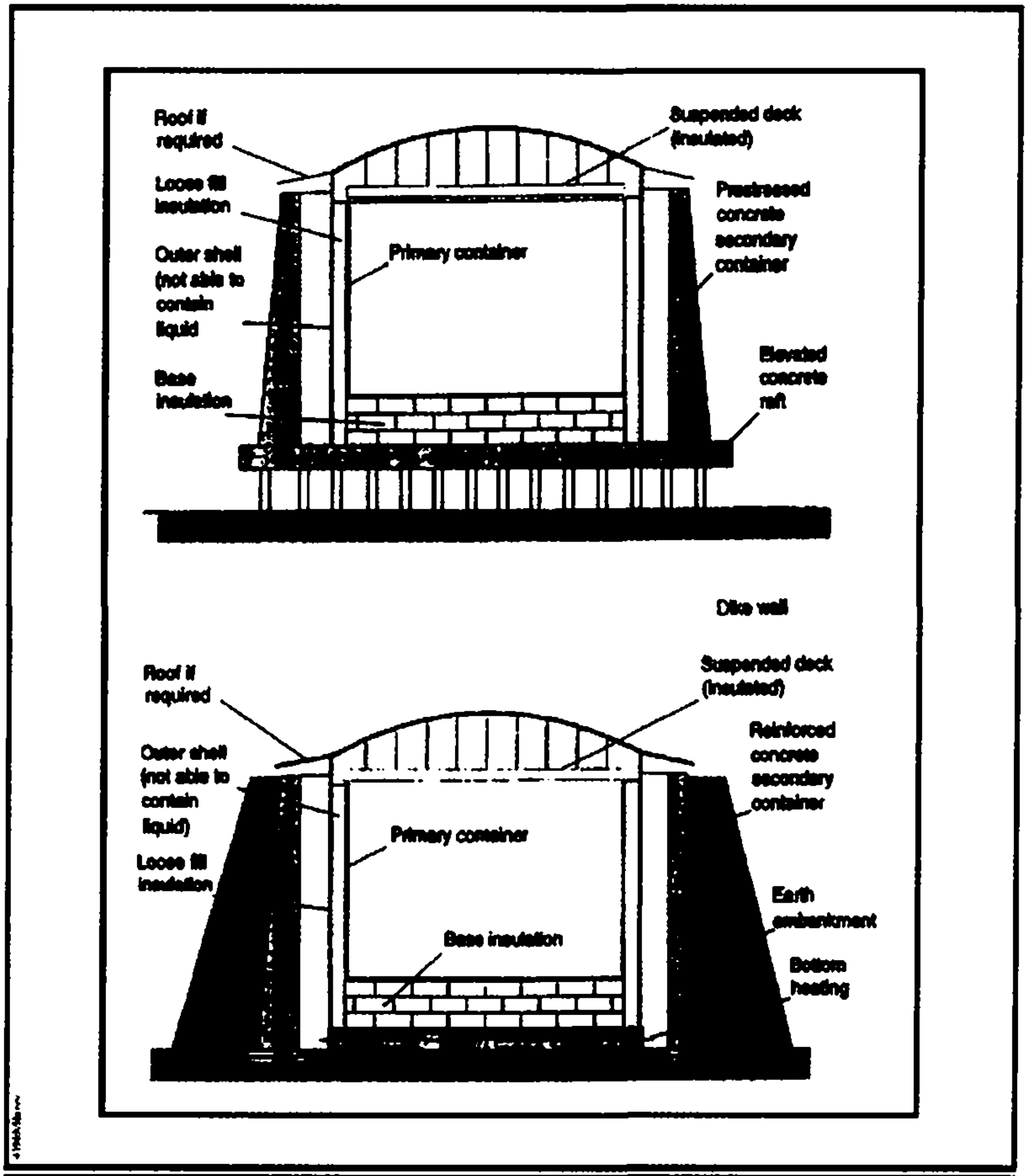


Figure H-3
Examples of Double Containment Tanks

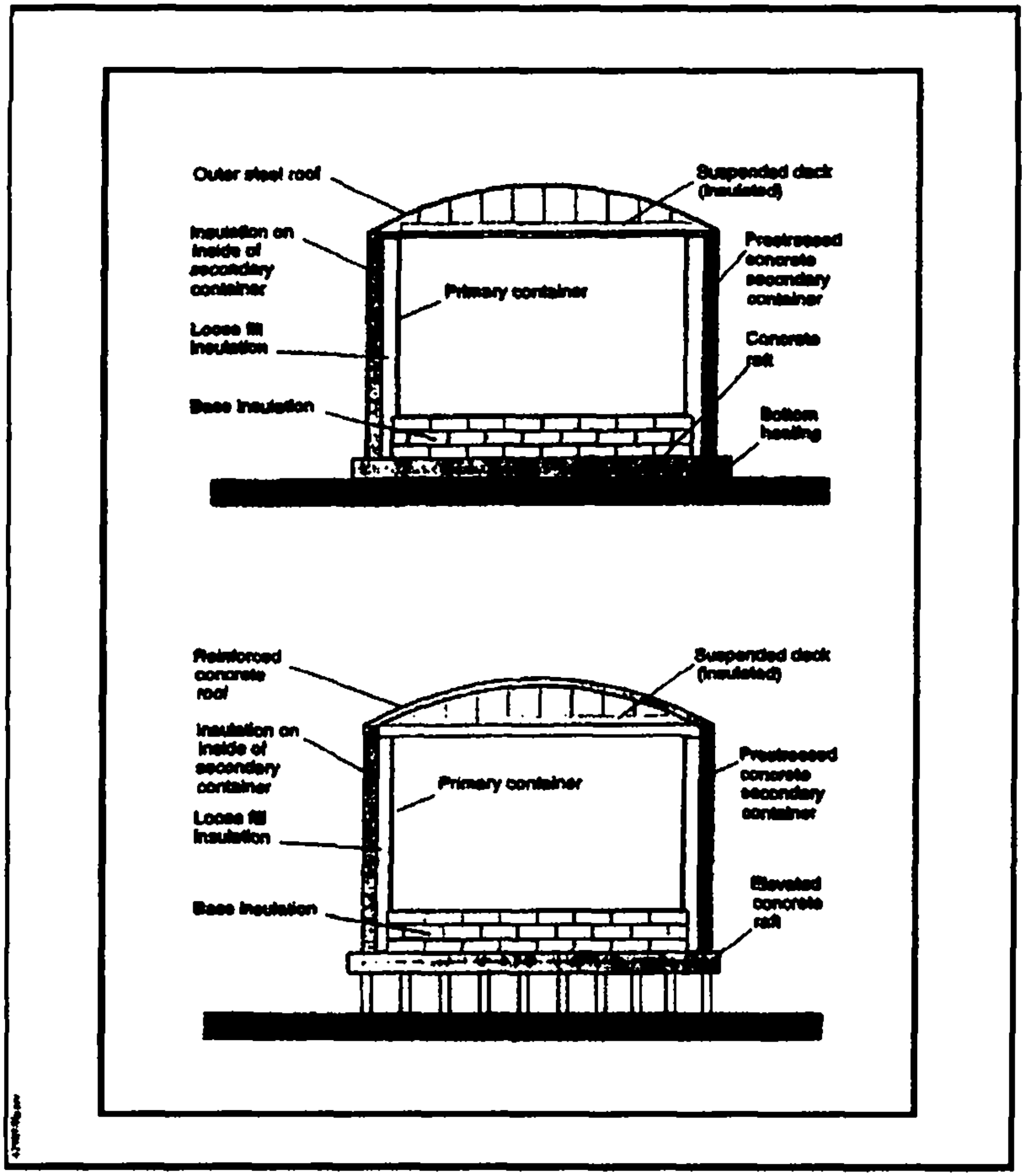


Figure H-4
Examples of Full Containment Tanks

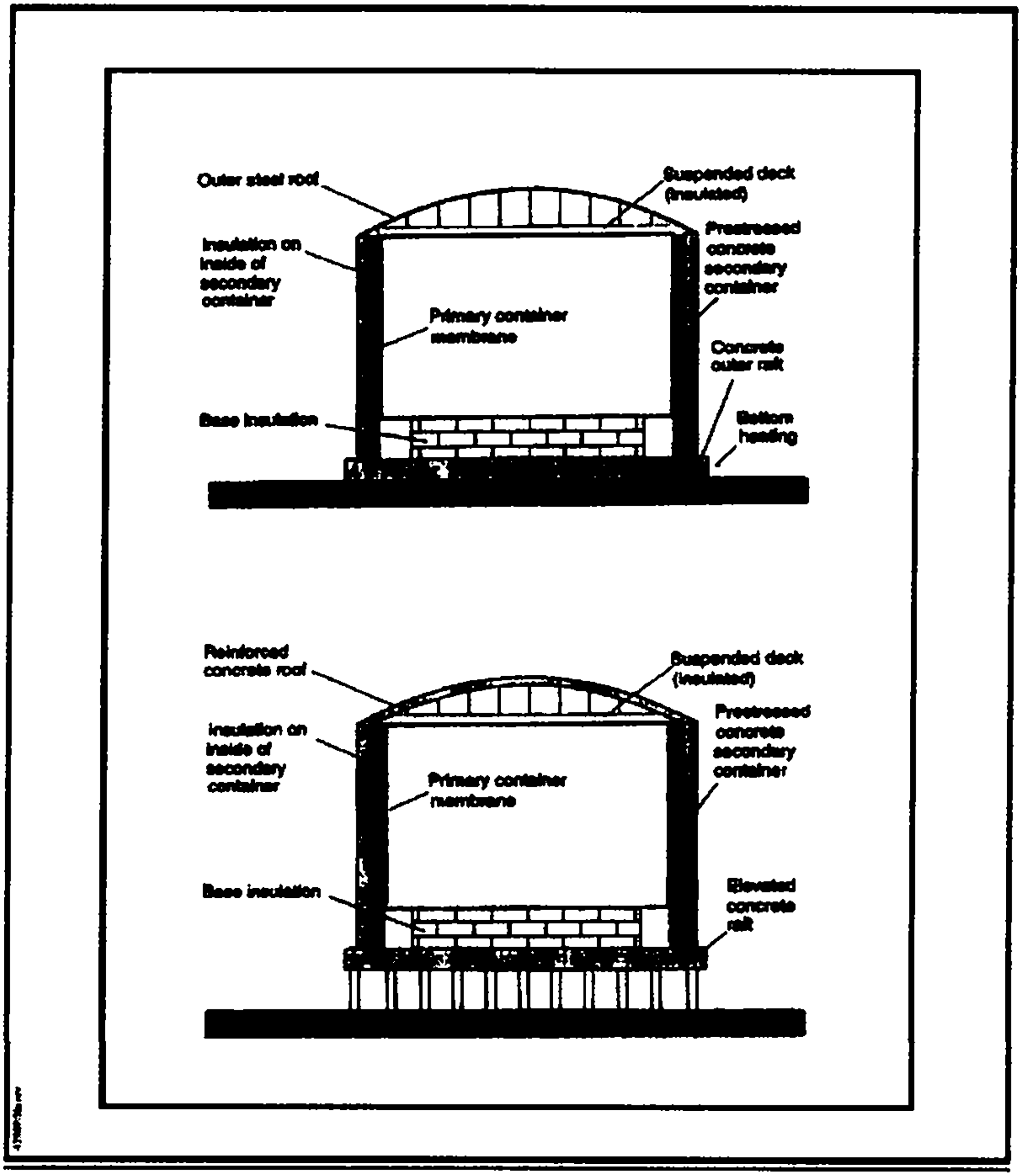


Figure H-5
Examples of Membrane Tanks

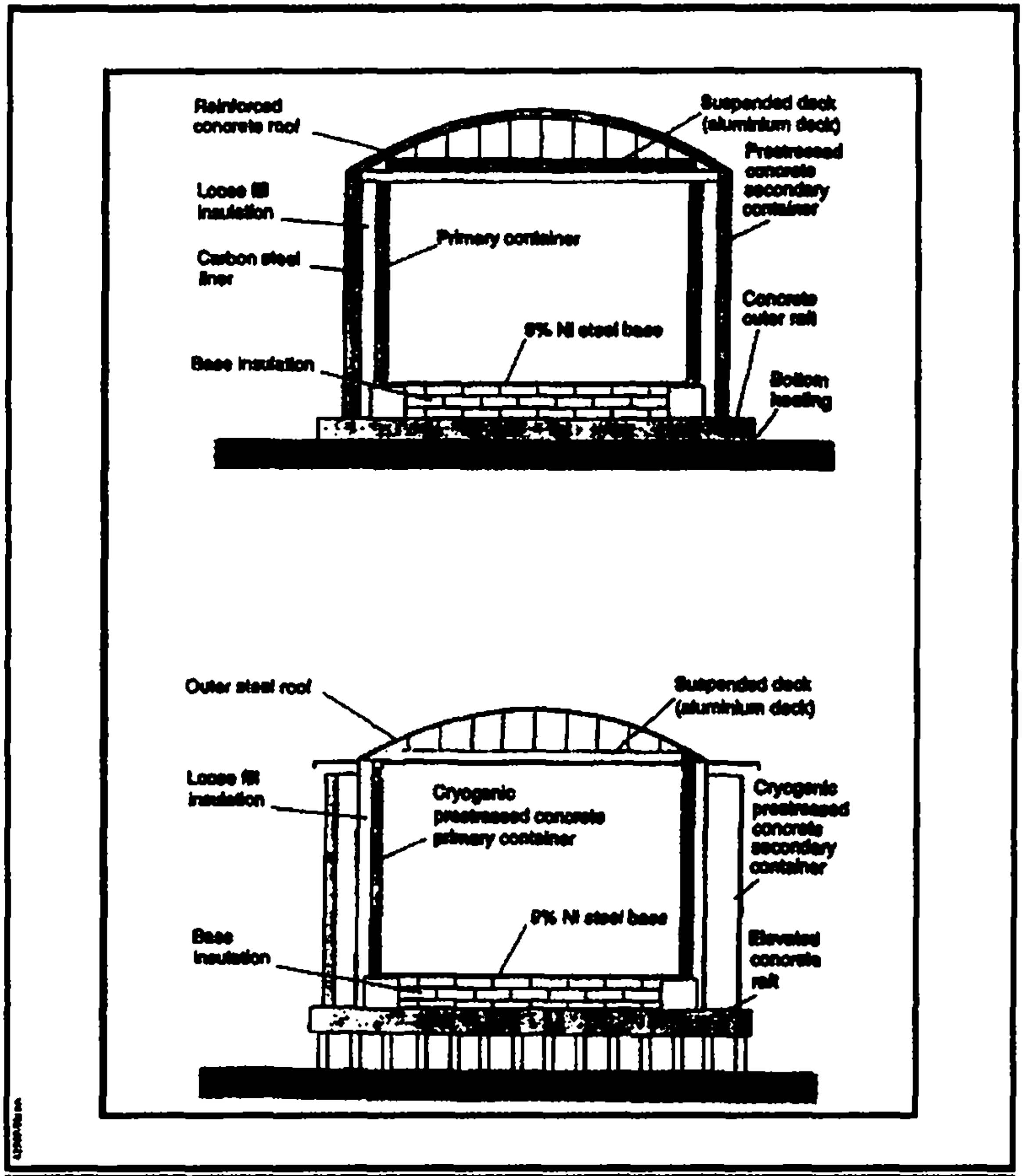


Figure H-6
Examples of Cryogenic Concrete Tanks

H.6 Cryogenic Concrete Tank

A cryogenic concrete tank is either a double containment tank (see H.3) or a full containment tank (see H.4). For this type of tank, the walls of the primary and secondary containers are both constructed of prestressed concrete. Examples of cryogenic concrete tanks are given in figure H.6.

We are not declaring a preference over any of the six tank designs (or other variations of the six) and/or which tank designer is better at designing and constructing LNG storage tanks. Cheniere is proposing to install single containment tanks with individual earthen impoundment dikes surrounding each tank. These dikes would be sized to hold 110 percent of the volume contained in each storage tank.

4.12.4 Siting Requirements – Thermal and Dispersion Exclusion Zones

4.12.4.1 Regulatory Requirements

The LNG facilities proposed for this Project must comply with the siting requirements of 49 CFR 193, Subpart B. On March 30, 2000, the DOT revised 49 CFR 193 to incorporate NFPA 59A (1996 edition) into the LNG regulations. On April 9, 2004, the DOT further revised 49 CFR 193 to incorporate the 2001 edition of NFPA 59A. The following sections specifically address offsite hazards:

- **Part 193.2001, Scope of Part**, excludes any matter other than siting provisions pertaining to marine cargo transfer systems between the marine vessel and the last manifold or valve immediately before a storage tank.
- **Part 193.2051, Scope**, states that each LNG facility designed, replaced, relocated or significantly altered after March 31, 2000, must be provided with siting requirements in accordance with Subpart B and NFPA 59A. In the event of a conflict with NFPA 59A, then Part 193 prevails.
- **Part 193.2057, Thermal radiation protection**, requires that each LNG container and LNG transfer system have thermal exclusion zones based on three radiation flux levels in accordance with Section 2.2.3.2 of NFPA 59A.
- **Part 193.2059, Flammable vapor-gas dispersion protection,** requires that each LNG container and LNG transfer system have a dispersion exclusion zone in accordance with Section 2.2.3.3 and 2.2.3.4 of NFPA 59A.

For the following LNG facilities that are proposed in this project, we have identified the applicable siting requirements from Part 193 and NFPA 59A:

- Three 1,006,400-barrel LNG storage tanks - Parts 193.2057 and 2059 require the establishment of thermal and flammable vapor exclusion zones for LNG tanks. NFPA 59A Section 2.2.3.2 specifies four thermal exclusion zones based on the design spill and the impounding area. Sections 2.2.3.3 and 2.2.3.4 specify a flammable vapor exclusion zone for the design spill which is determined in Section 2.2.3.5.

- Two marine unloading berths and a cargo transfer system consisting of eight 20-inch-diameter unloading arms, and two 30-inch-diameter transfer lines - Parts 193.2001, 2057, and 2059 require thermal and flammable vapor exclusion zones for the transfer system. NFPA 59A does not address LNG transfer systems.
- Nine 4,300 gpm in-tank pumps (three in each tank) and sixteen 1,686 gpm high-pressure sendout pumps - Parts 193.2057 and 2059 require thermal and flammable vapor exclusion zones. NFPA 59A Section 2.2.3.2 specifies the thermal exclusion zone and Section 2.2.3.3 and 2.2.3.4 specify the flammable vapor exclusion zone based on the design spill in a process area.
- Sixteen submerged combustion vaporizers - Same requirements as for LNG pumps.

The incorporation of the NFPA 59A requirements into Part 193 has resulted in some confusion and possible misinterpretation in applying the siting requirements:

Parts 193.2057 and 2059 require exclusion zones for LNG transfer systems, which are defined to include transfer piping. However, NFPA 59A only requires exclusion zones for "transfer areas" which are defined as the part of the plant where liquids are introduced or removed from the facility such as truck loading or ship unloading areas. The definition of transfer area in NFPA 59A specifically excludes permanent plant piping. Additionally, NFPA 59A Section 2.2.3.1 (2001) specifically excludes transfer areas at the water edge of marine terminals. When the DOT incorporated NFPA 59A into its regulations, it removed the requirement for impounding systems around transfer piping (old Part 193.2149). In the preamble to the final rule, the DOT determined that the most likely sources of leaks within LNG plant are LNG storage tanks, cargo transfer areas, and vaporizers and process equipment, which are all addressed in NFPA 59A Section 2.2.1.2. The result is that while Part 193 retains exclusion zones for LNG transfer systems, neither Part 193 nor NFPA 59A requires the impoundment from which to base the calculations. We do not believe that this was the intent, nor do we believe that omitting containment for transfer piping is a sound engineering practice. The FERC staff will continue to require containment for all LNG transfer piping within a plant site.

The incorporation of NFPA 59A also changed the way in which design spills and impoundment capacities may be determined. Under Section 2.2.2.2, the capacity of impounding areas for vaporization, process, or LNG transfer areas must equal the greatest volume during a 10-minute period from any single <u>accidental leakage source</u> or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the authority having jurisdiction. Similar criteria appear in Section 2.2.3.3 for determining the design spill used in thermal and flammable vapor exclusion zone calculations. Prior to the incorporation of NFPA 59A, the design spill in Part 193 assumed the <u>rupture of a single transfer pipe</u> with the greatest overall flow capacity, for not less than 10 minutes (old Part 193.2059(d)). As a result, the spill <u>rate</u> for vaporization, process, or LNG transfer areas may be assumed to be an "accidental leakage source" rather than a full pipe rupture; however, the spill <u>duration</u> must be 10 minutes unless the authority having jurisdiction, *i.e.*, DOT Office of Pipeline Safety (OPS), determines that a shorter time is acceptable. Again, given the confusion in applying the two requirements, the FERC staff will continue to utilize the 10-minute spill criteria at the maximum flow possible for containment sizing. This will ensure that impoundments are sized for a catastrophic failure, while recognizing that less conservative spill scenarios may be appropriate for exclusion zone calculations. In giving recognition to the integrity of all-welded transfer piping, the determination of the single accidental leakage source should be based on an evaluation of all small diameter attachments to the transfer piping for instrumentation, pressure relief, recirculation, etc, and any flanges that may be used at valves or other equipment, in order to determine the largest spill rate.

4.12.4.2 Impoundment Systems and Design Spills

The calculations of thermal and flammable exclusion zones for the proposed LNG facilities are based on the dimensions of the proposed impoundment systems and the spill volumes specified by Part 193 and NFPA 59A. Part 193.2181 specifies that the impoundment system serving a single LNG storage tank must have a volumetric capacity of 110 percent of the LNG tank's maximum liquid capacity. Cheniere's proposed LNG storage tank impoundments would be earthen dikes 604-feet-wide by 604-feet-long (based on dimensions at the inside of the top edge), approximately 21 feet high. In addition, each storage tank impoundment would include a sump measuring 60-foot wide by 60-foot long with a depth of 26 feet. The volumetric capacity of the impoundment would be 50,593,506 gallons which would exceed the 110 percent requirement by approximately 4,000,000 gallons.

The design spill for an LNG storage tank with no penetrations below the liquid level is determined in accordance with Section 2.2.3.5 of NFPA 59A and is defined as the largest flow from any single line that could be pumped into the impounding area from the tank withdrawal pumps at full rated capacity over a 10-minute period. Each LNG storage tank would be equipped with three in-tank pumps, individually rated for 4,300 gpm. The rupture of the in-tank pump discharge header would result in a spill rate of 12,900 gpm, which equates to a spill volume of 129,000 gallons. This spill would be contained by the earthen dike surrounding each LNG storage tank.

The piping for the marine cargo transfer system would be contained within an impoundment trough that is sloped to a collection sump located north of the two LNG ship berths. The concrete-lined dock area sump would be sized to contain a 10-minute spill from the 30-inch-diameter transfer lines that connect the dock to the LNG storage tanks. The design flow through both of the transfer lines combined would be 52,834 gpm. The ten minute spill would be 528,340 gallons and would be contained by the dock area sump, which measures 60 feet wide by 60 feet long, with a depth of 20 feet.

The vaporizer and sendout pump area would be curbed and graded so that any LNG spill would flow back to the process area sump to the east, located approximately midway between the process area and the earthen dikes. This concrete-lined sump is 60-feet wide by 60-feet long, with a depth of 20 feet. The process area sump, sized to accommodate a spill from the marine transfer lines, would have a capacity of 538,597 gallons. The design spill for the vaporizers and sendout pumps would be 258,240 gallons, a 10-minute spill of the full flow rate from the sendout pump suction header. The process area sump would accommodate this spill.

Table 4.12.4.2-1 presents the spill sizes used to determine adequate impounding capacity.

TABLE 4.12.4.2-1 Impoundment Areas			
Source	Spill Size (gallons)	Impoundment System	Impoundment Size (gallons)
LNG Storage Tank	42,267,528	LNG Tank Earthen Dike	50,593,506
In-tank LNG Pumps	129,000	LNG Tank Earthen Dike	50,593,506
Marine Cargo System	528,623	Dock Area Sump	538,597
Sendout Pumps and Vaporizers	258,240	Process Area Sump	538,597

Thermal Exclusion Zone

If a large quantity of LNG is spilled in the presence of an ignition source, the resulting LNG pool fire could cause high levels of thermal radiation. Exclusion distances for various flux levels were calculated according to 49 CFR 193.2057 and Section 2.2.3.2 of NFPA 59A, using the "LNGFIRE III" computer program model developed by the Gas Research Institute. NFPA 59A establishes certain atmospheric conditions (0 mph wind speed, 70°F, and 50 percent relative humidity) which are to be used in calculating the distances. However, Part 193.2057 supercedes these requirements and stipulates that the wind speed, ambient temperature, and relative humidity which produce the maximum exclusion distances must be used, except for conditions that occur less than 5 percent of the time based on recorded data for the area. For its analysis, Cheniere selected the following ambient conditions to produce the maximum distances: wind speed of 27.6 mph; ambient temperature of 34°F; and 80 percent relative humidity.

The FERC staff calculated thermal radiation distances for incident flux levels ranging from 1,600- to 10,000-Btu/ft^2-hr for an LNG storage tank fire. The following conditions were selected to produce the maximum distances: wind speeds ranging from 16 to 28 miles per hour; ambient temperature at 51°F, and 36 percent relative humidity. Thermal radiation distances were also determined for a 1,600 Btu/ft^2-hr incident flux level centered on both the process area and the dock area sumps.

Table 4.12.4.2-2 presents the calculated maximum distances for incident flux levels as calculated by the FERC staff. These values are generally in agreement with those calculated by Cheniere. Although portions of the 1,600 Btu/ft^2-hr zone for the storage tank falls outside of the northern property line, Cheniere states that these areas are within property over which it has control through restrictive covenants. However, these restrictive covenants were not filed with the application. Consequently, we recommend that:

- **<u>Prior to construction</u>, Cheniere should provide, in a filing with the Secretary, evidence of its ability to exercise legal control over the activities that occur within the portions of the thermal exclusion zones, listed in table 4.12.4.2-2 of the draft EIS, that fall outside of the LNG terminal property line.**

TABLE 4.12.4.2-2

Thermal Exclusion Zones

Source	Exclusion Area NFPA 59A Section 2-2.3.2(a)	Incident Flux (Btu/ft² hr) (a/)	Exclusion Zone (feet)
Process area sump	Property line that can be built upon.	1,600	324
Dock area sump	Property line that can be built upon.	1,600	324
LNG storage tank impoundment	Outdoor assembly area occupied by 50 or more people.	1,600	1,974
LNG storage tank impoundment	Offsite structures used for occupancies or residences.	3,000	1,577
LNG storage tank impoundment	Property line that can be built upon.	10,000	1,089

a/ The 1,600 Btu/ft^2-hr flux level is associated with an exposed person experiencing burns within about 30 seconds. At 3,000 Btu/ft^2-hr, an exposed person would experience burns within 10 seconds, however a wooden structure would not be expected to burn and affords protection to sheltered persons. At 10,000 Btu/ft^2-hr, clothing and wood can ignite spontaneously.

Vapor Dispersion Zone

A large quantity of LNG spilled without ignition would form a flammable vapor cloud that would travel with the prevailing wind until it either dispersed below the flammable limits or encountered an ignition source. Part 193.2059 and Sections 2.2.3.3 and 2.2.3.4 of NFPA 59A require that provisions be made to minimize the possibility of flammable vapors from reaching a property line that can be built upon and that would result in a distinct hazard. Part 193.2059 requires that dispersion distances be calculated for a 2.5 percent average gas concentration (one-half the lower flammability limit [LFL] of LNG vapor) under meteorological conditions which result in the longest downwind distances at least 90 percent of the time. Alternatively, maximum downwind distances may be estimated for stability Class F, a wind speed of 4.5 mph, 50 percent relative humidity, and the average regional temperature. The section allows the use of the DEGADIS Dense Gas Dispersion Model, or the FEM3A model, to compute dispersion distances. Design spills into impounding areas serving LNG containers, transfer systems and piping are to be determined in accordance with Section 2.2.3.5 of NFPA 59A.

In accordance with Section 2.2.3.3 of NFPA 59A, an average concentration of methane in air of 50 percent of the LFL cannot cross the property line from a design spill into each tank impoundment. In this case, compliance with Section 2.2.3.3 would also meet the requirements of Section 2.2.3.4 of NFPA 59A.

According to Table 2.2.3.5 of NFPA 59A, the design spill is the largest flow from the container (*i.e.*, storage tank) withdrawal pumps for a 10-minute duration at full rated capacity. This would be a guillotine rupture of the discharge header for the in-tank LNG pumps. Since each pump is rated at 4,300 gpm and there are three pumps per tank, the resulting spill would be 129,000 gallons. Assuming complete vaporization, the resulting vapor cloud would be totally contained within the dike. The LNG tank impoundments would be compliance with 49 CFR

193.2059 by considering the provisions for containing vapors under Section 2.2.3.2 of NFPA 59A.

Cheniere's application contained a vapor dispersion analysis for the process area sump and the dock area sump. In accordance with Part 193.2059, stability Class F, 4.5 miles per hour wind speed, 50 percent relative humidity, and an average regional temperature of 71°F were used as input conditions.

These sumps would receive spills from the vaporizer and sendout pump area, as well as any rupture of the marine transfer lines. In accordance with Table 2.2.3.5 of NFPA 59A, the design spill for these sumps would be the flow from any single accidental leakage source for 10 minutes. As previously stated, the determination of the single accidental leakage source should be based on an evaluation of all small diameter attachments to the transfer piping for instrumentation, pressure relief, recirculation, etc, and any flanges that may be used at valves or other equipment, in order to determine the largest spill rate. However, in its analysis, Cheniere elected to define the single accidental leakage source as a guillotine rupture of both unloading transfer lines, corresponding to a spill rate of 52,834 gpm.

In calculating vapor dispersion from these sumps, Cheniere modeled an instantaneous spill of both unloading lines, a volume of 528,340 gallons. Consequently, the staff verified Cheniere's modeling and achieved comparable results. SOURCE5 and DEGADIS predict 984 feet to the edge of the one-half LFL concentration envelope. In the case of the dock area sump, this exclusion zone would not extend beyond the plant property line. However, from the plot plans provided, it would appear that this 984-foot exclusion zone would extend beyond the northern plant boundary for a spill into the process area sump. However, Cheniere has indicated that this area falls within property over which it has control through restrictive covenants. Consequently, we recommend that:

- **<u>Prior to construction</u>, Cheniere should provide, in a filing with the Secretary, evidence of its ability to exercise legal control over the activities that occur within the portions of the vapor dispersion exclusion zones that fall outside of the LNG terminal property line.**

Another issue is the lengthy distance from potential spill locations to the process and dock area sumps. While it is an appropriate design philosophy to direct potential spills away from process equipment to remote impoundments, and it is technically correct to base exclusion zone calculations on these impoundments, it is also relevant to consider the control of vapors produced in the channels or trenches leading to these sumps. Long trenches increase the surface area available for heat transfer and, correspondingly, increase vapor generation. A number of vapor control options are available including: vapor fences; fixed high expansion foam generators; reduced trench lengths and/or surface area; and additional sumps at intermediate locations along transfer piping. As a result, we recommend that:

- **Cheniere should examine provisions to retain any vapor produced along the transfer line trenches and other areas serving to direct LNG spills to associated impoundments. Measures to be considered may include, but are not limited to: vapor fencing; intermediate sump locations; or trench surface area reduction.**

Cheniere should file final drawings and specifications for these measures with the Secretary before construction.

4.12.5 Marine Safety [9]

The hazards associated with the marine transportation of LNG differ from land-based hazards. Whereas the land-based facilities have features to both limit the duration of LNG spills and contain credible spill volumes, any LNG spill on water would be unconfined and would vaporize rapidly due to heat input from the water.

The history of LNG shipping has been free of major incidents, and none have resulted in significant quantities of cargo being released (see section 4.12.5.3, *History*). No incidents have occurred at existing LNG terminals during the 50 years of operation that resulted in any significant quantities of cargoes being released. However, the possibility of an LNG spill from a ship over the duration of the proposed project must be considered. Historically, the events most likely to cause a significant release of LNG were a ship casualty such as:

- a vessel colliding with an LNG ship in transit;
- an LNG ship alliding[10] with the terminal or a structure in the Corpus Christi or La Quinta Channel;
- a vessel alliding with an LNG ship while moored at the terminal; or
- a grounding sufficiently severe to puncture an LNG cargo tank.

However, the attacks on September 11, 2001 have made the public keenly aware of additional risks that must be considered in the evaluation of marine safety:

- a deliberate attack on an LNG ship by a terrorist group.

Any of the above events would have to occur with sufficient impact to breach the LNG ship's double hull and cargo tanks. Previous incidents with LNG ships have primarily involved grounding, and none of these have resulted in the breach of the double hull and subsequent release of LNG cargo.

The following discussion provides a chronology of the LNG ship voyage from the liquefaction facility to the import terminal, disclosing the risks at each step and how they are managed. Details and analysis are provided in subsequent sections.

LNG Vessels and Ocean Voyage

Imported LNG could be obtained from exporting terminals throughout the world and delivered by LNG ships to the proposed terminal. Exporting countries include Algeria, Australia, Brunei, Indonesia, Malaysia, Nigeria, Oman, Qatar, Trinidad, and United Arab Emirates. In 2003, LNG

[9] This section was written with the cooperation and assistance of the USCG, Marine Safety Office Corpus Christi.

[10] "Allision" is the action of dashing against or striking upon a stationary object (e.g., the running of one ship upon another ship that is docked) – distinguished from "collision," which is used to refer to two moving ships striking one another.

imports to the U.S. included: 72 percent from Trinidad, 12 percent from Nigeria, 10 percent from Algeria, 3 percent from Qatar, 2 percent from Oman, and 1 percent from Malaysia.

The LNG tankers used to import LNG to the U.S. would be constructed and operated in accordance with the International Maritime Organization's (IMO) Code for the Construction and Equipments of Ships Carrying Liquefied Gases in Bulk, the International Convention for SOLAS, and 46 CFR 154, which contain the U.S. safety standards for vessels carrying bulk liquefied natural gas. Foreign flag LNG tankers are required to possess a valid IMO Certificate of Fitness and a USCG Certificate of Compliance.

In 1993, amendments to the IMO's Code for the Construction and Equipments of Ships Carrying Dangerous Chemicals in Bulk require all tankers to have monitoring equipment with an alarm facility which is activated by detection of over-pressure or under-pressure conditions within a cargo tank. In addition, the cargo tanks are heavily instrumented, with gas detection equipment in the hold and inter-barrier spaces, temperature sensors, and pressure gauges. Fire protection must include the following systems:

- a water spray (deluge) system that covers the accommodation house control room and all main cargo valves;
- a traditional firewater system that provides water to fire monitors on deck and to fire stations found throughout the ship;
- a dry chemical fire extinguishing system for hydrocarbon fires; and
- a carbon dioxide system for protecting machinery including the ballast pump room, emergency generators and compressors.

As a result of September 11, 2001, the IMO agreed to new amendments to the 1974 SOLAS addressing port facility and ship security. The International Ship and Port Facility Security (ISPS) Code was adopted in 2003 by the IMO. This code requires both ships and ports to conduct vulnerability assessments and to develop security plans. The purpose of the code is to: prevent and suppress terrorism against ships; improve security aboard ships and ashore; and reduce the risk of passengers, crew, and port personnel on board ships and in port areas, for vessels and cargoes. All LNG vessels as well as other cargo vessels 300 gross tons and larger, as well as ports servicing those regulated vessels, must adhere to these IMO and SOLAS standards. Some of the IMO requirements for ships are as follows:

For the ships, these requirements must include:

- ships must develop security plans and have a Ship Security Officer;
- ships must be provided with a ship security alert system. These alarms transmit ship-to-shore security alerts to a competent authority designated by the Administration, which may include the company, identifying the ship, its location and indicating that the security of the ship is under threat or has been compromised;
- ships must have a comprehensive security plan for international port facilities, focusing on areas having direct contact with ships; and
- ships may have certain equipment onboard to help maintain or enhance the physical security of the ship.

For the port facilities, the requirements must include:

- port facility security plan;
- facility Security Officer; and
- certain security equipment may be required to maintain or enhance the physical security of the facility.

Both ships and ports must include the following:

- monitoring and controlling access;
- monitoring the activities of people and cargo;
- ensuring security communications and that they are readily available; and
- completion of the Declaration of Security.

LNG Vessel Transit in Corpus Christi and La Quinta Channels

LNG ships in route to the LNG terminal would transit the 19 miles from the sea buoy to the berth under the direction of a pilot (see figure 4.12-1). Upon reaching the terminal, three tugs would be used to berth the vessel. Cheniere has stated that it would provide three dedicated Z-drive tractor tugs of about 5,000-hp and 50 tons bollard pull. The berths are aligned such that the LNG vessels would be turned by tugs and backed onto berth. One tug would remain with the LNG ship the entire time that it is at the marine berth.

Typically the LNG ship would arrive and enter the port during daylight hours on the first day. Docking, LNG offloading, and undocking would take less than 24 hours. The LNG ship would depart during daylight hours on the second day. When leaving the berth, the bow of the LNG ship would be moved towards the turning basin and into the La Quinta Channel.

In addition to the Pilots, the USCG would control the transit of the LNG vessel through the harbor and while unloading cargo. Typical USCG requirements for other LNG import terminals include 96- and 24-hour advance notification of the vessel arrival. Upon arrival at the sea buoy, USCG personnel may board the LNG vessel for an inspection of the ship safety systems and review of the manifest. Other requirements may include: a USCG escort through the channel and to the dock; establishment of a moving safety and/or security zone around the vessel while in route and during unloading operations; an inspection of the dock safety systems prior to commencing cargo transfer; monitoring of all operations until the vessel departs; and maintaining security of the dock and vessel (see section 4.12.5.2).

LNG Vessel Casualties

The operational controls by the USCG and the Pilots, as well as the characteristics of the Corpus Christi and La Quinta Channels, virtually eliminate the possibility of an LNG cargo spill from groundings, collisions, and allisions. The soft nature of the sea bottom in the Corpus Christi and La Quinta Channels makes an LNG spill from cargo tanks highly unlikely in a grounding incident. The entrance jetties are bordered by shallow water approximately 25 to 30 feet deep, thereby preventing the LNG ships, which have drafts of over 37 feet, from contacting the jetties.

Non-Internet Public

Page 4-131
Map

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The USCG is authorized to establish safety zones, or other measures for limited, controlled, or conditional access and activity, when necessary for the protection of any vessel, structure, waters, or shore area. Both the USCG and the Pilots may enforce moving safety and/or security zones around the LNG ships. Although not yet defined, typically these zones would clear the harbor of the vessels with the tonnage and speed required to cause an LNG spill (see section 4.12.5.4 *Vessel Construction*). To minimize the potential of an inbound LNG vessel alliding with the terminal or other fixed structure, a Full Mission Maneuverability Simulation Study was performed at the COE Ship and Tow Simulator in Vicksburg, Mississippi, to test the LNG vessel entry into the jetties, the slowdown and approach to the turning area, and turning and backing the ship into the proposed berths. The study found the entrance to be safe, the terminal maneuvering area to be adequate, and the proposed tugs adequate to maneuver the 140,000 cubic meter LNG vessels (see section 4.12.5.1 *Vessel Simulation Study*).

Deliberate Attack on an LNG Vessel

In addition to addressing the potential hazards from LNG vessel casualties, the possibility of a deliberate attack on an LNG ship by a terrorist group must also be considered. Security of the LNG vessel is the responsibility of the owner/operator and the master of the vessel. Security of the facility is the responsibility of the owner/operator of the facility. Protection of the LNG vessel and the import terminal would involve personnel from the Cheniere security staff, and State and local law enforcement. The USCG would conduct random shoreside and waterside security patrols to include visits/passes of the LNG facility. In addition, the USCG may establish a safety and/or security zone around the LNG vessels in transit and while docked. Only personnel or vessels authorized by the Captain of the Port or the District Commander would be permitted in the safety/security zone.

Cheniere would provide security for the terminal according to a Facility Security Plan prepared under 33 CFR 105 and approved by the USCG Captain of the Port (see section 4.12.6.). Some of the requirements include:

- a designated Facility Security Officer responsible for implementing and periodically updating the Facility Security Plan and Assessment;
- a Facility Security Assessment to identify site vulnerabilities, possible security threats, consequences of an attack, and facility protective measures;
- a Facility Security Plan with procedures for responding to security incidents;
- scalable security measures to provide increasing levels of security at increasing Maritime Security (MARSEC) levels;
- security exercises at least once each calendar year and drills at least every three months; and
- mandatory reporting of all breaches of security and security incidents.

Security at the facility would be provided by both active and passive systems. The entire site would be surrounded by a protective enclosure (*i.e.*, fence) with sufficient strength to deter unauthorized access. The enclosure would also be illuminated with not less than 2.2 lux between sunset and sunrise. Intrusion detection systems and day/night camera coverage would identify unauthorized access. A separate security staff would conduct periodic patrols of the plant, screen visitors and contractors, and assist in maintaining security of the marine terminal during cargo unloading. Cheniere would be required to submit their Facility Security Plan to the Captain of the Port 60 days prior to commencement of operations. In order to ensure that the responsibilities of Cheniere's security staff enhance overall security, we recommend that:

- **Cheniere should coordinate with the USCG to define the responsibilities of Cheniere's security staff in supplementing other security personnel and in protecting the LNG tankers and terminal, and document the results of this consultation in a filing with the Secretary prior to commissioning.**

A Security Analysis prepared for Cheniere, and filed under Critical Energy Infrastructure Information (CEII), analyzed a range of potential attack scenarios and estimated consequences. In addition, a detailed evaluation of the consequences of a terrorist attack on a modern membrane LNG tanker was prepared by Lloyds Register North America for the Weaver's Cove LNG Project (see section 4.12.5.3 *Hazards*). These provide a basis for estimating the potential magnitude of a hazard from a successful terrorist attack, and for developing LNG vessel and waterfront security plans.

The methodology described in the ABSG Consulting Inc. (ABSG) study, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*, and revised in the FERC staff's responses to comments on the report (issued June 18, 2004), was used to calculate the thermal radiation and flammable vapor dispersion distances for 1-meter and 2.5 - meter diameter holes. Using the methodology, we have estimated distances to range from 2,200 to 4,340 feet for a thermal radiation of 1,600 Btu/ft^2-hr, the level which is hazardous for persons located outdoors and unprotected, from 1,710 to 3,300 feet for 3,000 Btu/ft^2-hr, an acceptable level for wooden structures, and from 1,040 to 1,970 feet for 10,000 Btu/ft^2-hr, a level sufficient to damage process equipment for these size holes, respectively.

These estimates of an average most probable "worst case" scenario provide guidance in developing the operating restrictions for LNG vessel movements in the Corpus Christi and La Quinta Ship Channels, as well as in establishing potential impact areas for emergency response and evacuation planning. Except for the 19-mile transit through the Corpus Christi and La Quinta Channels to the LNG berth, the transit would in the open water of the Gulf of Mexico. Large portions of the Corpus Christi and La Quinta Channels have no development or communities adjacent to the channel. However, within 2,200 to 4,340 feet of the Corpus Christi and La Quinta Channels are the communities of Port Aransas, Ingleside, and Ingleside-on-the-Bay. These communities are already familiar with oil, chemical, and LPG vessels passing at close range.

Assuming an LNG vessel transit through the channel at 8 knots (without tug assist), these areas would be exposed to a potential transient hazard of less than 15 minutes. Assuming tug assist, LNG vessel transit would be at 3 knots, and these areas would be exposed to a potential transient hazard of approximately 30 minutes. In addition, a temporary hazard would exist around the slip during part of the 10 to 12-hour period while the LNG vessel is at the dock and unloading cargo. The LNG vessel movement requirements that the USCG would impose in its operation plan, as well as any operational restrictions imposed by the Pilots, would minimize the possibility of a hazardous event occurring in the Corpus Christi and La Quinta Channels.

Emergency Response and Evacuation Planning

Prior to commencing operations, Cheniere would prepare emergency procedures manuals, as required by 49 CFR 193.2509, that provide for: (a) responding to controllable emergencies and recognizing an uncontrollable emergency; (b) taking action to minimize harm to the public including the possible need to evacuate the public; and (c) coordination and cooperation with appropriate local officials. Typically, the manuals are prepared at the later stages of the construction process and submitted to the FERC as a requirement prior to placing the facilities in service.

While recognizing that preparing emergency procedures typically occurs at the end of the construction phase rather than at the EIS stage, there remain a number of issues concerning the viability of the *Emergency Response and Evacuation Plan* that need to be demonstrated. Therefore, we recommend that:

- **Cheniere should develop emergency evacuation routes/methods in conjunction with the local emergency planning groups and town officials for areas that are within any transient hazard areas. These evacuation routes/methods should be filed with the Secretary for review and written approval by the Director of OEP prior to construction.**

In addition, we recommend that:

- **Cheniere should develop an Emergency Response Plan (including evacuation) and coordinate procedures with local emergency planning groups, fire departments, state and local law enforcement, and appropriate Federal agencies. This plan should include at a minimum:**

  a. designated contacts with state and local emergency response agencies;

  b. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;

  c. procedures for notifying residents and recreational users within areas of potential hazard;

  d. evacuation routes for public use areas and residents of areas that are within any transient hazard areas;

  e. locations of permanent sirens and other warning devices; and

  f. an "emergency coordinator" on each LNG vessel to activate sirens and other warning devices.

  The Emergency Response Plan should be filed with the Secretary for review and approval by the Director of OEP prior to commencement of service. Cheniere should notify the FERC staff of all meetings in advance and should report progress on its Emergency Response Plan at 6-month intervals starting at the commencement of construction.

Federal Oversight

Three Federal agencies share in the oversight of the safety and security of LNG import terminals: the USCG, the DOT, and the FERC. The FERC authorizes the siting and construction of LNG import terminals and is the lead Federal agency under NEPA to analyze the environmental, safety, security and cryogenic design of proposed facilities. The USCG has authority over the safety of LNG vessels and the marine transfer area. The USCG also has authority over security of LNG vessels and the entire LNG facility. The DOT has exclusive authority to promulgate and enforce safety regulations and standards over the onshore LNG facilities beginning at the last valve immediately before the LNG storage tank(s).

In February 2004, the three participating agencies entered into an Interagency Agreement to assure that they work in a coordinated manner to address the full range of issues regarding safety and security at LNG import terminals, including the terminal facilities and tanker operations, and to maximize the exchange of information related to the safety and security aspects of the LNG facilities and related marine operations. The Interagency Agreement ensures a seamless safety and security review by the three Federal agencies.

4.12.5.1 Corpus Christi Ship Channel

Corpus Christi Bay has a number of port and waterfront facilities, most of which are centered around the city of Corpus Christi on the west side of the bay. The port's deep water facilities are located along the dredged ship channels which are a continuation of the main Corpus Christi access channel which ships use as access to and from the Gulf of Mexico.

Cargoes handled at the port of Corpus Christi include grain, general freight, alumina, aluminum hydrate, caustic soda, crude oil, petroleum / petrochemical products, LPG and chemicals. Additionally, there are extensive marine support facilities including ship repair, bunkering, lay-up berths, and also bases for serving offshore oilfield supply vessels. There are other port/waterfront facilities located around the Corpus Christi Bay, including:

- Naval Station Ingleside (close to the crossing point of the Corpus Christi and La Quinta Channels and Gulf Intracoastal Water Way (GIWW);
- the Port Aransas Ferry facilities between Port Aransas and Harbor Island (within 1 mile of the cut between San Jose Island and Mustang Island);
- Kiewit Offshore Services (construction of oil rigs and production platforms) located near Ingleside;
- numerous leisure facilities (marinas, moorings, boatyards, etc.) at various locations around the bay; and
- numerous fishing vessel facilities (vessel docks and landing sites) at various locations around the bay.

All LNG shipping would enter and depart Corpus Christi Bay via the Corpus Christi Channel, as is the case with most of the seagoing shipping bound for the port of Corpus Christi. The Corpus Christi Channel is approximately 34 nautical miles long from the sea buoy in the Gulf of Mexico to the end at Corpus Christi Harbor, including the length of the La Quinta Channel. The route that would be followed by LNG ships bound for the Cheniere Corpus Christi LNG terminal is described in section 4.9.2 *Marine Transportation.* The length of each segment of the channel that would be traversed, and channel characteristics as they relate to marine safety are summarized in table 4.12.5.1-1.

TABLE 4.12.5.1-1

Channel Characteristics for Route that Would be Used by LNG Ships Calling on Proposed LNG Terminal

Channel Segment	Length (NM)	Width (ft)	Depth (ft)
Aransas Pass Outer Bar to Inner Basin	3.9	600 - 700	45 - 47
Corpus Christi Channel (Inner Basin to La Quinta Junction)	8.5	300 - 600	45
La Quinta Channel	4.9	300 - 400	45
Total Length	**17.3**		

Source: Port of Corpus Christi Authority, 1998

Upon reaching the Cheniere Corpus Christi LNG terminal LNG ships would be required to turn in a specially constructed turning basin at the north end of the La Quinta Channel, adjacent to the LNG berths. Once they have been turned in the basin with tug assistance, they would maneuver back and onto the LNG berths and be moored such that they are pointing outwards towards the La Quinta Channel. This would allow ships to depart the LNG terminal without turning, which would provide for a more rapid emergency evacuation from the berth should this be required.

The turning basin design (location, shape, size and depth) has been developed by means of extensive Full Mission Ship Simulations in which local Pilots undertook a series of maneuvers using LNG ship model and tug resources representative of the proposed LNG terminal. The exercises were carried out in simulated wind conditions typical of the worst conditions which might be expected at the location.

Current Traffic

Vessel movements in Corpus Christi Bay are heavily dominated (numerically) by barge traffic, much of which transits to and from Corpus Christi Bay ports via the GIWW. The number of inbound vessel transits in Corpus Christi Bay from 1993 to 2002 are shown in figure 4.12-2. The dominant cargo commodity for vessels entering Corpus Christi Bay is petroleum products (figure 4.12-3).

Table 4.12.5.1-2 lists recorded vessel traffic in Corpus Christi Bay. Approximately 89 percent of the vessel traffic in Corpus Christi Bay is made up of vessels with a draft of less than 18 feet. This traffic enters and leaves Corpus Christi Bay primarily by means of the GIWW, and not via the main shipping channels. Approximately 11 percent of the existing traffic is deep draft vessels that are limited to the shipping channels.

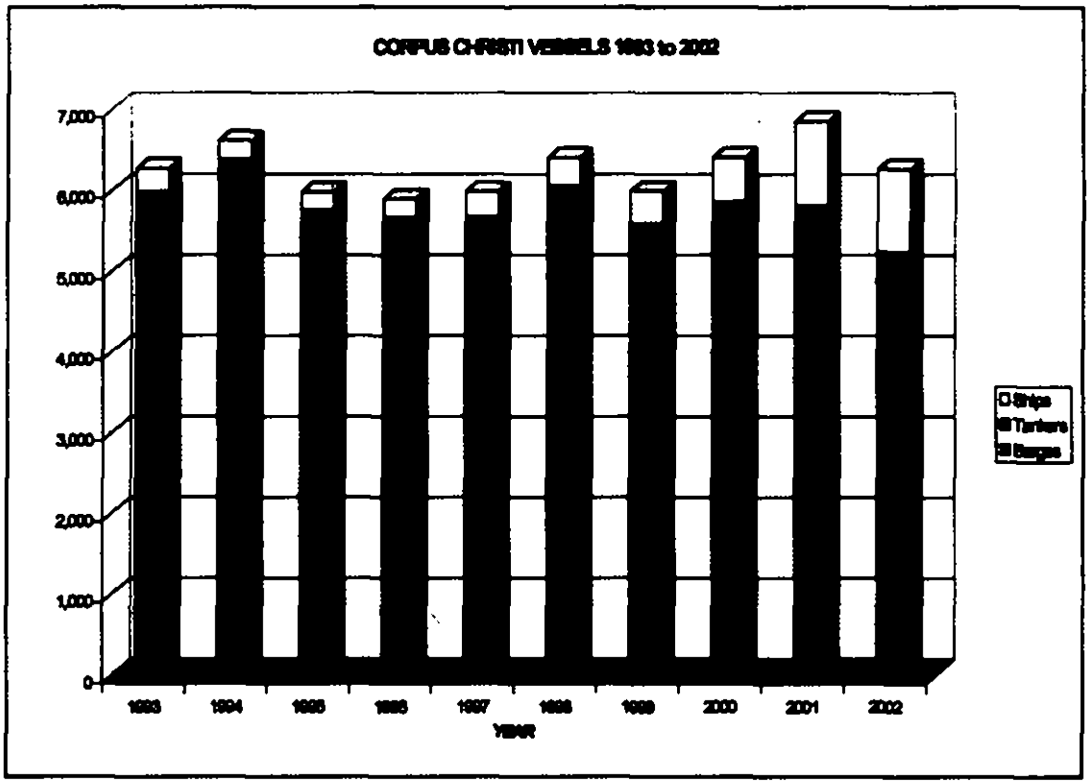

Figure 4.12-2
Vessel Movements in Corpus Christi Bay

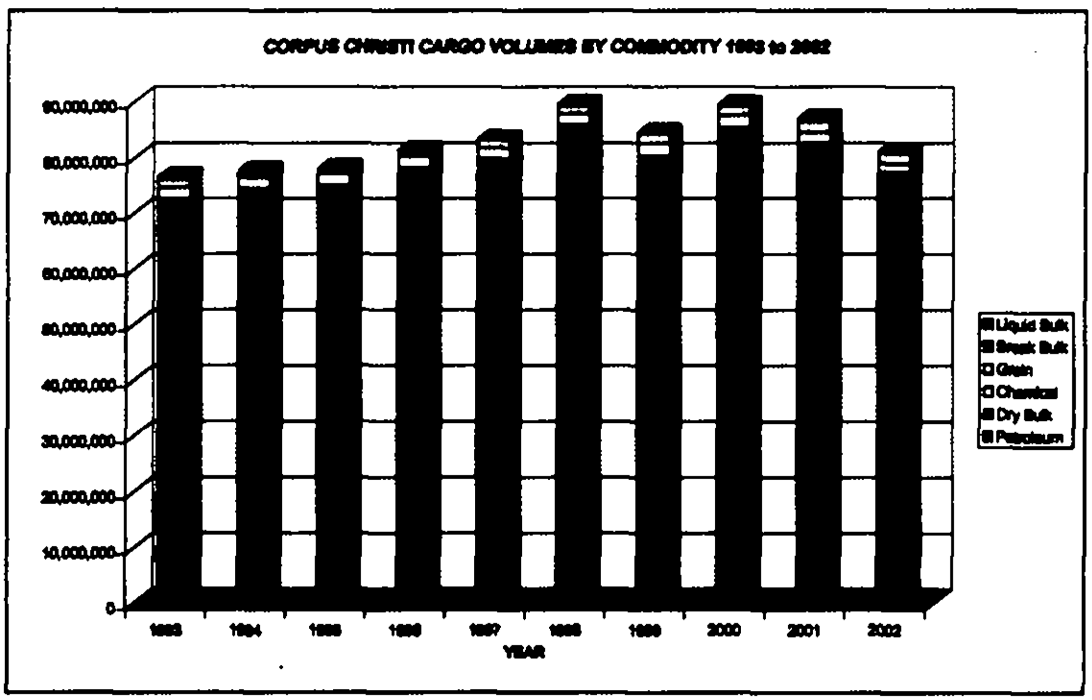

Figure 4.12-3
Ship Cargo Volumes (Short Tons),
by Commodity, Corpus Christi Bay

TABLE 4.12.5.1-2

Corpus Christi Ship Traffic
By Vessel Draft

Draft/ Vessel Type		Number of Vessel Transits by Year						
		1997	1998	1999	2000	2001	Total	Percent
≥ 18 feet								
Tug/Tow		38	47	38	27	70	220	0.4
Tanker		993	942	888	916	837	4,576	7.9
Cargo/Pax		257	333	385	356	305	1,636	2.8
	Subtotal	**1,288**	**1,322**	**1,311**	**1,299**	**1,212**	**6,432**	**11.1**
≤ 18 feet								
Tug/Tow		7,849	8,001	6,971	7,368	7,321	37,510	64.8
Tanker		94	91	99	95	78	457	0.8
Cargo/Pax		2,827	2,408	2,548	2,929	2,752	13,464	23.3
	Subtotal	**10,770**	**10,500**	**9,618**	**10,392**	**10,151**	**51,431**	**88.9**
	Total	**12,058**	**11,822**	**10,929**	**11,691**	**11,363**	**57,863**	**100**

Source: COE, 2001.

Of the 19 nautical miles of route that LNG tankers would use to reach the Cheniere Corpus Christi LNG terminal, approximately 1.0 nautical mile directly south of Ingleside would be along a channel where both the Corpus Christi Channel and the GIWW are collocated (figure 4.12-4). In this area both deep draft and shallow draft vessels must share the same route, and barge traffic transiting from the Bay ports (mainly Corpus Christi) to the GIWW, and vice versa, potentially conflicts with the proposed LNG traffic.

In addition, Naval Station Ingleside is home to approximately 25 mine sweepers, and is a port of call for other naval vessels. The base is a training center and the mine sweepers practice in the Gulf and in the Jewell Fulton Channel off La Quinta Channel on a weekly schedule. While the Navy ship schedules are classified, Naval Station Ingleside has indicated it would coordinate the training schedule around the LNG ships provided Cheniere keeps them closely advised of the LNG ship schedules.

The Port Aransas ferry, connecting Harbor Island with Port Aransas, operates 24-hours a day, 365-days a year and crosses the ship channel perpendicularly. Scheduled crossings typically last from 3 to 10 minutes according to weather and channel traffic conditions. However, automobile traffic has increased over recent years and the number of unscheduled crossings has risen accordingly. According to traffic demand, vehicles may have to wait as much as 20 minutes to board the ferry. Depending on the presence of tugs, an LNG vessel would transit through the channel at 3 knots (with tug assist) or 8 knots (without tug assist). Assuming a typical LNG vessel safety zone of 2 miles ahead and 1 mile astern, the ferry could be delayed 20 minutes to an hour by a passing LNG carrier. In its September 13, 2004 response to the environmental information request issued August 27, 2004, Cheniere stated that it has been coordinating with local officials from both the City of Port Aransas and the TDOT regarding ferry operations. Cheniere states that these officials have confirmed that the proposed LNG traffic would not adversely affect ferry operations. In addition, further consultation with these parties, as well as the City of Aransas Pass, will be pursued to ensure that ferry operations would not be affected.

Non-Internet Public

Page 4-139
Map

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

However, we recommend that:

- ***Prior to construction*, Cheniere should file with the Secretary documentation that suitable procedures and coordination exist between Cheniere, the Pilots, and the TDOT to minimize delays to the Port Aransas Ferry operations from LNG carrier transits.**

Transportation of oil rigs and production platforms constructed at Kiewit Offshore Services will occasionally be moved through the ship channel. Although movement of these components often result in channel closure, they are infrequent and scheduled far enough in advance to allow coordination between the USCG and the Pilots to minimize traffic disruptions.

Future Traffic

Cheniere's marine safety study provided data on existing vessel traffic that shows a variable pattern of shipping volume, and indicates no evidence of an increase in volume for the near future. If it is assumed that future vessel traffic remains steady, the addition of up to 300 LNG ships per year that would call on the Cheniere Corpus Christi LNG terminal would result in a 5 percent increase in large vessel traffic, and less than 1 percent increase in total vessel traffic.

However, there are a number of other proposed facilities along the La Quinta Ship Channel which could increase large, deep draft vessel traffic. The PCCA has proposed the La Quinta Container Terminal that would be just west of Cheniere's proposed LNG terminal at the end of the La Quinta Channel. The draft environmental document for the La Quinta Container Terminal estimates 262 to 363 additional vessels per year. Additionally, the ExxonMobil has proposed the Vista del Sol LNG Project (Docket Nos. CP04-395-000 et al.) which would add an estimated 100 additional LNG vessels per year. The proposed Ingleside Energy Center LNG Project (Docket Nos. CP05-11-000 at al.) may require 122 LNG vessels per year. Based on the number of vessel transits per year shown in table 4.12.5.1-2, current traffic levels average 3.5 vessels (with a draft greater than 18 feet) per day. If all the proposed facilities were built, the increased traffic would average 6 vessels per day.

Corpus Christi Harbor Channel Capacity

There are a number of factors that influence the movement of ship traffic in the Corpus Christi Bay Channels. These include:

- **Jetty Entrance Channel and Cross-Current** – The COE-designated entrance channel extends from the end of the Port Aransas Channel jetties to the sea buoy. The jetty entrance includes the critical maneuvering area from just outside to just inside the ends of the jetty where ships transition from exposure to cross-currents in the open Gulf to being in protected waters.

- The navigable channel narrows from 700 to 800 feet (Aransas Pass Channel) to 600 feet in the Jetty Channel. On occasion, "long-shore" or "littoral" currents occur along the Texas coast. These wind-generated currents in conjunction with tidal effects can flow in either direction and are perpendicular to the port shipping channels. These currents require ships to approach the jetty entrance at an angle of up to 10 degrees. Currently pilots restrict entrance of typical deep-draft ships (820-feet in length with 125-foot beam and drafts up to 40 feet) calling at Corpus Christi ports when the crosscurrent exceeds 5 knots (approximately 5 percent of the time).

- Entrance of the largest ships (900-feet in length with beams up to 145 feet and drafts up to 42 feet) calling at Corpus Christi is possible only when the crosscurrent is negligible or 70 to 75 percent of the time.

- **Corpus Christi Channel Draft** – The main channel is maintained at a nominal depth of –45 feet MLT, meaning that the COE dredges Corpus Christi Harbor Channel to –47 feet plus up to 2 feet more for over depth allowance. This allows for the channel to shoal up to –45 feet MLT before it is dredged again. Under normal tides there is usually 2 feet, typically providing a minimum of 47 feet of water. The largest LNG ships currently planned would have a draft of about 39.4 feet. If a 10 percent under keel clearance were desired, a depth of about 44.4 feet would be required for these vessels. The 47 foot effective depth of the Corpus Christi Channel would accommodate these LNG ships.

- **Day Transit and One-way Traffic** – On June 10, 2003, Cheniere sent a Letter of Intent (LOI) to the USCG advising that LNG ships serving the proposed LNG facility would transit the Bay channels only in daylight hours (see section 4.12.5.2). Although the LNG carriers would arrive at the offshore anchorage at any time of the day or night, this daylight only operating practice would require the ships to anchor and await a daylight transit of the ship channels. On May 23, 2003, Cheniere signed a Memorandum of Understanding with the Pilots for the development of a safe and efficient plan for the movement and berthing of LNG carriers at the proposed facility. In this agreement, as well as in the LOI, Cheniere has indicated that the LNG carriers would adhere to one-way traffic as required by the USCG. In addition, Cheniere and the Pilots have agreed that any ship traffic entering and leaving the port would be in a convoy with the LNG carriers last in line.

- **Tugs** – Cheniere has indicated that it would provide a dedicated tug service comprised of at least three modern Z-drive tugs. Although the Full Mission Maneuverability Simulation Study (see below) included three 50-ton Bollard pull Z-drive tractor tugs, Cheniere has not finalized selection of the actual design features and final number of tugs to be provided. Final equipment selection would be determined with the assistance of the Pilots and the USCG.

- **Moving Safety Zone** – Cheniere's LOI indicated that a moving safety/security zone 2 miles ahead, 1 mile astern, the width of the waterway is being used for planning purposes for the inbound transit of a loaded LNG carrier. Cheniere has requested that a safety zone not be applied to the outbound empty LNG carrier. The USCG currently enforces a 500-yard radius safety zone around incoming and outgoing LPG carriers while transiting the Corpus Christi Ship Channel.

- **Reduced Visibility** – Fog, while not a major concern in Corpus Christi, can occur in spring and late fall, with delay periods normally less than 8 hours, although occasional delays up to 24 hours can occur. When operation resumes after fog closures of the port, pilots first clear the outbound vessel traffic.

- **High Winds** – Winds speeds of 10-12 knots are reported for the Corpus Christi area throughout the year. Winds in excess of 33 knots are reported 2 or 3 percent of the time between November and February, and less than 1 percent of the time for the remainder of the year. The USCG may establish a specific limit for LNG ship movement and berthing in high winds (typically 25 knots). The Pilots do not have a predetermined maximum wind speed for closing the channel; however, all traffic is usually stopped if high winds create unsafe transit conditions. Cheniere's vessel maneuvering simulation study (see below) found that the LNG ships would maneuver satisfactorily in sustained winds of 25 to 30 knots and could be docked in winds significantly higher.
- **Pilot Availability** – The Pilots ensure that they have enough manpower to handle all the traffic in Corpus Christi Bay. It would recruit and train more pilots as required to handle the additional LNG traffic and future container traffic if the La Quinta Container Terminal is constructed. The increase in pilot workload would be facilitated by allocating the newly trained pilots to smaller vessels, thereby ensuring that the more senior and experienced pilots handle the LNG ships.

Cheniere has discussed ship traffic impacts with the Pilots, the PCCA, and representatives of the USCG Captain of the Port. Both the PCCA and the Pilots have stated that the LNG ship traffic resulting from the proposed facilities would not create substantial delays for other deep water draft ships due to the short distances involved in port entry and departure transits and the planned availability of three dedicated tugs. The Pilots have estimated that an LNG ship would be in the Aransas Approach, Jetty, and Corpus Christi Channels for approximately 1.5 hours from the time that the pilot boards at the sea buoy to the time that the ship is clear of the Corpus Christi Channel and safely inside the La Quinta Channel. The time from entering the La Quinta Channel to all secure at the berth would be about 2.0 hours.

Vessel Simulation Study

Cheniere conducted a Full Mission Maneuverability Simulation Study at the COE Ship and Tow Simulator in Vicksburg, Mississippi. The study for the proposed LNG terminal was performed to test out the maneuvers, optimize the geometry of the turning basin and confirm the tug requirements. The study was designed to test the LNG vessel entry into the jetties, the slowdown and approach to the turning area, and turning and backing the ship into the berth. Two pilots participated to evaluate vessel safety and controllability. The study evaluated vessel maneuvering in the proposed enlarged and deepened slip and turning basin under a variety of environmental conditions including the most credible difficult tidal flows and conditions likely to be encountered. A large number of vessel transits were performed, primarily on inbound transits. Current (140,000 m^3) and future (200,000 m^3) LNG tankers were simulated, to represent the largest vessels likely to use the terminal. In all cases, assistance was provided by three 50-ton Bollard pull Z-drive tractor tugs.

In conclusion, the pilots found the entrance to be safe, the terminal maneuvering area to be adequate, and the proposed tugs adequate to maneuver the 140,000 m^3 LNG vessels. The study recommended some changes to the shape and size of the turning basin and some additional channel markers and ranges at the northern end of the La Quinta Channel.

Several inbound transits were also performed for a 200,000 m^3 LNG carrier to represent the future largest class of vessels. The pilots rated the transit to be safe for operation of the 140,000 m^3 LNG vessels and that the 200,000 m^3 LNG vessels may need to be re-evaluated prior to their introduction. Therefore, we recommend that:

- **Cheniere should conduct a Maneuverability Simulation Study for LNG vessels greater than 140,000 cubic meter capacity. Cheniere should submit the study to the Pilots and USCG for their review and comment and file the study and the comments with the Secretary for the review and approval of the Director of OEP prior to the use of such ships.**

4.12.5.2 Requirements for LNG Ship Operations

The arrival, transit, cargo transfer, and departure of LNG ships in the Corpus Christi Channel would adhere to the procedures of a *Liquefied Natural Gas Vessel Management and Emergency Plan* to be developed by the USCG Marine Safety Office, Corpus Christi, Texas. In addition, Cheniere would develop Operations and Emergency manuals in consultation with the USCG. These procedures would be developed to ensure the safety and security of all operations associated with LNG ship transit and unloading. The Plan would contain specific requirements for the LNG ship, pre-arrival notification, transit through Corpus Christi Channel, the waterfront facility, cargo transfer operations, USCG inspection and monitoring activities, and emergency operations. The Corpus Christi Marine Safety Office would monitor each LNG ship in accordance with the plan.

Some of the anticipated key provisions of the plan would be the establishment of a moving safety and security zone for all inbound, outbound, and moored LNG ships; the use of a minimum of three tugs to assist the LNG carrier transit; and one tug to remain with the LNG ship while it is moored at the berth.

The USCG regulations in 33 CFR 127 apply to the marine transfer area of waterfront facilities between the LNG ship and the last manifold or valve located immediately before a storage tank. 33 CFR 127 regulates the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, fire fighting, and security of LNG waterfront facilities. The safety systems, including the communications, emergency shut down, gas detection, and fire protection must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, Cheniere would be required to submit two copies of its Operations Manual and Emergency Manual to the Captain of the Port.

33 CFR 127 separates cargo transfer operations into three distinct phases: Preliminary Transfer Inspection (Section 127.315); Declaration of Inspection (Section 127.317); and LNG Transfer (Section 127.319). These different sections require specific actions to be completed prior to and during the transfer. Additionally, there are specific actions required in the case of a release of LNG (Section 127.321).

In accordance with 33 CFR 127.007, Cheniere submitted its LOI to the USCG on June 10, 2003. On September 15, 2003, Cheniere provided the USCG with an updated LOI based on discussions with various parties and on revised facility designs. A Letter of Recommendation must be received from the USCG at least 60 days prior to commencing construction. The Letter of

Recommendation would address the following items in assessing the suitability of the Corpus Christi and La Quinta Ship Channels for LNG transport:

- density and character of marine traffic;
- locks, bridges, or other man-made obstructions;
- depths of the water;
- tidal range;
- protection from high seas;
- underwater pipelines and cables; and
- distance of berthed vessel from the channel and the width of the channel.

In a letter dated September 22, 2003, the Corpus Christi Captain of the Port stated that he does not foresee any significant issues that would preclude the use of the Corpus Christi and La Quinta Ship Channels for LNG carrier transit. However, the USCG is reserving issuance of a Letter of Recommendation until the completion of the FERC EIS and the COE waterfront facility permit process. While the Letter of Recommendation would address the suitability of Corpus Christi and La Quinta Ship Channels for LNG ship transportation, it would not constitute a final authority to commence LNG operations. Issues related to the public impact of safety and security or exclusion zones would be addressed later in the development of the USCG's *LNG Vessel Management and Emergency Plan*. In addition, the USCG would establish safety and security zones under 33 CFR 165 for LNG vessels in transit and while docked. Only personnel or vessels authorized by the Caption of the Port are permitted in the safety zone.

4.12.5.3 LNG Ship Safety

Since 1959, LNG has been transported by ship without a major release of cargo or a major accident involving an LNG ship. Starting in 1971, LNG began arriving at the Distrigas facility in Everett, Massachusetts. To date, more than 450 cargoes, with volumes ranging from 60,000 to 138,000 m^3, have been delivered into the Port of Boston without incident. During 2003, a total of 506 Bcf (204 cargoes) of LNG was imported into the U.S. For 30 years, LNG shipping operations have been safely conducted in the U.S.

The world's LNG ship fleet numbers 151, with an additional 57 ships contracted for delivery by 2006. During the last 40 years, LNG ships have made over 33,000 voyages and safely transported over 2.72 billion cubic meters of LNG. This includes over 1,500 voyages to or from U.S. ports. Currently, all of the ships in the LNG fleet operate under a foreign flag with foreign crews. A foreign flagship must have a Certificate of Compliance inspection by the USCG to ensure compliance with International safety standards.

History

During the 33,000 voyages that have been completed since the inception of LNG maritime transportation, there have been only eight significant incidents involving LNG ships, none of which resulted in spills due to rupturing of the cargo tanks. These incidents are described below:

- ***Pollenger*** had an LNG spill onto the steel cover of cargo tank number one during unloading at Everett, Massachusetts in April 1979. The spill caused cracking of the steel plate.

- ***Mostafa Ben Boulaid*** had a check valve fail when unloading at Cove Point, Maryland, releasing a small quantity of LNG onto the ship and causing some minor fracture of the deck plating. Activation of the ship's safety systems (*i.e.*, the emergency shutdown system and water spray system), along with excellent response of the crew, kept the incident from propagating, thus minimizing any serious damage.
- ***El Paso Paul Kayser*** grounded on a rock in June 1979 in the Straits of Gibraltar during a loaded voyage from Algeria to the U.S. Extensive bottom damage to the ballast tanks resulted; however, the cargo tanks were not damaged, and no cargo was released. The complete cargo of LNG was subsequently transferred to another LNG ship and delivered to its U.S. destination.
- ***LNG Libra's*** propeller shaft fractured while the ship was en route to Japan with a full cargo in October 1980. The ship was taken under tow, and the cargo was safely transferred to another LNG ship and delivered to its destination.
- ***LNG Taurus*** grounded in December 1980 near the entrance to Taboata Harbor, Japan. The grounding resulted in extensive bottom damage, but the cargo tanks were not affected. The ship was refloated and the cargo unloaded.
- ***Isabella*** had LNG spill onto its deck due to a cargo tank overflow in June 1985, causing severe cracking of the steelwork. The spill had been attributed to a cargo valve failure during discharging of cargo.
- ***Tellier*** was blown from its docking berth at Skikda, Algeria in February 1989 during severe winds causing damage to the loading arms and the ship and shore piping. The cargo loading had been secured just before the wind struck, but the loading arms had not been drained. Consequently, the LNG remaining in the loading arms spilled onto the deck causing fracture of some plating.
- ***Norman Lady*** was struck by the USS Oklahoma City nuclear submarine while rising to periscope depth near the Strait of Gibraltar in November 2002. The 87,000 cubic meter LNG tanker, which had just unloaded its cargo at Barcelona, Spain, sustained only minor damage to the outer layer of its double hull but not to its cargo tanks.

There have also been some incidents that involved the release of small quantities of LNG, such as minor leaks from seals and gaskets, some of which required that operations be temporarily stopped in order to rectify the malfunction.

Vessel Construction

In 1980, at the initial peak of LNG import activity in the U.S., the USCG published the report, *Liquefied Natural Gas and Liquefied Petroleum Gas – Views and Practices – Policy and Safety*. The report summarized the USCG's extensive research into the safety hazards of LNG and its view that "...the nature of both LNG and LPG presents an acceptable risk for transportation in maritime commerce." This is due to the fact that LNG ships are well constructed, robust vessels designed to withstand low-energy type incidents that are prevalent in harbors and during docking operations. Moreover, safety measures, both equipment and training, are planned and designed into these LNG ships to prevent or control all types of potential incidents.

The insulation of cargo tanks is a complex assembly of many layers. The relief valve capacity for cargo tanks is designed to compensate for over-pressure caused by fire. The potential that impingement by a cryogenic liquid could cause brittle fracture of the ship's hull was known to the USCG in the mid-1970s when the U.S. regulation for LNG carriers in 49 CFR 154 were being developed. Accordingly, the regulations require the use of special crack-arresting steel in strategic locations throughout the vessel's hull. LNG carriers used in U.S. waters must also be constructed in accordance with the IMO Code for the Construction and Equipments of Ships Carrying Liquefied Gases in Bulk. This standard requires that the vessel inner hull adjacent to the cargo tanks be protected against contact from liquid cargo through a combination of proper material selection, adequate insulation, and use of heating systems.

As required by the IMO conventions and design standards, hold spaces and insulation areas on an LNG carrier are equipped with gas detection and low temperature alarms. These devices monitor for leaks of LNG into the insulation between primary and secondary LNG cargo tank barriers. In addition, hazard detection systems are also provided to monitor the hull structure adjacent to the cargo tank, compressor rooms, motor rooms, cargo control rooms, enclosed spaces in the cargo area, specific ventilation hoods and gas ducts, and air locks.

LNG carriers are equipped with a firewater system with the ability to supply at least two jets of water to any part of the deck in the cargo area and parts of the cargo containment and tank covers above-deck. A water spray system is also available for cooling, fire prevention, and crew protection in specific areas. In addition, certain areas of LNG carriers are fitted with dry chemical powder-type extinguishing systems and CO_2 smothering systems for fighting fires.

Unlike many conventional crude oil tankers, all LNG ships used to deliver LNG to this Project would have double-hull construction, with the inner and outer hulls separated by about 10 feet. Furthermore, the cargo tanks are normally separated from the inner hull by a layer of insulation approximately 1-foot thick. As a result, many grounding incidents severe enough to cause a cargo spill on a single-bottom oil tanker would be unable to penetrate both inner and outer hulls of an LNG ship. An earlier Federal Power Commission (FPC, predecessor to the FERC) study estimated that the double-bottom of an LNG ship would be sufficient to prevent cargo tank penetration in about 85 percent of the cases that penetrated a single-bottom oil tanker.

The probability of an LNG ship sustaining cargo tank damage in a collision would depend on several factors – the displacement and construction of both the struck and striking vessels, the velocity of the striking vessel and its angle of impact with the struck vessel, and the location of the point of impact. The previous FPC study estimated the additional protection afforded by the double-hull would be effective in low energy collisions, overall it would prevent cargo tank penetration in about 25 percent of the cases that penetrated a single-hull oil tanker.

In 1995, to assist the USCG in San Juan, Puerto Rico, EcoEléctrica L.P. prepared an analysis of the damage that could result from an oil tanker striking an LNG ship at berth (FERC, 1996). The analysis assumed a 125,000 m^3 LNG ship and an 82,000 dead weight ton tanker carrying number 6 fuel oil, without tug assistance. The analysis determined the minimum striking speed to penetrate the cargo tanks of an LNG ship for a range of potential collision angles. The resulting minimum striking speeds are presented in table 4.12.5.3-1 for the two principal cargo systems.

TABLE 4.12.5.3-1

Minimum Striking Speed to Penetrate LNG Cargo Tanks

Angle of Impact	Minimum Striking Speed (knots)	
	Spherical Tanks	Membrane Tanks
Greater than 60 degrees	4.5	3
45 degrees	6.3	4
30 degrees	9	6
15 degrees	18	12

For membrane tanks, the critical beam-on striking speed is 3.0 knots, and for spherical tanks, the critical beam-on speed is 4.5 knots. For both containment types, lower angles of impact result in much greater minimum striking speeds to penetrate LNG cargo tanks. In the July/August, 2002 issue of the "LNG Journal," the SIGTTO General Manager provides a table that shows the critical speed necessary for a 20,000-ton vessel to puncture the outer hull of an LNG carrier is 7.3 knots. For a 93,000-ton ship, the impact speed is 3.2 knots. In neither case does such an impact result in damage to the LNG cargo containment system or the release of LNG.

Hazards

In the event of a collision or allision of sufficient magnitude to rupture an LNG cargo tank, it is likely that sparks or flames would ignite the flammable vapors at the spill site. In a grounding of sufficient magnitude to rupture an LNG cargo tank, the damage would occur under water and the potential for ignition would be less than for collisions or allisions. In this case, an LNG spill would rapidly vaporize on water and form a potentially flammable cloud. If not ignited, the flammable vapor cloud would drift downwind until the effects of dispersion would dilute the vapors below the lower flammable limit for methane. The maximum range of potentially flammable vapors (*i.e.*, the distance to the lower flammable limit) is a function of the volume of LNG spilled, the rate of the spill, and the prevailing meteorological conditions. If the flammable vapor cloud encountered an ignition source, the cloud would burn back to the spill site.

The Final EIS for the Calcasieu LNG Project (Lake Charles, Louisiana) (FPC, 1976) analyzed the maximum range of a flammable vapor cloud and hazardous radiation levels from an instantaneous one-tank spill. As was consistent with risk analyses at that time and for nearly 25 years thereafter, the instantaneous spillage of one cargo tank was considered to be the "worst case" scenario. Physical constraints on maximum vessel speeds and maximum depths of penetration required to rupture one LNG cargo tank render the possibility of an instantaneous release of more than one cargo tank to be implausible. This is not to imply that the loss of multiple cargo tanks could never occur, but that the extent of the hazard would not exceed that of the instantaneous spillage of one tank.

For an instantaneous one-tank spill with ignition, the Final EIS for the Calcasieu LNG Project estimated that a hazardous thermal radiation level of 5,300 Btu/hr-ft^2 would extend 3,595 feet from the center of the spill. For an instantaneous one-tank spill without ignition, the Final EIS for the Yukon Pacific LNG Project (FERC, 1995) estimated that potentially flammable vapors could travel up to 3.3 miles with a 10 mph wind and typical atmospheric stability.

In October 2001, the use of a one-tank instantaneous release as the "worst case" scenario was re-examined by Quest Consultants, Inc. (Quest) as part of an effort by the U.S. Department of Energy to determine the hazards associated with reopening the Distrigas LNG import terminal in Boston, MA following the terrorist attacks of September 11, 2001. It was determined that time-release spills through 1-meter and 5-meter diameter holes would more accurately simulate credible "worst case" damage scenarios. Maximum flammable vapor cloud and radiation hazards were calculated for the two spill scenarios. For a spill on water with ignition, the maximum distance to a radiant flux level of 1,500 Btu/Ft^2-hr was estimated to be 1,770 feet. For a spill on water without ignition, a flammable vapor cloud of 2.5 miles was estimated. In November 2003, in response to comments concerning its October 2001 study, Quest clarified that its study only applied to LNG spills resulting from a collision with a large ship in Boston's Outer Harbor where waves would restrict the spreading of LNG on water.

During the past year, there has been an emergence of studies by various parties to define the "worst case" scenario that would result from a deliberate, terrorist attack on an LNG vessel and the subsequent release of cargo. Distances have been estimated to range from 1,770 to 4,200 feet for a thermal radiation level of 1,500 Btu/ft^2-hr. Part of the reason for the apparent discrepancies is the lack of large-scale historical incidents, and the need to extrapolate small-scale field test data to a worst case event. This inevitably leads to differing conservative assumptions among the various parties. For example, some models calculate a time-release cargo discharge through 1-meter or 5-meter diameter holes, while others assume that the cargo tank empties instantaneously.

As a result, the Commission commissioned a study by ABSG to search and review the literature on experimental LNG spills and on consequence methodologies that are applicable to modeling incidents of LNG spills on water. Further, the goal of the study was to identify appropriate methods for estimating flammable vapor and thermal radiation hazard distances for potential LNG vessel cargo releases during transit and while at berth. The resulting study, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*, was released for public comment in May 2004 (ABSG, 2004). On June 18, 2004, the FERC staff's responses to comments on the consequence assessment methods was issued. As discussed in greater detail in staff's responses, various components of the consequence assessment methodologies were revised based on comments received. The revised methodology provides procedures for calculating: (1) the rate of release of LNG from a cargo tank penetration for various sized holes; (2) the spreading of an unconfined LNG pool on water for both continuous spills and rapid (nearly instantaneous) releases; (3) the rate of vapor generation from an unconfined spill on water; (4) thermal radiation distances for LNG pool fires on water; and (5) and flammable vapor dispersion distances.

A detailed evaluation of the consequences of a terrorist attack on a modern membrane LNG tanker was prepared by Lloyds Register North America for the Weaver's Cove LNG Project and filed under CEII. The study evaluated the consequences of attacks on an LNG tanker by missiles and explosives. Finite element analysis was used to evaluate the effect of various sized charges on both the outer and inner hulls. A 1-meter diameter hole of the inner hull at the waterline was found to be the "worst case" scenario for hazard consequence assessments. This finding is consistent with the attack on the double-hull oil tanker *Limberg* which caused greater than a 5-meter hole on the outer hull but only minor damage to the inner hull. The study found that shoulder-fired weapons produced much less damage. A failure modes and effects analysis was used to understand internal LNG release characteristics; and a residual strength analysis used to investigate damage scenarios for a loaded LNG tanker.

The methodology described in the ABSG study and revised in the FERC staff's responses to comments was used to calculate the thermal radiation and flammable vapor dispersion distances for 1-meter and 2.5 - meter diameter holes. Based on the penetration of the largest cargo tank of a 140,000 m^3 LNG tanker, a potential spill of 23,000 m^3 is estimated for the volume of LNG above the waterline. The estimated pool spread results and thermal radiation hazard distances are identified in table 4.12.5.3-2 below. Thermal radiation calculations are based on an ambient temperature of 50° F, a relative humidity of 50 percent, and 20 miles per hour wind speed. Thermal radiation distances are also presented for a 2.5-meter diameter hole to serve as an upper limit of potential damage.

TABLE 4.12.5.3-2

LNG Spills on Water

	LNG Release and Spread	
Hole diameter	1 meter	2.5 meters
Spill time	94 minutes	15 minutes
	Pool Fire Calculations	
Maximum pool radius	340 feet	817 feet
Fire duration	94 minutes	15 minutes
Distance to:		
1,600 Btu/ft^2-hr	2,200 feet	4,340 feet
3,000 Btu/ft^2-hr	1,710 feet	3,330 feet
10,000 Btu/ft^2-hr	1,040 feet	1,970 feet

Flammable vapor dispersion calculations were based on an ambient temperature of 50°F, 50 percent relative humidity, a 4.5 miles per hour wind speed and atmospheric stability class F. Based on a 1-meter diameter hole, an unignited release would result in an estimated pool radius of 421 feet. The unignited vapor cloud would extend to 8,672 feet to the LFL and 12,070 feet to one-half the LFL. It is important to identify certain key assumptions of conditions that must exist in order to achieve the maximum vapor cloud distances. First it would be necessary for an event to create a 1-meter diameter hole by penetrating the outer hull, the inner hull, and cargo containment without ignition. Far more credible is that the event creating a 1-meter diameter hole would also result in a number of ignition sources which would lead to an LNG pool fire and subsequent thermal radiation hazards. It is also unlikely that a flammable could achieve its maximum distance over land surfaces without encountering an ignition source, and subsequently burning back to the source. Flammable vapor dispersion for a 2.5-meter diameter hole was not performed since, realistically, the cloud would not even extend to the maximum distance for a 1-meter diameter hole before encountering an ignition source.

Although large portions of the Corpus Christi and La Quinta Channels have no development or communities adjacent to the channel, the communities of Port Aransas, Ingleside, and Ingleside-on-the-Bay are within 2,200 to 4,340 feet of the ship channels. These communities are already familiar with oil, chemical, and LPG vessels passing at close range. The operational restrictions that would be imposed by the Pilots on LNG vessel movements through this area, as well as requirements that the USCG would impose in its operating plan, would minimize the possibility of a hazardous event occurring in this portion of the Corpus Christi and La Quinta Channels.

By focusing on the "worst case" scenario for LNG transportation, there is a tendency to dismiss the potential hazards for other fuels and products commonly transported on our waterways. Some of the previously identified studies that calculate long hazard distances for LNG cargo fires also estimate similarly long distances for gasoline, propane and jet fuel cargo fires. Also, it should not be assumed that the hazard distances identified are the assured outcome of an LNG vessel accident or attack, given the conservatisms in the models and the level of damage required to yield such large scale releases. Further, these estimated "worst case" scenarios should not be misconstrued as defining an exclusionary zone. Rather the "worst case" scenarios provide guidance in developing the operating restrictions for LNG vessel movements in Corpus Christi and La Quinta Channels, as well as in establishing potential impact areas for emergency response and evacuation planning.

Conclusions on Marine Traffic Safety

- The operational safety of LNG ships is under the jurisdiction of the USCG. LNG ships have safely transited another Gulf Coast Waterway, the Calcasieu Ship Channel in Louisiana, for the past 20 years and worldwide for 50 years. The operational restrictions imposed by the USCG and the Pilots would minimize the potential for a hazardous event occurring in the Corpus Christi Bay area and affecting the safety of the nearby public.
- The additional LNG vessel traffic should have only a minimal impact on other vessel traffic in Corpus Christi Bay. Further, Cheniere plans to add three dedicated Z-drive tractor tugs would benefit all channel users, when not in use for LNG ship maneuvers. A variety of factors, some of which are unavoidable (such as the inherent narrowness of the channels), currently cause a certain level of delay for vessels using the Corpus Christi and La Quinta Channels. The operation of LNG ships should have a similar impact as other large vessels, and should cause no more disruption than similar vessel traffic.

4.12.6 Terrorism and Security Issues

The security requirements for the onshore component of the proposed project are governed by 49 CFR 193, Subpart J - Security. This subpart includes requirements for conducting security inspections and patrols, liaison with local law enforcement officials, design and construction of protective enclosures, lighting, monitoring, alternative power sources, and warning signs. Requirements for maintaining safety of the marine terminal are in 33 CFR 127. Requirements for maintaining security of the marine terminal are in 33 CFR 105.

In the aftermath of the terrorist attacks that occurred on September 11, 2001, terrorism has become a very real issue for the facilities under the Commission's jurisdiction. The FERC, like other Federal agencies, is faced with a dilemma in how much information can be offered to the public while still providing a significant level of protection to the facility. Consequently, the FERC has removed energy facility design plans and location information from its website to ensure that sensitive information filed under CEII is not readily available (RM02-4-000 and PL02-1-000 issued February 20, 2003).

Since September 11, 2001, the FERC has been involved with other Federal agencies in developing a coordinated approach to protecting the energy facilities of the U.S. The FERC continues to coordinate with these agencies, specifically with the USCG to address this issue. The USCG now requires arriving ships to provide them with a 96-hour advance notice of arrival that includes key information about the vessel and its crew which allows the USCG to conduct a terrorism risk assessment and put in place appropriate mitigation before the ship reaches the ship channel. In addition, interstate natural gas companies are actively involved with several industry groups to chart how best to address security measures in the current environment. A Security Task Force has been created and is addressing ways to improve pipeline security practices, strengthen communications within the industry and the interface with government, and extend public outreach efforts.

In September 2002, the DOT's OPS issued non-public guidelines to LNG operators that direct them to develop new security procedures for onshore facilities. Operators were required to prepare a security plan within six months that responds to the five threat levels defined by the Office of Homeland Security. The OPS conducts subsequent on-site reviews of the security procedures.

On October 22, 2003, the USCG issued a series of six final rules, which promulgated the maritime security requirements of the Marine Transportation Security Act of 2002: Implementation of National Maritime Security Initiatives; Area Maritime Security; Vessel Security; Facility Security; Continental Shelf Facility Security; and the Automatic Identification System. The entire series of rulemakings establishes a new subchapter H in 33 CFR. In support of the rulemakings, the USCG applied a risk-based decision making process to comprehensively evaluate the relative risks of various target and attack mode combinations and scenarios for those vessel types and port facilities that pose a risk of a security incident. This approach provides a more realistic estimation of risk than a simple "worst-case outcome" assessment. Risk management principles acknowledges that while risk generally cannot be eliminated, it can be reduced by adjusting operations to lower consequences, threats, or vulnerability, recognizing that it is easier to reduce vulnerabilities by adding security measures.

On December 29, 2003, terminal owners or operators subject to 33 CFR 105 were required to submit a *Facility Security Assessment and Facility Security Plan* to the USCG Captain of the Port for review and approval. The Facility Security Plans are required to be implemented no later than July 1, 2004 or for facilities constructed after July 1, 2004, 60 days prior to operations. Some of the principal owner or operator responsibilities include:

- Designate a Facility Security Officer with a general knowledge of current security threats and patterns, risk assessment methodology, and the responsibility for implementing the Facility Security Plan and Assessing and performing an annual audit for the life of the Project;
- Conduct a Facility Security Assessment to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures;

- Develop a Facility Security Plan based on the Facility Security Assessment, with procedures for responding to transportation security incidents, notification and coordination with local, state and Federal authorities, prevent unauthorized access; measures and equipment to prevent or deter dangerous substances and devices, training and evacuation;
- Implement scalable security measures to provide increasing levels of security at increasing MARSEC levels for facility access control, restricted areas, cargo handling, vessel stores and bunkers, and monitoring;
- Conduct security exercises at least once each calendar year and drills at least every 3 months; and
- Reporting of all breaches of security and security incidents.

Increased security awareness has occurred throughout the industry and the nation. President Bush established the Office of Homeland Security with the mission of coordinating the efforts of all executive departments and agencies to detect, prepare for, prevent, protect against, respond to, and recover from terrorist attacks within the U.S. The Commission, in cooperation with other Federal agencies and industry trade groups, has joined in the efforts to protect the energy infrastructure, including the more than 300,000 miles of interstate natural gas transmission pipeline and associated LNG facilities.

Safety and security are important considerations in any Commission action. The attacks of September 11, 2001 have changed the way pipeline operators as well as regulators must consider terrorism, both in approving new projects and in operating existing facilities. However, the likelihood of future acts of terrorism or sabotage occurring at the proposed Cheniere Corpus Christi LNG terminal, or at any of the myriad natural gas pipeline or energy facilities throughout the U.S. is unpredictable given the disparate motives and abilities of terrorist groups. The continuing need to construct facilities to support the future natural gas pipeline infrastructure is not diminished by the threat of any such unpredictable acts.

4.12.7 Pipeline Reliability and Safety

The transportation of natural gas by pipeline involves some risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is a fire or explosion following a major pipeline rupture. Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiate, possessing a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death.

Methane has an ignition temperature of 1,000° F and is flammable at concentrations between 5.0 percent and 15.0 percent in air. Unconfined mixtures of methane in air are not explosive. However, a flammable concentration within an enclosed space in the presence of an ignition source can explode. It is buoyant at atmospheric temperatures and disperses rapidly in air.

Safety Standards

The DOT is mandated to provide pipeline safety under 49 USC Chapter 601. The OPS administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards which set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve safety. The OPS ensures that people and the environment are protected from the risk of pipeline incidents. This work is shared with state agency partners and others at the Federal, state, and local level. Section 5(a) of the Natural Gas Pipeline Safety Act provides for a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing the Federal standards, while Section 5(b) permits a state agency that does not qualify under Section 5(a) to perform certain inspection and monitoring functions. A state may also act as DOT's agent to inspect interstate facilities within its boundaries; however, the DOT is responsible for enforcement action. The majority of the states have either 5(a) certifications or 5(b) agreements, while nine states act as interstate agents.

The DOT pipeline standards are published in 49 CFR Parts 190-199. Part 192 specifically addresses natural gas pipeline safety issues.

Under a Memorandum of Understanding on Natural Gas Transportation Facilities (Memorandum) dated January 15, 1993 between the DOT and the FERC, the DOT has the exclusive authority to promulgate Federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of the FERC's regulations require that an applicant certify that it will design, install, inspect, test, construct, operate, replace, and maintain the facility for which a certificate is requested in accordance with Federal safety standards and plans for maintenance and inspection, or shall certify that it has been granted a waiver of the requirements of the safety standards by the DOT in accordance with Section 3(e) of the Natural Gas Pipeline Safety Act. The FERC accepts this certification and does not impose additional safety standards other than the DOT standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the Memorandum to promptly alert the DOT. The Memorandum also provides for referring complaints and inquiries made by state and local governments and the general public involving safety matters related to pipeline under the Commission's jurisdiction. The FERC also participates as a member of the DOT's Technical Pipeline Safety Standards Committee which determines if proposed safety regulations are reasonable, feasible, and practicable.

The pipeline and aboveground facilities associated with the Cheniere Corpus Christi LNG Project must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR 192. The regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. Part 192 specifies material selection and qualification, minimum design requirements, and protection from internal, external, and atmospheric corrosion.

Part 192 also defines area classifications, based on population density in the vicinity of the pipeline, and specifies more rigorous safety requirements for populated areas. The class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1 mile length of pipeline. The four area classifications are defined as follows:

Class 1	Location with 10 or fewer buildings intended for human occupancy.
Class 2	Location with more than 10 but less than 46 buildings intended for human occupancy.
Class 3	Location with 46 or more buildings intended for human occupancy or where the pipeline lies within 100 yards of any building, or small well-defined outside area occupied by 20 or more people during normal use.
Class 4	Location where buildings with four or more stories aboveground are prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. Pipelines constructed on land in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil and 18 inches in consolidated rock. All pipelines installed in navigable rivers, streams, and harbors must have a minimum cover of 48 inches in soil or 24 inches in consolidated rock. Class 2, 3, and 4 locations, as well as drainage ditches of public roads and railroad crossings, require a minimum cover of 36 inches in normal soil and 24 inches in consolidated rock.

Class locations also specify the maximum distance to a sectionalizing block valve (*e.g.*, 10.0 miles in Class 1, 7.5 miles in Class 2, 4.0 miles in Class 3, and 2.5 miles in Class 4). Pipe wall thickness and pipeline design pressures, hydrostatic test pressures, maximum allowable operating pressure, inspection and testing of welds, and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas. The majority of the proposed pipeline route would cross open land that is sparsely populated. Of the 23.0 miles of proposed pipeline route, approximately 20.1 miles would be located in Class 1 areas. Approximately 0.8 mile of the pipeline route would be in a Class 2 area where it would pass south of the city of Taft (MPs 9.4 – 10.2). The first 2.1 miles of the pipeline route between the LNG terminal and Highway 181/35 would be in a Class 3 area. No portions of the proposed route would be located in Class 4 areas. In addition, all pipeline interconnects, and pipeline facilities within the fenced enclosures of the meter stations, launcher and receiver, and mainline valves would be designed and constructed to meet Class 3 requirements.

Congress recently passed an act to strengthen the Nations Pipeline safety laws. The pipeline Safety Improvement Act of 2002 (HR 3609) was passed by Congress on November 15, 2002, and signed into law by the President in December 2002. No later than December 17, 2004, gas transmission operators must develop and follow a written integrity management program that contains all the elements described in Part 192.911 and addresses the risks on each covered transmission pipeline segment. Specifically, the law establishes an integrity management program which applies to all high consequence areas (HCAs). The DOT (68 FR 69778, 69 FR 18228, and 69 FR 29903) defines HCAs as they relate to the different class zones, potential impact circles, or areas containing an identified site as defined in Part 192.903 of the DOT regulations.

The OPS published a series of rules from August 6, 2002 to May 26, 2004 (69 FR 29903), that defines HCAs where a gas pipeline accident could do considerable harm to people and their property and requires an integrity management program to minimize the potential for an accident. This definition satisfies, in part, the Congressional mandate in 49 USC 60109 for the

OPS to prescribe standards that establish criteria for identifying each gas pipeline facility in a high-density population area.

The HCA may be defined in one or two ways. In the first method an HCA includes:

- current class 3 and 4 locations;
- any area in Class 1 or 2 where the potential impact radius[11] is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle;[12] or
- any area in Class 1 or 2 where the potential impact circle includes an identified site.[13]

In the second method an HCA includes any area within a potential impact circle which contains:

- 20 or more buildings intended for human occupancy; or
- an identified site.

Once a pipeline operator has determined the HCAs on its pipeline, it must apply the elements of its integrity management program to those segments of the pipeline within HCAs. The DOT regulations specify the requirements for the integrity management plan at Part 192.911. Of the 23.0 miles of proposed pipeline route, approximately 2.9 miles would be classified as a high consequence area. The pipeline integrity management rule for HCAs requires inspection of the entire pipeline in HCAs every 7 years.

Part 192 prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. The proposed pipeline would be continuously monitored and controlled via computer and local logic controllers at the manned control center at the LNG terminal site. A locally based, full time company staff would be assigned to operate and maintain the natural gas pipeline. The company staff would be fully trained in pipeline operations, maintenance, and normal, abnormal, and emergency procedures.

The pipeline would be patrolled and inspected on the ground on a periodic basis per the DOT requirements or better. The frequency of these inspections would be affected by activity along the pipeline route such as construction or possible encroachment. These inspections would identify conditions indicative of pipeline leaks, evidence of pipeline damage or deterioration, damage to erosion controls, loss of cover, third party activities or conditions which may presently or in the future affect pipeline integrity, safety, or operation of the pipeline. The pipeline system would participate in the state "One Call" system.

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[11] The potential impact radius is calculated as the product of 0.69 and the square root of the MAOP of the pipeline in psi multiplied by the pipeline diameter in inches.

[12] The potential impact circle is a circle of radius equal to the potential impact radius.

[13] An identified site is an outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12-month period; a building that is occupied by 20 or more persons on at least 5 days a week for any 10 weeks in any 12-month period; or a facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

Under Part 192.615, each pipeline operator must also establish an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. Key elements of the plan include procedures for:

- receiving, identifying, and classifying emergency events, gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- emergency shutdown of system and safe restoration of service;
- making personnel, equipment, tools, and materials available at the scene of an emergency; and
- protecting people first and then property, and making them safe from actual or potential hazards.

Part 192 requires that each operator must establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency, and to coordinate mutual assistance. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials. Cheniere would provide the appropriate training to local emergency service personnel before the pipeline is placed in service. No additional specialized local fire protection equipment would be required to handle pipeline emergencies.

Pipeline Accident Data

Since February 9, 1970, 49 CFR 191 has required all operators of transmission and gathering systems to notify the DOT of any reportable incident and to submit a report on form F7100.2 within 20 days. Reportable incidents are defined as any leaks that:

- caused a death or personal injury requiring hospitalization;
- required taking any segment of transmission line out of service;
- resulted in gas ignition;
- caused estimated damage to the property of the operator, or others, or both, of a total of $5,000 or more;
- required immediate repair on a transmission line;
- occurred while testing with gas or another medium; or
- in the judgment of the operator was significant, even though it did not meet the above criteria.

The DOT changed reporting requirements after June 1984 to reduce the amount of data collected. Since that date, operators must only report incidents that involve property damage of more than $50,000, injury, death, release of gas, or that are otherwise considered significant by the operator. Table 4.12.7-1 presents a summary of incident data for the 1970 to 1984 period, as well as more recent incident data for 1986 through 2003, recognizing the difference in reporting requirements. The 14.5-year period from 1970 through June 1984, which provides a larger universe of data and more basic report information than subsequent years, has been subject to detailed analysis, as discussed in the following sections.[14]

TABLE 4.12.7-1

Natural Gas Service Incidents by Cause

Cause	**Incidents per 1,000 miles of Pipeline (percentage)**	
	1970-1984	**1986-2003**
Outside force	0.70 (53.8)	0.10 (38.6)
Corrosion	0.22 (16.9)	0.06 (23.8)
Construction or material defect	0.27 (20.8)	0.04 (14.7)
Other	0.11 (8.5)	0.06 (22.8)
Total	**1.30**	**0.26**

During the 14.5-year period, 5,862 service incidents were reported over the more than 300,000 total miles of natural gas transmission and gathering systems nationwide. Service incidents, defined as failures that occur during pipeline operation, have remained fairly constant over this period with no clear upward or downward trend in annual totals. In addition, 2,013 test failures were reported. Correction of test failures removed defects from the pipeline before operation.

Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 4.12.7-1 provides a percentage distribution of the causal factors as well as the annual frequency of each factor per 1,000 miles of pipeline in service.

The dominant incident cause is outside forces, constituting 53.8 percent of all service incidents. Outside forces incidents result from the encroachment of mechanical equipment such as bulldozers and backhoes; earth movements due to soil settlement, washouts, or geologic hazards; weather effects such as winds, storms, and thermal strains; and willful damage. Table 4.12.7-2 shows that human error in equipment usage was responsible for approximately 75 percent of outside forces incidents. Since April 1982, operators have been required to participate in "One Call" public utility programs in populated areas to minimize unauthorized excavation activities in the vicinity of pipelines. The "One Call" program is a service used by public utilities and some private sector companies (*e.g.*, oil pipelines and cable television) to provide preconstruction information to contractors or other maintenance workers on the underground location of pipes, cables, and culverts. The 1986 through 2003 data show that the portion of incidents caused by outside forces has decreased to 38.6 percent.

The pipelines included in the data set in table 4.12.7-1 vary widely in terms of age, pipe diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline.

[14] Jones, D.J., G.S. Kramer, D.N. Gideon, and R.J. Eiber, 1986. "An Analysis of Reportable Incidents for Natural Gas Transportation and Gathering Lines 1970 Through June 1984." NG-18 Report No. 158, Pipeline Research Committee of the American Gas Association.

TABLE 4.12.7-2 Outside Forces Incidents by Cause (1970-1984)	
Cause	**Percent**
Equipment operated by outside party	67.1
Equipment operated by or for operator	7.3
Earth movement	13.3
Weather	10.8
Other	1.5

The frequency of service incidents is strongly dependent on pipeline age. While pipelines installed since 1950 exhibit a fairly constant level of service incident frequency, pipelines installed before that time have a significantly higher rate, partially due to corrosion. Older pipelines have a higher frequency of corrosion incidents, since corrosion is a time-dependent process. Further, new pipe generally uses more advanced coatings and cathodic protection to reduce corrosion potential.

Older pipelines have a higher frequency of outside forces incidents partly because their location may be less well known and less well marked than newer lines. In addition, the older pipelines contain a disproportionate number of smaller diameter pipelines, which have a greater rate of outside forces incidents. Small diameter pipelines are more easily crushed or broken by mechanical equipment or earth movements.

Table 4.12.7-3 clearly demonstrates the effectiveness of corrosion control in reducing the incidence of failures caused by external corrosion. The use of both an external protective coating and a cathodic protection system, required on all pipelines installed after July 1971, significantly reduces the rate of failure compared to unprotected or partially protected pipe. The data shows that bare, cathodically protected pipe actually has a higher corrosion rate than unprotected pipe. This anomaly reflects the retrofitting of cathodic protection to actively corroding spots on pipes.

TABLE 4.12.7-3 External Corrosion by Level of Control (1970-1984)	
Corrosion Control	**Incidents per 1,000 miles per Year**
None-bare pipe	0.42
Cathodic protection only	0.97
Coated only	0.40
Coated and cathodic protection	0.11

Impacts on Public Safety

The service incident data summarized in table 4.12.7-1 include pipeline failures of all magnitudes with widely varying consequences. Approximately two-thirds of the incidents were classified as leaks, and the remaining third classified as ruptures, implying a more serious failure.

Table 4.12.7-4 presents the average annual fatalities that occurred on natural gas transmission and gathering lines from 1970 to 2003. Fatalities between 1970 and June 1984 have been separated into employees and nonemployees, to better identify a fatality rate experienced by the general public. Of the total 5.0 nationwide average, fatalities among the public averaged 2.6 per year over this period. The simplified reporting requirements in effect after June 1984 do not differentiate between employees and nonemployees. However, the data show that the total annual average for the period 1984 through 2003 decreased to 3.8 fatalities per year. Subtracting two major offshore incidents in 1989, which do not reflect the risk to the onshore public, yields a total annual rate of 2.9 fatalities per year for this period.

TABLE 4.12.7-4

Annual Average Fatalities - Natural Gas Transmission and Gathering Systems a/, b/

Year	Employees	Nonemployees	Total
1970-June 1984	2.4	2.6	5.0
1984-2003 c/	-	-	3.8
1984-2003 c/	-	-	2.9 d/

a/ 1970 through June 1984 - American Gas Association, 1986.
b/ DOT Hazardous Materials Information System.
c/ Employee/nonemployee breakdown not available after June 1984.
d/ Without 18 offshore fatalities occurring in 1989 – 11 fatalities resulted from a fishing vessel striking an offshore pipeline and 7 fatalities resulted from explosion on an offshore production platform.

The nationwide totals of accidental fatalities from various manmade and natural hazards are listed in table 4.12.7-5 in order to provide a relative measure of the industry-wide safety of natural gas pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. Nevertheless, the average 2.6 public fatalities per year is relatively small considering the more than 300,000 miles of transmission and gathering lines in service nationwide. Furthermore, the fatality rate is approximately two orders of magnitude (100 times) lower than the fatalities from natural hazards such as lightning, tornadoes, floods, earthquakes, etc.

The available data show that natural gas pipelines continue to be a safe, reliable means of energy transportation. Based on approximately 302,000 miles in service, the rate of public fatalities for the nationwide mix of transmission and gathering lines in service is 0.01 per year per 1,000 miles of pipeline. Using this rate, the Cheniere Corpus Christi LNG Project might result in a public fatality every 4,348 years. This would represent a slight increase in risk to the nearby public.

TABLE 4.12.7-5

Nationwide Accidental Deaths a/

Type of Accident	Fatalities
All accidents	90,523
Motor vehicles	43,649
Falls	14,985
Drowning	3,488
Poisoning	9,510
Fires and burns	3,791
Suffocation by ingested object	3,206
Tornado, flood, earthquake, etc (1984-93 average)	181
All liquid and gas pipelines (1986-2003 average) b/	27
Gas transmission and gathering lines, nonemployees only (1970-84 average) c/	2.6

a/ All data, unless otherwise noted, reflects 1996 statistics from the U.S. Department of Commerce, Bureau of the Census, "Statistical Abstract of the United States 118th Edition."
b/ U.S. Department of Transportation, Office of Pipeline Safety, www.ops.dot.gov/stats.
c/ American Gas Association, 1986.

4.13 CUMULATIVE IMPACTS

Cumulative impacts result when effects associated with past, present, or reasonably foreseeable future other projects within a defined regional geographic area are combined, superimposed upon, or added to, other impacts associated with the proposed Project. Although the individual impacts of the separate projects may be minor, the collective effects from the projects taken together could be significant.

For the purposes of this analysis, the geographic region for our analysis of cumulative impacts on marine resources would be the portion of the Corpus Christi Bay extending from the Port Aransas jetties along the Corpus Christi Ship Channel to Ingleside and up the La Quinta Channel to Cheniere's proposed LNG terminal. For land-based cumulative impacts, the area studied roughly corresponds to the mostly industrial and agricultural lands along the shoreline of the La Quinta Channel from Portland east, and Gregory south to Ingleside, and the proposed pipeline corridor which roughly parallels US 181 from Ingleside north to Sinton. Cumulative socioeconomic impacts are considered within the CCMSA.

Existing environmental conditions in the Project area are a result of past activities in the area as well as the natural baseline conditions. For example, much of the coastal marsh and the subtidal habitat in the Corpus Christi Bay has been disturbed by previous industrial development and marine access to it, particularly along the La Quinta Channel, where large defense, manufacturing, and petrochemical facilities have been in operation since the early 1950s.

Table 4.13-1 provides a list of projects considered in our cumulative impact analysis. Included in our analysis are those known projects with potential impacts to the same resources for which some effect has been evaluated for the Cheniere Corpus Christi LNG Project. This led to a focus on projects with a waterside component along the Corpus Christi and La Quinta Channels, including proposed LNG projects currently being reviewed by the FERC and projects identified by the COE it the EIS for its proposed channel improvement (COE, 2003a). A brief description of the seven projects listed in table 4.13-1 and included in our analysis follows.

Vista del Sol LNG Project

The Vista del Sol LNG Project is proposed by ExxonMobil in Docket No. CP04-395-000, et al., with its application filed with the FERC on August 6, 2004. The Vista del Sol LNG terminal would be located along the La Quinta Channel, about two miles southeast of the Cheniere LNG terminal, and would consist of two LNG ship berths, three LNG storage tanks, and about 25.3 miles of 36-inch-diameter sendout pipeline. The marine terminal would be capable of receiving up to 100 LNG ships per year, or the equivalent of about one LNG tanker visiting the terminal every 4 days. The LNG terminal would be located on approximately 92 acres within a 311-acre site between the communities of Ingleside and Gregory, San Patricio County, Texas, and adjacent to the Sherwin plant to the north, and the Occidental and DuPont chemical plants to the east and south. The terminal would be designed to accommodate future expansion that would include an additional berth and two more LNG tanks. The expanded facility would be capable of unloading up to 200 LNG ships per year. ExxonMobil proposes to have the project constructed and operational in mid-2008.

Ingleside Energy Center LNG Project

The application for Occidential's Ingleside Energy Center LNG Project, in Docket Nos. CP05-11-000, et al., was filed with the FERC on October 25, 2004. The Ingleside Energy Center LNG terminal would be located along the La Quinta Channel about four miles southeast of Cheniere's LNG terminal, and would consist of one ship berth, two LNG storage tanks, regasification facilities, and about 26 miles of 26-inch-diameter sendout pipeline. The project would include interconnections to nine existing interstate and intrastate pipelines. The LNG terminal would be located adjacent to Occidental's chemical manufacturing facility north of Ingleside, San Patricio County, Texas. Occidental proposes to have the project constructed and operational in 2008.

Corpus Christi Ship Channel Improvement Project

The Galveston District of the COE proposes to deepen the Corpus Christi Ship Channel to improve the efficiency and safety of the deep-draft navigation system and protect the quality of the coastal and estuarine resources in the area. The COE's plan consists of deepening the Corpus Christi Ship Channel to 52 feet; widening the Upper Bay and Lower Bay reaches to 530 feet; adding parallel 12-foot-deep, 200-foot-wide barge lanes within the Upper Bay portion of the channel; and extending the La Quinta Channel for 1.4 miles at a depth of 39 feet and a width of 300 feet. The project would be implemented over approximately a four-year period, beginning sometime after 2004.

TABLE 4.13-1

Cumulative Impacts of Projects in Corpus Christi Region

	Project							
	Cheniere Corpus Christi LNG Project	Vista del Sol LNG Project	Ingleside Energy Center LNG Project	Corpus Christi Ship Channel Improvement	La Quinta Container Terminal	Kiewit Offshore Services	Homeport Naval Station Ingleside a/	Total
RESOURCE IMPACTS								
Water Resources								
Dredge volume (mcy)	4.4	5.8	3.7	41.0	1.3	1.3	13.6	71.1
Perennial Waterbodies Crossed (no)	2	20	9	NA	NA	NA	UNK	31
Fish and Wildlife Habitat (ac)								
Flats/Salt Marsh	5.3	7.8	4.3	NA	2.1	NA	113.2	159.0
Freshwater Wetlands	0	0.01	0.2	NA	UNK	UNK	38.6	38.8
Shallow Bay Bottom Habitat	72	46.4	33	399	27.1	UNK	225	802.5
Gulf of Mexico Bottom Habitat	0	NA	NA	526	NA	NA	NA	526.0
Submerged Aquatic Vegetation	5.4	16.7	1.07	5	2.4	NA	1.1	31.7
EFH (subtotal of flats/salt marsh, shallow bay bottom habitat, and SAV)	82.7	70.9	38.37	404	31.6	NA	339.3	967
Land Use								
agricultural lands - permanent impact (ac)	4.4	152.1	0.6	NA	869	NA	UNK	1,026
Socioeconomics								
jobs (construction, temp., no. jobs)	500	649	525	370	4250	UNK	535	6,829
wages (construction, temp., millions)	$25.2	$110.5	$42.0	$1.1	$210.0	UNK	UNK	$388.8
jobs (avg. annual, no. jobs)	75	72	36	71	600	UNK	8470	9324
wages (avg. annual, millions)	$3.6	$3.5	$2.3	$0.02	$233.4	UNK	$150.0	$392.8
tax revenue (per year)	$4.5	$3.2	$10.0	UNK	$21.0	UNK	UNK	$38.7
Transporation (operation)								
Vehicles (no. per day)	1,280	1,700	700	NA	2,600	UNK	UNK	6,280
Ship calls (no. per year)	300	100	122	UNK	363	UNK	UNK	885
Air Quality (construction)								
COx (tpy)	505	67.3 (CO only)	204.53	283.87	432	UNK	UNK	1425.4
NOx (tpy)	418	511.6	645.49	1239.4	1017	UNK	UNK	3831.5
VOC (tpy)	5	28.1	62.07	36.41	112	UNK	UNK	243.6
MITIGATION (Acres Created)								
Upland Habitat	NA	NA	NA	120	NA	NA	NA	120.0
Shallow Water Habitat	NA	NA	NA	935	27.1	NA	5.5	967.6
Submerged Aquatic Vegetation	16.8	UNK	NA	15	7.2	NA	11.6	50.6
Wetlands (salt marsh, brackish, fresh)	NA	UNK	NA	26	5.9	NA	42	73.9

a/ Includes Mine Warfare Center of Excellence as reported in COE, 2003a.

NA - Not Applicable UNK - Unknown

La Quinta Container Terminal

The PCCA proposes to construct the La Quinta Container Terminal to help meet the need for additional container facility in the western Gulf and provide economic diversification for the Corpus Christi regional economy. The project would consist of a 254-acre marine terminal with three berths and a 3,700-foot-long wharf; a 65-acre intermodal yard for loading/unloading of rail cars; a 65-acre landside access corridor to connect that terminal with major road and railways; a 115-acre vegetated buffer zone; a 160-acre DMPA to accommodate dredged material disposal (if needed); 250 acres of ancillary facilities for warehousing, a distribution center, and trucking operations; and 204 additional acres for drainage, utilities, and open space. The project would be immediately to the west of the proposed Cheniere LNG terminal. The PCCA proposes to have the project in operation by 2008.

Kiewit Offshore Services

Kiewit Offshore Services, located north of the intersection of the La Quinta Channel and Jewel Fulton Channel, recently widened a portion of the La Quinta Channel and increased the depth of its dock to allow for the transport of oversized offshore oil and gas platforms. The project required hydraulic dredging of approximately 1.3 mcy of sediments. Much of the widening was done at the bottom of the existing channel without affecting the width of the top of the channel, which limited the new disturbance of shallow bottom habitat. As a result of the dredging project, the Kiewit facility will be able to handle some of the world's largest oil and gas platforms, such as the BP platform Thunder Horse that arrived at Kiewit's facility in September 2004, and is expected to be towed from its facility to a point in the Gulf of Mexico in early 2005.

Naval Station Ingleside

The U.S. Navy homeports 27 battleships at eight locations along the Gulf Coast, including its base at Ingleside. Waterfront facilities are necessary to support those vessels. In addition, the Navy maintains a Magnetic Silencing Facility at its Mine Warfare Center for Excellence at Ingleside, and recently constructed a small craft pier adjacent to the Ingleside Naval Station. These projects require dredging of navigation channels and turning basins along the eastern shoreline of Corpus Christi Bay. Dredging activities were located in and adjacent to the Corpus Christi Ship Channel from La Quinta to Harbor Island. Maintenance dredging is expected to occur every 5 years for the 50-year life of the project.

4.13.1 Water Resources

Cumulative effects on water resources affected by the proposed Cheniere Corpus Christi LNG Project when combined with other projects in the area would be limited primarily to the waters of the La Quinta Channel and the Corpus Christi Ship Channel, as all seven of the projects are located along those channels and involve dredging to expand or maintain the channels. Increased turbidity and sedimentation from initial dredging during the construction of new channels and turning basins, and during future maintenance dredging, would temporarily decrease water quality in the immediate vicinity of each project. If dredging associated with the Cheniere Corpus Christi LNG Project were to occur concurrently with the other dredging projects, the reduction in water quality could be exacerbated. However, the negative effects of dredging in and adjacent to the existing La Quinta and Corpus Christi Channels would be temporary, and water quality would be expected to return to ambient conditions soon after completion of activities.

The natural gas pipelines associated with the three proposed LNG projects would cross a total of 31 perennial waterbodies. Each company would implement crossing methods and erosion and sediment control measures from our Procedures and would comply with local, state, and Federal permit requirements for each crossing. Impacts from pipeline construction across surface waters are generally short term, and no long term or cumulative effects on theses waterbodies would be expected following restoration of the pipeline rights-of-way.

4.13.2 Wetlands and Submerged Aquatic Vegetation

In total, the projects included in our analysis would permanently impact an estimated 159 acres of tidal flats and salt marsh, 32 acres of submerged aquatic vegetation, and 39 acres of freshwater wetlands. In the case of the sendout pipelines for the Cheniere, Vista del Sol, and Ingleside LNG Projects, impacts on freshwater wetlands would be temporary; these wetlands would be restored after construction, with no net wetland loss. Each of the project proponents would be required by the terms and conditions of their respective Section 404 permit to provide compensatory mitigation for unavoidable wetland impacts. For example, Cheniere's preferred wetland mitigation would include off-site mitigation at Shamrock Island. Combined, the projects listed in table 4.13-1 would create 51 acres of submerged aquatic vegetation and 74 acres of salt marsh, brackish, or freshwater wetlands, as well as additional acres of upland habitat.

4.13.3 Wildlife and Aquatic Resources

When projects are constructed at or near the same time, the combination of construction activities could have a cumulative impact on wildlife. However, all of the projects considered in our analysis would be within or adjacent to industrial areas or developed sites, with limited wildlife habitat value. In addition, during construction activities mobile species would be able to relocate to nearby adjacent habitat and then reoccupy open project lands after they have been restored. Therefore, we believe cumulative impacts on wildlife would be short-term and not significant.

In total, the projects included in our analysis would impact an estimated 803 acres of shallow bottom habitat, 526 acres of Gulf of Mexico bottom habitat, and 32 acres of submerged aquatic vegetation. Nearly all of this area would be affected by dredging proposed to create or deepen shipping channels, maneuvering areas, or docks. As a result of this dredging, shallow bottom habitat would be converted to deeper water, and maintained as such through periodic maintenance dredging. Most other impacts associated with dredging would be short term, such as localized increased turbidity during dredging operations. Impact on submerged aquatic vegetation would be addressed through compensatory mitigation (see above).

Approximately 967 acres of designated EFH would be affected by the projects listed in table 4.13-1. Of the total potential acreage of impacted EFH, by far the largest contributors to the loss are Naval Station Ingleside and the Corpus Christi Ship Channel Improvement projects. Impact on EFH as a whole is addressed for each individual project, and impact on vegetated components of EFH (submerged aquatic vegetation and salt marsh) would be addressed through compensatory mitigation during Section 404 permitting.

4.13.4 Land Use, Recreation, and Visual Resources

The Cheneire and Ingleside LNG terminals would be located on tracts of open or industrial land, while the Vista del Sol LNG and La Quinta Container Terminal would be within tracts dominated by agricultural land use. Combined these projects would result in the permanent alteration of about 1,026 acres of agricultural lands. Given that about 406,000 acres in San Patricio County was classified as farmland in 1997 according to the U.S. Census, this would not be considered a significant loss.

The PCCA would build a berm as a buffer between its proposed La Quinta Container Terminal and residential neighborhoods to the west and north. The nearest house to the container terminal would be some 3,800 feet away. Respectively, the Cheniere, Vista del Sol, and Ingleside LNG terminals would be at least 1.6 mile, 0.5 mile, and 1.0 mile away from residences, and there would be no cumulative impact on these residences.

No developed recreational facilities were identified in close proximity to these projects. The COE (2003a) pointed out that the channel improvement projects listed on table 4.12-1 would result in greater access to the bay by boaters, and therefore have a positive benefit for regional tourism and recreational fishing.

The projects with proposed new infrastructure facilities would have some visual impact on the immediate surroundings. However, cumulatively, the projects would be consistent with ongoing industrial activities and existing facilities along the Corpus Christi and La Quinta Channels, and would not significantly alter the visual landscape of the area.

4.13.5 Socioeconomics

Combined, the projects listed on table 4.13-1 would generate almost 7,000 temporary construction jobs. Many of these workers would reside locally. One positive benefit of these new jobs would be to lower local unemployment rates. The influx of non-local laborers would only represent an increase of about one percent for the total population of San Patricio and Nueces Counties (assuming half the construction workers are non-local). The 27,000 potentially vacant or rental units available in the two counties would offer enough housing for non-local workers. Likewise, the counties have developed infrastructure to provide public services and utilities necessary to support the projects. No identified minority or low-income populations would be disproportionately impacted by the projects.

There would be positive cumulative economic benefits from these projects. Wages to construction workers would total about $388 million. Taxes generated from operation of the Cheniere, Vista del Sol, and Ingleside LNG terminals would total about $18 million annually, and full development of the La Quinta Container Terminal would add another $21 million in state and local tax revenues.

4.13.6 Transportation

4.13.6.1 Land Transportation

Combined, the Cheniere, Vista del Sol, and Ingleside LNG terminals would generate a total of about 3,580 vehicle trips per day during peak construction periods. The cumulative impact of construction traffic from all projects would depend on the timing of each project's construction and the amount of overlap between the construction phase of the projects. We have recommended that Cheniere should consult with the TDOT and other local entities responsible for transportation issues to determine the need for a Construction Transportation Management Plan to minimize temporary impacts associated with construction traffic. Operation of the La Quinta Container Terminal would result in an estimated 2,600 truck trips and 2 train trips daily entering and exiting the terminal site. The PCCA believes its La Quinta Container Terminal would not have a significant impact on local traffic flow because area highways are currently uncongested and able to handle increased traffic, and TDOT is planning future highway improvements.

4.13.6.2 Marine Transportation

In addition to the Cheniere Corpus Christi LNG Project, estimates of potential increased traffic by large ships are available for the La Quinta Container Terminal, Vista del Sol LNG Project, and Ingleside Energy Center LNG Project. Based on available information, the planned or proposed projects along the La Quinta Channel would result in an additional 885 ship calls per year to the Corpus Christi and La Quinta Ship Channels (table 4.13.6.2-1). The additional ship traffic of these projects combined could increase large vessel traffic levels from the existing average level of 3.5 vessels per day to an average of 6 vessels per day. While the Pilots indicated that the port could handle this additional ship traffic, it would be up to the USCG, through its Letters of Recommendations, to address the suitability of the Corpus Christi and La Quinta Ship Channels for LNG ship transportation.

TABLE 4.13.6.2-1

Estimated Number of Ship Calls for Proposed Projects in Corpus Christi Bay

Project	Estimated Number of Ship Calls per Year
Cheniere Corpus Christi LNG	300
Vista del Sol LNG	100
Ingleside Energy Center LNG	122
PCCA Container Terminal	363
Total	**885**

4.13.7 Air Quality and Noise

Table 4.13-1 provides air quality numbers for the Cheniere, Vista del Sol, and Ingleside LNG terminals and the La Quinta Container Terminal. The region is currently in attainment with air quality standards, and we believe these projects would not significantly contribute to the deteriorization of local air quality. For example, the SCVs at Cheniere's LNG terminal would run on relative clean-burning natural gas. Each individual project would need to apply to the TCEQ for an air quality permit.

Noise produced during construction of the listed projects could create short-term annoyances to some residences, and could have short-term impacts on some aquatic species. Noise impacts would be localized and would attenuate quickly as the distance from the noise source increases. Therefore, cumulative noise impacts associated with construction would be unlikely unless one or more of the projects were constructed at the same time and in the same location. Operation of the projects with land-based facilities would also generate noise. For the proposed LNG projects, the FERC would require that noise generated during operation does not exceed the 55 decibel limit established by the EPA for protection of public health and welfare. The PCCA estimates that noise generated by operation of the La Quinta Container Terminal would be below 66 decibels at the nearest NSA.

4.13.8 Conclusions about Cumulative Impacts

The COE's EIS found that most cumulative environmental impacts from the projects they studied would be temporary and minor (COE, 2003a). We agree. Cumulative benefits would be realized from the creation of new wetlands, seagrass and marsh habitat through wetland mitigation programs; improved bay access from channel improvements resulting in better recreational fishing opportunities; and a boost to the local economy through jobs and wages, purchases of goods and materials, and tax revenues.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF THE STAFF'S ENVIRONMENTAL ANALYSIS

We have determined that construction and operation of the Cheniere Corpus Christi LNG Project would result in limited and mostly insignificant environmental impacts. If the Project is found to be required by the public convenience and necessity and is constructed and operated in accordance with Cheniere's proposed mitigation and our recommended mitigation measures, it would be an environmentally acceptable action. Our conclusion is based on information provided by Cheniere and data developed from data requests; field investigations by Commission staff; literature research; alternatives analysis; comments from Federal, state, and local agencies; and input from public groups and individual citizens.

As part of our review, we developed measures that we believe would appropriately and reasonably avoid, minimize, or mitigate for environmental impacts resulting from construction and operation of the proposed Project. We are, therefore, recommending that our mitigation measures be attached as conditions to any authorization issued by the Commission.

5.1.1 Geology

Construction and operation of the Project would have minimal impact on geological resources. Four plugged and abandoned wells are located within the LNG terminal and marine basin site. Cheniere is in the process of determining whether any of these would interfere with construction of the Project, and will file its determination with the Commission and identify future action. The pipeline would be within 150 feet of 12 existing oil and gas wells, of which 4 would be within the construction right-of-way. Cheniere would conduct preconstruction surveys to ground-truth the location of these wells, and avoid them through minor route realignments. A site-specific seismic hazard analysis conducted by Cheniere indicates that due to very low level of ground motion predicted at the site, earthquake hazards were not considered a controlling factor in the LNG terminal design. No geologic hazards would be expected to affect the proposed facilities.

5.1.2 Soils and Sediments

Construction of the LNG terminal would permanently affect about 2 acres of soils classified as either hydric or prime farmland. Cheniere would cover about 458 acres of existing processed bauxite residue beds with about 4.4 mcy of sediments dredged from creation of its marine basin. The dredged sediments would be uncontaminated clays, and the DMPAs would be revegetated at the conclusion of construction.

The majority of the pipeline would cross prime farmland soils that would be temporarily affected during construction. After consulting with the NRCS, Cheniere agreed not to segregate topsoil deeper than 18 inches in Victoria clay and Raymondville clay loam soils, along about 12.8 miles of the proposed pipeline route. For about 18.7 miles of the route, where agricultural lands are deeply plowed, Cheniere would bury the pipeline at least four feet below the surface. About 4 acres of prime farmland would be permanently lost due to operation of the aboveground facilities along the pipeline. However, the NRCS does not believe this loss would be significant, and we agree.

After construction, agricultural lands along the pipeline would be restored to their previous condition and use. We conclude that the Project would have minimal impacts on soils because Cheniere would implement the FERC's Plan and Procedures.

5.1.3 Water Resources

Groundwater

Construction and operation of the Project would not have a significant impact on groundwater resources. The EPA has not designated the Gulf Coast aquifer, which underlies the Project, as a sole source aquifer. There are no public or private water supply wells, or officially designated wellhead protection areas, within 150 feet of the proposed Project. Because no bedrock was identified near the surface, Cheniere does not anticipate the need for blasting during construction.

The greatest potential for impact on groundwater would be from spills, leaks, or other releases of hazardous substances during construction or operation. Cheniere has agreed to implement the FERC's Procedures, which includes use of Spill Prevention and Response Procedures that meet state and Federal requirements. Cheniere has filed a SPCC Plan and has stated it would file a revised SPCC Plan with greater Project-specific measures.

Surface Water

Construction of the terminal's new marine basin would impact about 78 acres of shallow bay habitat, and result in the transformation of shallow water in the La Quinta Channel into deeper water habitat. Water quality in the area being dredged would be temporarily affected by increased turbidity during dredging, but would return to preconstruction conditions following completion of dredging. During operation of the LNG terminal, the SCVs would produce fresh water which would be pumped into Sherwin's raw water reservoir north of the processing area. Hydrostatic test water would also be discharged into the reservoir. However, on rare occasions when the reservoir may be full (due to excessive rain events or other factors), water may be released into the bay through the drainage ditch on the west side of Cheniere's tract. Cheniere would obtain the necessary permits regulating dredging, return water from the DMPAs, hydrostatic test water, and release of stormwater and wastewater from the LNG terminal into the bay.

The proposed pipeline would cross two perennial streams and eight intermittent-flowing waterbodies. Most of the waterbodies would be crossed using the open cut method. One drain would be bored. To minimize impact on surface waters, Cheniere would implement the protective measures in the FERC's Procedures. We have accepted Cheniere's requested variance from our Procedures to cross waterbodies between March 1 and August 31 when the region experiences its least rainfall and stream levels should be at their lowest.

5.1.4 Wetlands and Vegetation

Wetlands

Construction of the Cheniere Corpus Christi LNG Project would affect a total of 13.7 acres of wetlands, including 12.4 acres at the LNG terminal site and 1.3 acres along the pipeline route. During construction, Cheniere would minimize impact on wetlands by implementing measures in the FERC's Procedures. Cheniere has requested one variance from the Procedures to allow an extra 25 feet of temporary pipeline construction right-of-way width across three wetlands, and we have reviewed site-specific justification for this request and find it acceptable. Operation of the LNG terminal would permanently affect 10.7 acres of wetlands, including 5.4 acres of seagrass beds, 1.3 acres of tidal flat, and 4.0 acres of coastal marsh. In consultation with appropriate resource agencies, Cheniere prepared an Aquatic Resources Mitigation Plan, including a conceptual wetland mitigation plan which provides for the creation of new wetlands and seagrass beds off-site at Shamrock Island in Corpus Christi Bay. Wetland mitigation ultimately implemented by Cheniere to compensate for unavoidable impacts would be determined during the COE Section 404/10 permit review.

Terrestrial Vegetation

Cheniere's LNG terminal tract contains about 12 acres of coastal grasses and about 51 acres of scrub/shrub vegetation. However, construction and operation of the LNG terminal would only impact about 5 acres of open land containing coastal grasslands and scrub/shrub vegetation. The remainder of the upland portions of the tract is industrial land.

Construction of the proposed pipeline and associated aboveground facilities would affect about 320 acres of agricultural and 55 acres of open land. The open land includes grasslands and scrub/shrub vegetation. After construction, the pipeline right-of-way would be restored to its previous condition and use. Landowners could replant crops in agricultural lands, and open land would be seeded by Cheniere with species selected after consultation with the NRCS. During operation of the pipeline, mowing in parcels of open land would keep the right-of-way in an herbaceous state. We conclude that following our Plan and Procedures would result in the Project not having significant impacts on terrestrial vegetation.

5.1.5 Wildlife and Aquatic Resources

Wildlife

Impacts on wildlife resulting from construction and operation of the Project would include the temporary alteration and permanent loss of habitat. Wildlife habitat within the Project area includes open water, coastal marsh, tidal flats, coastal grasslands, scrub/shrub vegetation, agricultural land, and palustrine wetlands. At the LNG terminal, about 5.3 acres of coastal marsh and tidal flat habitat combined would be permanently lost. Only about 5 acres of grassland and scrub/shrub habitat would be affected by construction and operation of the LNG terminal. Some shrubland habitat would be permanently converted to grassland habitat as a result of vegetation maintenance on the pipeline right-of-way. We do not expect wildlife to be significantly impacted by the Project. Once construction is completed and work areas restored, wildlife could re-occupy open available habitat. The majority of the LNG terminal site is currently industrial land with limited usefulness as wildlife habitat.

Aquatic Resources

Operation of the LNG terminal would permanently affect about 5.4 acres of seagrass beds. Cheniere would mitigate for that loss by implementing its Aquatic Resources Mitigation Plan.

NOAA Fisheries identified EFH for postlarval, juvenile and subadult white shrimp, brown shrimp, red drum, postlarval and juvenile pink shrimp, and subadult Spanish mackerel in the Project area. Our EFH assessment concludes that temporary impacts, such as dredging the new marine basin, would not have significant long-term impacts. The permanent loss of EFH at the LNG terminal, totaling about 12 acres combined of seagrass, coastal marsh, and tidal flats, would be mitigated by Cheniere implementing its Aquatic Resources Mitigation Plan, and whatever other mitigation measures are required by the COE and NOAA Fisheries.

5.1.6 Threatened, Endangered, and Other Special Status Species

The FWS and NOAA Fisheries have identified a total of 23 federally listed endangered or threatened species that could potentially occur in the Project area. Based on our analysis of habitat that would be affected by the Project and other information, such as biological surveys conducted on behalf of Cheniere, we conclude that the Project would not affect or not adversely affect any of these species. In comments to Cheniere, the FWS indicated that the Project would have no effect on federally listed threatened, endangered, candidate, or proposed species.

5.1.7 Land Use, Recreation, and Visual Resources

The nearest residences to the property boundary of the proposed LNG terminal are about 1.6 miles west. No residences are located within 50 feet of the proposed pipeline workspace. No public lands, developed recreational facilities, or special interest areas would be affected by the Project.

The most prominent visual features of the proposed LNG terminal would be three LNG storage tanks, each 175 feet above the current grade and 145 feet in diameter. However, the height of the LNG storage tanks would be 22 feet lower than the tallest structure on the adjacent Sherwin plant. We evaluated estimated views of the storage tanks from four surrounding observation points using visual simulations prepared by Cheniere. While the LNG storage tanks would be visible from surrounding locations, they would not dominate the landscape, would be consistent with existing views of adjacent industrial facilities, and would not represent a significant visual impact.

Cheniere has requested but has not yet received its Texas CZMP consistency determination from the TGLO, Coastal Coordination Council for its LNG terminal. We have recommended that Cheniere not be allowed to begin construction of the LNG terminal until it has received the Coastal Coordination Council's determination that the project is consistent with the Texas CZMP. The TGLO did make a finding of consistency for the proposed pipeline.

5.1.8 Socioeconomics

During construction of the LNG terminal, Cheniere would employ an average of about 330 workers. Construction of the pipeline and meter station would employ an average of 325 workers. About 75 full-time employees would be needed for operation of the LNG terminal. About 61 percent of the construction workforce would reside within 50 miles of the jobsite. The addition of non-local workers would not represent a significant increase in the population of San Patricio and Nueces Counties. The two counties combined also have adequate housing available for Project employees and their families. Local infrastructure and public services are developed enough to handle Project needs. The Project should not have an adverse effect on local property values, and would not disproportionately impact any minority or low-income neighborhoods. The Project would benefit the local economy through expenditures for wages, purchases of materials, and taxes.

5.1.9 Transportation and Traffic

Onshore vehicular traffic generated during construction of the LNG terminal would increase by an estimated 2 to 3 percent over existing daily traffic volume on SH 35, the primary access route to the proposed terminal. While this would not be a significant impact on traffic flow on SH 35, there could be significant impacts on interchanges and intersections leading to the LNG terminal site. We have recommended that Cheniere consult with appropriate transportation authorities to determine the need for a Project-specific construction transportation management plan.

During operation, the LNG terminal would receive up to 300 LNG ships per year, resulting in an average of one additional vessel movement inward and outward per day through the Corpus Christi and La Quinta Ship Channels. The LNG ship traffic for the Project would represent less than a 1 percent increase in the total ship traffic in Corpus Christi Bay, and about a 5 percent increase in bay large vessel traffic.

5.1.10 Cultural Resources

Cheniere conducted cultural resource surveys and filed with the FERC and the SHPO survey reports that document inventories covering a portion of the LNG terminal site and all but 2.1 miles of the proposed pipeline route. The SHPO has accepted the survey reports and indicated that no historic properties would be affected within the areas inventoried. We have recommended that Cheniere not be allowed to construct any facilities or use any staging, storage, temporary work areas, or access roads until Cheniere files with the FERC all remaining cultural resources reports and SHPO review comments.

5.1.11 Air Quality and Noise

Although a slight degradation of the air quality due to pollutant emissions would occur, air emissions resulting from construction of the Project would not significantly affect ambient air quality in the Corpus Christi region. Cheniere would use dust control measures during construction of the LNG terminal and pipeline to minimize the generation of fugitive dust during construction. Air emissions from operation of the LNG terminal would be minimal because the equipment would burn natural gas as opposed to more polluting coal or oil. Cheniere has applied to the TCEQ for a state air quality permit. The TCEQ has preliminarily reviewed and approved the air quality modeling analysis that shows that the National Ambient Air Quality Standards would not be violated and emissions of designated "criteria pollutants" would not increase above the regulatory limit for prevention of significant air quality deterioration. Since the Project area is classified as in attainment for all criteria pollutants, a General Conformity Determination is not required.

Noise quality at the nearest NSAs would not be significantly affected by operation of the LNG facility. Although background noise may be heard by nearby residents, the facility would not exceed the 55 decibel limit recommended for the protection of public health and welfare. To further ensure that noise from operation of the facility would not impact residences, we have recommended that after the LNG terminal is in operation Cheniere conduct noise measurements to confirm that predicted noise impacts are not exceeded, and that Cheniere implement additional mitigation if necessary.

5.1.12 Reliability and Safety

We evaluated the safety of both the proposed LNG import terminal facility and the related LNG vessel transit through the Corpus Christi and La Quinta Ship Channels. With respect to the onshore facility, we completed a cryogenic design and technical review of the proposed terminal design and safety systems, and have identified specific areas of concern and included recommendations to address theses concerns. We also calculated thermal radiation and flammable vapor hazard distances for an accident or an attack on an LNG vessel. Based on the extensive operational experience of LNG shipping, the structural design of an LNG vessel, and the operational controls imposed by the USCG and the local pilots, the likelihood of a cargo containment failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision – is highly unlikely. For similar reasons, an accident involving the onshore LNG import terminal is unlikely to affect the public. As a result, the risk to the public from accidental causes should be considered negligible.

Although the Letter of Recommendation has not been issued, the USCG has indicated that there do not appear to be any significant issues which would preclude the use of the waterways for LNG carrier transit. The Letter of Recommendation would address the suitability of the Corpus Christi and La Quinta Ship Channels for LNG marine traffic, but it would not in itself represent final authority to commence LNG marine transport operations. Issues related to the public impact of safety and security or exclusion zones would be addressed in the *LNG Vessel Management and Emergency Plan* to be developed by Cheniere and approved by the USCG.

5.1.13 Alternatives

We considered the alternatives of no action or postponed action. While the no action or postponed action alternatives would eliminate or postpone the environmental impacts identified in this EIS, the objectives of the proposed Project would not be met.

Our analysis of system alternatives included an evaluation of the use of existing LNG import and storage systems. None of the existing facilities has the capacity or space to add the capacity proposed in this Project. We also looked at the construction of an offshore terminal to meet the objectives of the proposed Cheniere Corpus Christi LNG Project. Our review indicates that construction of an offshore alternative would involve a longer pipeline, the construction of a graving dock that would impact the shoreline, and a permanent onshore facility for terminal support activities. Therefore, we do not consider construction of an offshore facility a reasonable alternative to the proposed Project. We also looked at alternative port sites, none of which would provide significant environmental advantages over the proposed site.

Our alternatives analysis included the evaluation of a pipeline route alternative that was the route originally proposed by Cheniere. We also evaluated two alternative routes that would originate from points east of Cheniere's proposed LNG terminal. None of the route alternatives would provide significant environmental advantages over the proposed pipeline route.

5.2 FERC STAFF'S RECOMMENDED MITIGATION

If the Commission issues their authorization for the proposed Project, we recommend that the Commission's Order include measures 1 through 49 of the following section. We believe these measures would further mitigate the environmental impacts associated with the construction and operation of the proposed Project.

1. Cheniere shall follow the construction procedures and mitigation measures described in its application, supplemental filings (including responses to staff data requests) and as identified in the EIS, unless modified by this Order. Cheniere must:
   a. request any modification to these procedures, measures, or conditions in a filing with the Secretary;
   b. justify each modification relative to site-specific conditions;
   c. explain how that modification provides an equal or greater level of environmental protection than the original measure; and
   d. receive approval in writing from the Director of OEP **before using that modification.**

2. The Director of OEP has delegation authority to take whatever steps are necessary to ensure the protection of all environmental resources during construction and operation of the project. This authority shall allow:
   a. the modification of conditions of this Order; and
   b. the design and implementation of any additional measures deemed necessary (including stop work authority) to assure continued compliance with the intent of the environmental conditions as well as the avoidance or mitigation of adverse environmental impact resulting from project construction and operation.

3. **Prior to any construction,** Cheniere shall file an affirmative statement with the Secretary, certified by a senior company official, that all company personnel, environmental inspectors, and contractor personnel will be informed of the environmental inspector's authority and have been or will be trained on the implementation of the environmental mitigation measures appropriate to their jobs **before** becoming involved with construction and restoration activities.

4. The authorized facility locations shall be as shown in the EIS, as supplemented by filed alignment sheets, and shall include all of the staff's recommended facility locations.

As soon as they are available, and before the start of construction, Cheniere shall file with the Secretary any revised detailed survey alignment maps/sheets at a scale not smaller than 1:6,000 with station positions for all facilities approved by this Order. All requests for modifications of environmental conditions of this Order or site-specific clearances must be written and must reference locations designated on these alignment maps/sheets.

Cheniere's exercise of eminent domain authority granted under Section 7(h) of the NGA in any condemnation proceedings related to the Order for the pipeline must be consistent with this authorized facilities and locations. Cheniere's right of eminent domain granted under Section 7(h) of the NGA does not authorize it to increase the size of its natural gas pipeline to accommodate future needs or to acquire a right-of-way for a pipeline to transport a commodity other than natural gas.

5. Cheniere shall file with the Secretary detailed alignment maps/sheets and aerial photographs at a scale not smaller than 1:6,000 identifying all route realignments or facility relocations, and staging areas, pipe storage yards, new access roads, and other areas that would be used or disturbed and have not been previously identified in filings with the Secretary. Approval for each of these areas must be explicitly requested in writing. For each area, the request must include a description of the existing land use/cover type, and documentation of landowner approval, whether any cultural resources or federally listed threatened or endangered species would be affected, and whether any other environmentally sensitive areas are within or abutting the area. All areas shall be clearly identified on the maps/sheets/aerial photographs. Each area must be approved in writing by the Director of OEP **before construction in or near that area.**

   This requirement does not apply to extra workspace allowed by the *Upland Erosion Control, Revegetation, and Maintenance Plan,* minor field realignments per landowner needs and requirements which do not affect other landowners or sensitive environmental areas such as wetlands.

   Examples of alterations requiring approval include all route realignments and facility location changes resulting from:

   a. implementation of cultural resources mitigation measures;
   b. implementation of endangered, threatened, or special concern species mitigation measures;
   c. recommendations by state regulatory authorities; and
   d. agreements with individual landowners that affect other landowners or could affect sensitive environmental areas.

6. **At least 60 days before that start of construction,** Cheniere shall file an initial Implementation Plan with the Secretary for review and written approval by the Director of OEP describing how Cheniere will implement the mitigation measures required by this Order. Cheniere must file revisions to the plan as schedules change. The plan shall identify:

a. how Cheniere will incorporate these requirements into the contract bid documents, construction contracts (especially penalty clauses and specifications), and construction drawings so that the mitigation required at each site is clear to onsite construction and inspection personnel;
b. the number of environmental inspectors assigned per spread, and how the company will ensure that sufficient personnel are available to implement the environmental mitigation;
c. company personnel, including environmental inspectors and contractors, who will receive copies of the appropriate material;
d. the training and instructions Cheniere will give to all personnel involved with construction and restoration (initial and refresher training as the project progresses and personnel change), with the opportunity for OEP staff to participate in the training session(s);
e. the company personnel (if known) and specific portion of Cheniere's organization having responsibility for compliance;
f. the procedures (including use of contract penalties) Cheniere will follow if *noncompliance occurs*; and
g. for each discrete facility, a Gantt or PERT chart (or similar project scheduling diagram), and dates for:
   (1) the completion of all required surveys and reports;
   (2) the mitigation training of onsite personnel;
   (3) the start of construction; and
   (4) the start and completion of restoration.

7. Cheniere shall develop and implement an environmental complaint resolution procedure. The procedure shall provide landowners with clear and simple directions for identifying and resolving their environmental mitigation problems/concerns during construction of the project and restoration of the right-of-way. **Prior to construction,** Cheniere shall mail the complaint procedures to each landowner whose property would be crossed by the Project.

   a. In its letter to affected landowners, Cheniere shall:
      (1) provide a local contact that the landowners should call first with their concerns; the letter should indicate how soon a landowner should expect a response;
      (2) instruct the landowners that, if they are not satisfied with the response, they should call Cheniere's Hotline; the letter should indicate how soon to expect a response; and
      (3) instruct the landowners that, if they are still not satisfied with the response from Cheniere's Hotline, they should contact the Commission's Enforcement Hotline at (888) 889-8030.

   b. In addition, Cheniere shall include in its weekly status report a copy of a table that contains the following information for each problem/concern:

(1) the date of the call;
(2) the identification number from the certificated alignment sheets of the affected property;
(3) the description of the problem/concern; and
(4) an explanation of how and when the problem was resolved, will be resolved, or why it has not been resolved.

8. Cheniere shall employ a team of environmental inspectors (at least two per construction spread with one available at the LNG terminal as appropriate during site preparation). The environmental inspectors shall be:

a. responsible for monitoring and ensuring compliance with all mitigation measures required by this Order and other grants, permits, certificates, or other authorizing documents;
b. responsible for evaluating the construction contractor's implementation of the environmental mitigation measures required in the contract (see condition 6 above) and any other authorizing document;
c. empowered to order correction of acts that violate the environmental conditions of this Order, and any other authorizing document;
d. a full-time position, separate from all other activity inspectors;
e. responsible for documenting compliance with the environmental conditions of this Order, as well as any environmental conditions/permit requirements imposed by other Federal, state, or local agencies; and
f. responsible for maintaining status reports.

9. Cheniere shall file updated status reports prepared by the head environmental inspector with the Secretary on a weekly basis **until all construction and restoration activities are complete**. On request, these status reports will also be provided to other Federal and state agencies with permitting responsibilities. Status reports shall include:

a. the current construction status of the project, work planned for the following reporting period, and any schedule changes for stream crossings or work in other environmentally sensitive areas;
b. a listing of all problems encountered and each instance of noncompliance observed by the environmental inspector(s) during the reporting period (both for the conditions imposed by the Commission and any environmental conditions/permit requirements imposed by other Federal, state, or local agencies);
c. corrective actions implemented in response to all instances of noncompliance, and their cost;
d. the effectiveness of all corrective actions implemented;
e. a description of any landowner/resident complaints which may relate to compliance with the requirements of this Order, and the measures taken to satisfy their concerns; and
f. copies of any correspondence received by Cheniere from other Federal, state or local permitting agencies concerning instances of noncompliance, and Cheniere's response.

10. Cheniere must receive written authorization from the Director of OEP **before commencing service** for the Project. Such authorization will only be granted following a determination that the LNG facility has been constructed in accordance with Commission approval and applicable standards, can be expected to operate safety as designed, and that rehabilitation and restoration of the right-of-way is proceeding satisfactorily.

11. **Within 30 days** of placing the authorized facilities in service, Cheniere shall file an affirmative statement with the Secretary, certified by a senior company official:

    a. that the facilities have been constructed in compliance with all applicable conditions, and that continuing activities will be consistent with all applicable conditions; or

    b. identifying which of the certificate conditions Cheniere has complied with or will comply with. This statement shall also identify any areas affected by the project where compliance measures were not properly implemented, if not previously identified in filed status reports, and the reason for noncompliance.

12. **Prior to construction**, Cheniere shall file with the Secretary documentation of consultations with the COE regarding timing of the dredging for the LNG marine basin and maneuvering area. To the extent possible, Cheniere shall coordinate its dredging operations with the proposed COE dredging of the La Quinta Channel extension to avoid construction conflicts.

13. Cheniere shall file with the Secretary **prior to construction** the following information on nonjurisdictional facilities, including the AEP transmission line and substation, San Patricio Municipal Water District pipeline, and three existing natural gas pipelines and associated aboveground facilities:

    a. documentation of consultations with the appropriate agencies and the status of Federal, state, or local permits or approvals required for their construction, abandonment, removal, or relocation. Consultations shall address handling and removal of potential hazardous substances during facility removal; and

    b. status and copies of any surveys and reports prepared for waterbodies, wetlands, threatened and endangered species, and cultural resources.

14. **Prior to construction**, Cheniere shall file with the Secretary details of its coordination with the City of Port Aransas, or other entities, regarding its planned or potential assistance with ongoing or future shoreline protection efforts.

15. Cheniere shall not begin construction activities for the LNG terminal **until**:

    a. the staff receives comments from FWS and NOAA Fisheries regarding the proposed action;

    b. the staff completes formal consultation with FWS and NOAA Fisheries, if required; and

    c. Cheniere has received written notification from the Director of OEP that construction or use of mitigation may begin.

16. If facilities are not constructed **within one year** from the date of issuance of the authorization from the Director of OEP that construction may begin, Cheniere shall

consult with the appropriate offices of the FWS and NOAA Fisheries to verify that previous consultations and determinations of effect are still current.

17. Cheniere shall not begin construction of any component of its LNG terminal **until** it files with the Secretary a copy of the consistency determination issued by the TGLO Coastal Coordination Council.

18. Cheniere shall consult with the TDOT and other local entities responsible for transportation issues including San Patricio and Nueces Counties and the Cities of Gregory and Portland, and determine the need for a Project-specific Construction Transportation Management Plan. Such a plan shall provide specific measures that would be used to transport materials and construction workers to the proposed LNG terminal work site. Aspects of the plan may include, but are not limited to, identification of off-site vehicle parking areas, traffic control measures, traffic control personnel, and construction and delivery hours. Cheniere shall file with the Secretary, **prior to construction**, the results of this consultation and the Construction Transportation Management Plan if recommended by the transportation authorities.

19. Cheniere shall **defer construction** and use of its proposed facilities, including related ancillary areas for staging, storage, and temporary work areas, and new or to-be-improved access roads, **until**:

    a. Cheniere files with the Secretary all additional required inventory and evaluation reports, a SHPO-approved Project-specific unanticipated discovery plan, and any necessary treatment plans;
    b. Cheniere files the SHPO comments on all cultural resources investigation reports and plans;
    c. the ACHP has been given an opportunity to comment if any historic properties would be adversely effected by the Project; and
    d. the Director of OEP reviews and approves all cultural resources reports and plans, and notifies Cheniere in writing that it may proceed with treatment or construction.

    All material filed with the Commission containing location, character, and ownership information about cultural resources must have the cover and any relevant pages therein clearly labeled in bold lettering: **"CONTAINS PRIVILEGED INFORMATION – DO NOT RELEASE."**

20. Cheniere shall make all reasonable efforts to assure its predicted noise levels from the LNG terminal are not exceeded at the NSAs and file noise surveys showing this with the Secretary **no later than 60 days** after placing the LNG terminal in service. However, if the noise attributable to the operation of the LNG terminal exceeds 55 dBA L_{dn} at an NSA or the noise increase exceeds 10 dBA L_{90} at an NSA, Cheniere shall file a report on what changes are needed and shall install additional noise controls to meet the level **within one year** of the in-service date. Cheniere shall confirm compliance with these requirements by filing a second noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls.

21. Cheniere shall provide a technical review of its facility design that:

    a. identifies all combustion/ventilation air intake equipment and the distance(s) to any possible hydrocarbon release (LNG, flammable refrigerants, flammable liquids, and flammable gases); and

    b. demonstrates that these areas are adequately covered by hazard detection devices and indicates how these devices would isolate or shut down any combustion equipment whose continued operation could add to or sustain an emergency.

    Cheniere shall file this review with the Director of OEP for review and approval **prior to construction.**

22. Cheniere shall file a copy of the contingency plan for outer containment failure with the Secretary **prior to commissioning**.

23. Cheniere shall file a copy of the criteria for horizontal and rotational movement of the inner vessel for use during and after cool down with the Secretary **before construction**.

24. Cheniere shall notify the FERC **on a timely basis** in the event the temperature of any region of any storage tank outer containment vessel becomes less than the minimum specified operating temperature for the material, and shall specify procedures for corrective action.

25. Cheniere shall file final drawings and specifications of the spill protection system to be applied to the LNG tank roofs with the Secretary **before construction**.

26. Cheniere shall file final drawings of the storage tank piping support structure with the Secretary **before construction**.

27. Cheniere shall file differential tank tilt settlement limits and differential movement limits between LNG tank and piping, and procedures to be implemented in the event that limits are exceeded with the Secretary **before construction**.

28. Cheniere shall file a complete list of the type, number, and location of all hazard detection equipment with the Secretary **before construction**.

29. Cheniere shall equip flammable gas and UV/IR hazard detectors with local instrument status indication as an additional safety feature, and document this in a filing with the Secretary **prior to commissioning**.

30. Cheniere shall install all hazard detectors with redundancy and fault detection and fault alarm monitoring in all potentially hazardous areas and enclosures, and document this in a filing with the Secretary **prior to commissioning**.

31. Cheniere shall file a copy of the fire protection evaluation carried out in accordance with the requirements of NFPA 59A, chapter 9.1.2, with the Secretary **before construction**.

32. Cheniere shall file a complete list of the type, number, and location of all hazard control equipment with the Secretary **before construction**.

33. Cheniere shall file a copy of the facility security plan with the Secretary **before commissioning**.

34. Cheniere shall file security personnel requirements for prior to and during LNG carrier unloading with the Secretary **before commissioning**.

35. Cheniere shall develop procedures for offsite contractors' responsibilities, restrictions, limitations, and supervision of contractors by Cheniere staff, and file a copy of these procedures with the Secretary **before construction.**

36. Cheniere shall file Operation and Maintenance procedures and manuals, as well as emergency plans and safety procedure manuals, with the Secretary **before commissioning** operations. In addition, copies of the Security Manual, Transit Operations Manual, and the Emergency Response Manual prepared for the USCG shall be filed with the Secretary.

37. Cheniere shall notify the FERC staff of any proposed revisions to the security plan and physical security of the facility **before commissioning** the proposed facilities.

38. Cheniere shall file monthly progress reports on the proposed construction project with the Secretary. Details shall include a summary of activities, problems encountered, and remedial actions taken. Problems of significant magnitude shall be reported to the FERC **on a timely basis**. Additional site inspections and technical reviews would be held by the FERC staff **prior to commencement** of operation.

39. The facility shall be subject to regular technical reviews and site inspections by the FERC staff on at least a **biennial** basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Cheniere shall respond to a specific data request including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Cheniere shall also provide up-to-date detailed piping and instrumentation diagrams reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted annual report.

40. Cheniere shall file **semi-annual** operational reports with the Secretary to identify changes in facility design and operating conditions, abnormal operating experiences, activities (including ship arrivals, quantity and composition of imported LNG, vaporization quantities, boil-off/flash gas, etc.), plant modifications including future plans and progress thereof. Abnormalities shall include, but not be limited to: unloading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tanks, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, vapor or liquid releases, fires involving natural gas and/or from other sources, negative pressure (vacuum) within a storage tank and higher than predicted boil-off rates. Adverse weather conditions and the effect on the facility also shall be reported.

Reports shall be submitted **within 45 days** after each period ending June 30 and December 31. In addition to the above items, a section entitled "Significant plant modifications proposed for the next 12 months (dates)" shall be included in the semi-annual operational reports. Such information would provide the FERC staff with early notice of anticipated future construction/maintenance projects at the LNG facility.

41. Cheniere shall report significant non-scheduled events, including safety-related incidents (*i.e.*, LNG or natural gas releases, fires, explosions, mechanical failures, unusual over pressurization, and major injuries) to the FERC staff **within 48 hours**. In the event an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification shall be made **immediately**, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. This notification practice shall be incorporated into the LNG facility's emergency plan. Examples of reportable LNG-related incidents include:

   a. fire;

   b. explosion;

   c. property damage exceeding $10,000;

   d. death or injury requiring hospitalization;

   e. free flow of LNG for five minutes or more that results in pooling;

   f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of an LNG facility that contains, controls, or processes gas or LNG;

   g. any crack or other material defect that impairs the structural integrity or reliability of an LNG facility that contains, controls, or processes gas or LNG;

   h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes gas or LNG to rise above its maximum allowable operating pressure (or working pressure for LNG facilities) plus the build-up allowed for operation of pressure limiting or control devices;

   i. a leak in an LNG facility that contains or processes gas or LNG that constitutes an emergency;

   j. inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank;

   k. any safety-related condition that could lead to an imminent hazard and cause (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility that contains or processes gas or LNG;

   l. safety-related incidents to LNG trucks or LNG vessels occurring at or in route to and from the LNG facility; or

m. the judgment of the LNG personnel and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan.

In the event of an incident, the Director of OEP has delegated authority to take whatever steps are necessary to ensure operational reliability and to protect human life, health, property or the environment, including authority to direct the LNG facility to cease operations. Following the initial company notification, the FERC staff will determine the need for a separate follow-up report or follow-up in the upcoming semi-annual operational report. All company follow-up reports shall include investigation results and recommendations to minimize a reoccurrence of the incident.

42. **Prior to construction,** Cheniere shall provide, in a filing with the Secretary, evidence of its ability to exercise legal control over the activities that occur within the portions of the thermal exclusion zones, listed in table 4.12.4.2-2 of the draft EIS, that fall outside of the LNG terminal property line.

43. **Prior to construction**, Cheniere shall provide, in a filing with the Secretary, evidence of its ability to exercise legal control over the activities that occur within the portions of the vapor dispersion exclusion zones that fall outside of the LNG terminal property line.

44. Cheniere shall examine provisions to retain any vapor produced along the transfer line trenches and other areas serving to direct LNG spills to associated impoundments. Measures to be considered may include, but are not limited to: vapor fencing; intermediate sump locations; or trench surface area reduction. Cheniere shall file final drawings and specifications for these measures with the Secretary **before construction**.

45. Cheniere shall coordinate with the USCG to define the responsibilities of Cheniere's security staff in supplementing other security personnel and in protecting the LNG tankers and terminal, and document the results of this consultation in a filing with the Secretary **prior to commissioning**.

46. Cheniere shall develop emergency evacuation routes/methods in conjunction with the local emergency planning groups and town officials for areas that are within any transient hazard areas. These evacuation routes/methods shall be filed with the Secretary for review and written approval by the Director of OEP **prior to construction.**

47. Cheniere shall develop an Emergency Response Plan (including evacuation) and coordinate procedures with local emergency planning groups, fire departments, state and local law enforcement, and appropriate Federal agencies. This plan shall include at a minimum:

    a. designated contacts with state and local emergency response agencies;

    b. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;

    c. procedures for notifying residents and recreational users within areas of potential hazard;

d. evacuation routes for public use areas and residents of areas that are within any transient hazard areas;

e. locations of permanent sirens and other warning devices; and

f. an "emergency coordinator" on each LNG vessel to activate sirens and other warning devices.

The Emergency Response Plan shall be filed with the Secretary for review and approval by the Director of OEP **prior to commencement** of service. Cheniere shall notify the FERC staff of all meetings in advance and shall report progress on its Emergency Response Plan at 6-month intervals starting at the commencement of construction.

48. **Prior to construction**, Cheniere shall file with the Secretary documentation that suitable procedures and coordination exist between Cheniere, the Pilots, and the TDOT to minimize delays to the Port Aransas Ferry operations from LNG carrier transits.

49. Cheniere shall conduct a Maneuverability Simulation Study for LNG vessels greater than 140,000 cubic meter capacity. Cheniere shall submit the study to the Pilots and the USCG for their review and comment, and file the study and the comments with the Secretary for the review and approval of the Director of OEP **prior to the use** of such ships.

APPENDIX A

DRAFT EIS DISTRIBUTION LIST

APPENDIX A

DRAFT EIS DISTRIBUTION LIST

Note: All addresses in Texas unless otherwise noted.

Federal Agencies

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Texas Parks & Wildlife Dept., Environmental Branch, Austin
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The Aransas Pass Progress
San Patricio County News
Coastal Bend Herald

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APPENDIX B

PIPELINE FACILITY LOCATION MAPS

Non-Internet Public

Appendix B
Pipeline Facility Location Maps
9 pages

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

APPENDIX C

ADDITIONAL TEMPORARY WORKSPACE AREAS

TABLE C-1
Additional Temporary Workspace Areas for the Cheniere Corpus Christi Pipeline a/

Project Facility or Feature Crossed	Milepost	Dimensions (feet) b/	Area (acres) c/	Existing Land Use
Pig Launcher, MLV	0.0	250 × 170	1.0	Industrial
LaQuinta Road	0.8	2 (175 × 100)	0.8	Crop, Industrial
Drainage Ditch	1.4	2 (250 × 50)	0.6	Crop
U.S. Hwy 181, State Hwy 35, and Southern Pacific Railroad	2.1	2 (175 × 100)	0.8	Crop
Drainage Ditch	2.6	2 (250 × 50)	0.6	Crop
County Road 2986	3.0	2 (125 × 25)	0.1	Crop
Drainage Ditch	4.9	2 (250 × 50)	0.6	Crop
County Road 3667	5.2	2 (125 × 25)	0.1	Crop
County Road 3567	6.4	2 (125 × 25)	0.1	Crop
Crosstex Pipeline	6.6	2 (125 × 50)	0.3	Crop
Koch Pipeline	6.7	2 (125 × 50)	0.3	Crop
Valero Pipeline, 8- and 12-inch El Paso Pipelines, Unknown Pipeline	6.9	2 (125 × 50)	0.3	Crop
County Road 1612	7.4	2 (125 × 25)	0.1	Crop
TETCO Pipeline Interconnect	7.8	50 × 200	0.2	Crop
County Road 75	8.7	2 (125 × 25)	0.1	Crop
Private Road	9.3	2 (125 × 25)	0.1	Crop
State Hwy 893 East	9.8	225 × 100	0.5	Crop
State Hwy 893 West	9.8	200 x 100	0.5	Open
State Hwy 631	10.0	100 × 175	0.4	Open
County Road 1944 East	10.1	325 × 100	0.8	Open
County Road 1944 West	10.1	225 × 100	0.5	Crop
Seadrift Pipeline	11.0	2 (125 × 50)	0.3	Crop
Equistar Pipeline	11.6	2 (125 × 50)	0.3	Crop
Gulf South Pipeline	11.7	2 (125 × 50)	0.3	Crop
Drainage Ditch	12.6	2 (250 × 50)	0.6	Crop
County Road 2965	13.3	2 (125 × 25)	0.1	Crop
Channel Industry Pipeline	14.7	2 (125 × 50)	0.3	Crop
U.S. Hwy 181	15.2	2 (175 × 100)	0.8	Crop
County Road 1210	16.2	2 (125 × 25)	0.1	Crop
Seadrift Pipeline	16.2	2 (125 × 50)	0.3	Crop
Crosstex Pipeline	16.6	2 (125 × 50)	0.3	Crop
Oliver Creek	16.8	2 (300 × 100)	1.6	Crop
State Hwy 188	17.0	2 (175 × 100)	0.8	Crop
Chiltipin Creek East	18.0	300 × 150	1.1	Crop

TABLE C-1
Additional Temporary Workspace Areas for the Cheniere Corpus Christi Pipeline a/

Project Facility or Feature Crossed	Milepost	Dimensions (feet) b/	Area (acres) c/	Existing Land Use
Chiltipin Creek West	18.0	300 × 150	1.0	Open
U.S. Hwy 77	20.2	2 (175 × 100)	0.8	Open
Kinder Morgan-Tejas and ExxonMobil Pipelines	21.1	2 (125 × 50)	0.3	Open
El Paso Pipeline	22.2	2 (125 × 50)	0.3	Crop
Unnamed Natural Gas Pipelines (2)	22.5	2 (125 × 50)	0.3	Crop
Tennessee Gas Pipeline Interconnect, Pig Receiver, MLV	23.0	300 × 150	1.0	Crop
Total	-	-	**19.4**	-

a/ Additional Temporary Workspace is the area for construction outside of the construction right-of-way.
b/ Workspace dimensions are approximate in table; acreages are based on actual workspace dimensions.
c/ All acreages are rounded to the nearest tenth.

APPENDIX D

CHENIER'S AQUATIC RESOURCES MITIGATION PLAN

PBS&J Project No. 460893.01
Document No. 040276

CORPUS CHRISTI LNG TERMINAL AND CHENIERE CORPUS CHRISTI PIPELINE PROJECT AQUATIC RESOURCES MITIGATION PLAN

Prepared for:

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and
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September 2004

Contents

Acronyms and Abbreviations

ATWS	Additional Temporary Workspace
Bscf	Billion Standard Cubic Feet
CBBEP	Coastal Bend Bays & Estuary Program, Inc.
CCLNG	Corpus Christi LNG
CCSC	Corpus Christi Ship Channel
CWA	Construction Work Area
DMPA	Dredge Material Placement Area
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
GLO	Texas General Land Office
GT	Geotextile Tube
LNG	Liquefied Natural Gas
LQSC	La Quinta Ship Channel
MLV	Mainline Valve
MP	Milepost
NOAA	National Oceanic and Atmospheric Administration
NOR	Notice of Registration
PMZ	Plume Management Zone
RAP	Response Action Plan
msl	Mean Sea Level
SAV	Submerged Aquatic Vegetation
TCEQ	Texas Commission on Environmental Quality
TNC	The Nature Conservancy
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TRRP	Texas Risk Reduction Program
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish & Wildlife Service

1.0 PROJECT DESCRIPTIONS

1.1 CORPUS CHRISTI LNG TERMINAL

The proposed Corpus Christi liquefied natural gas ("CCLNG") terminal will import, store, and vaporize LNG for supply to U.S. natural gas markets. The CCLNG terminal will be located on the north shore of Corpus Christi Bay adjacent to the La Quinta Channel in San Patricio and Nueces Counties, Texas. The proposed CCLNG terminal facilities will consist of a marine terminal with associated LNG transfer lines, storage facilities, facilities for LNG vaporization and send-out, additional utilities, infrastructure, and support systems required for operation of the CCLNG terminal.

The proposed marine terminal will include a maneuvering area and a protected double-berth LNG unloading dock. These facilities will be capable of unloading about 300 ships per year, or approximately one ship every 1.5 days. The proposed docking slip will be dredged to a depth of minus 42 feet mean sea level ("msl"). A 3:1 slope will form the sides of the slip, portions of which will be protected using articulated block mats or other suitable means of stabilization. A sizable expansion of the maneuvering area will be dredged to minus 42 feet msl, in which side slopes will also be 3:1. Construction of the proposed slip and maneuvering area will require the dredging of approximately 4,382,000 cubic yards of material.

1.2 CHENIERE CORPUS CHRISTI PIPELINE

The Cheniere Corpus Christi Pipeline ("Corpus Christi Pipeline") project involves the construction of a 23-mile natural gas pipeline. The new 48-inch pipeline will be used to transport natural gas from the CCLNG terminal to seven interconnect and metering facilities, which will interconnect with the major interstate and intrastate natural gas transmission pipelines in south Texas. The Corpus Christi Pipeline project will have a capacity to transport 2.7 billion standard cubic feet ("Bscf") per day of natural gas. The pipeline facilities will consist of a 23-mile, 48-inch diameter pipeline, launcher and receiver traps, three mainline valves ("MLV"), and seven metering facilities.

Aboveground facilities associated with the Corpus Christi Pipeline project are presented in the following table.

Table 1.2-1
Proposed Aboveground Facilities for the Corpus Christi Pipeline Project, San Patricio County, Texas

Project Facility	New/ Modified	Milepost	Location (Town/County)
Pig Launcher, MLV	New	0.0	Gregory, San Patricio County, Texas
Texas Eastern Transmission Company (TETCO) Pipeline Interconnect	New	7.8	San Patricio County, Texas
MLV	New	10.2	Taft, San Patricio County, Texas
Gulf South Pipeline Interconnect	New	11.2	Taft, San Patricio County, Texas
Channel Pipeline Interconnect	New	14.6	San Patricio County, Texas
Florida Gas Pipeline Interconnect	New	16.5	San Patricio County, Texas
Tejas Pipeline Interconnect	New	21.3	Sinton, San Patricio County, Texas
Transco Pipeline Interconnect	New	22.8	Sinton, San Patricio County, Texas
NGPL Pipeline Interconnect	New	22.8	Sinton, San Patricio County, Texas
Pig Receiver, MLV	New	23.0	Sinton, San Patricio County, Texas
Tennessee Gas Pipeline Interconnect	New		Sinton, San Patricio County, Texas

Each meter/regulating station will include a supply line from the pipeline, emergency bypass line, meter runs, pressure regulation (if required), and a discharge line. Meter run piping and components will be located outside of the control buildings. Yard piping, with the exception of the meter station isolation valve controls, will be installed underground.

Evaluating the physical condition of the pipeline is necessary to ensure the safety of the pipeline system. A cylindrical device, referred to as a "smart pig," is commonly utilized to determine the integrity of the pipeline. Electromechnical sensors and ultrasonic technology will record data about the pipeline integrity, such as wall thickness, dents, corroded areas, and other anomalies associated with pipe materials. The Corpus Christi Pipeline project will include pig launching and receiving facilities at the beginning and end of the proposed pipeline.

Three MLV's will effectively isolate the pipeline into segments for safety, operating, and maintenance purposes. One MLV will be located at the origin and one at the terminus of the proposed pipeline, respectively, and the third MLV will be located at MP 10.2. A gas/hydraulic actuator that includes an automatic line break device, which closes the valve when a rapid pressure drop is detected, will operate the MLV's. All MLV's will be capable of being remotely monitored and controlled from a central control facility via a SCADA system. MLV sites will be located near roads to maximize ease of access, but away from populated areas. Each MLV site will be fenced with an all-weather gravel access road designed for easy accessibility by operating personnel. The MLV's will be located so as to avoid overhead obstructions and power lines.

2.0 AQUATIC RESOURCE BASELINE INVENTORY

Aquatic resources within the CCLNG terminal and Corpus Christi Pipeline project areas include wetlands, essential fish habitat ("EFH"), and open-water areas. The following is a discussion of the aquatic resources within these areas.

2.1 CORPUS CHRISTI LNG TERMINAL

Three wetland communities were identified within the proposed CCLNG terminal area. Table 2.1-1 identifies each wetland community and the extent of impacts within the construction work area (all temporary and permanent wetland impacts) and the operation area (permanent wetland impacts). All communities, submerged and emergent, are considered EFH as determined through literature reviews, field investigations, and correspondence with the resource agencies (NOAA Fisheries, September 2003). A total of 12.35 acres of wetlands will be impacted during construction. Of this 12.35 acres, 10.65 acres will be permanently impacted by operation of the CCLNG terminal facility. Permanent impacts are considered those areas that will not be allowed to revert to pre-construction conditions. Temporary impacts are those areas that will be disturbed during construction, but once construction is complete, the area will restored to preconstruction contours and allowed to naturally revegetate.

Table 2.1-1
Wetlands Impacted by the Corpus Christi LNG Terminal

Wetland Type		Construction (Temporary) Impacts[1] (Acres)	Operation (Permanent) Impacts[2] (Acres)
Seagrass		5.990	5.350
Coastal Marsh	Mangroves	2.013	1.590
	Smooth cordgrass	2.761	2.380
Tidal Flat	Vegetated	1.135	1.100
	Non-vegetated	0.451	0.230
Total		**12.35**	**10.65**

[1] Construction impacts include all temporary construction-related impacts as well as permanent wetland impacts.
[2] Operation impacts include only impacts associated with permanent conversion of wetland to non-wetland use.

As indicated in Table 2.1-2, existing open-water habitat areas (classified as EFH) within the CCLNG terminal project area total approximately 67.35 acres. During construction and operation, an additional 10.65 acres of open-water habitat (or EFH) will be created in the berthing area.

Table 2.1-2 Open Water Within the Corpus Christi Terminal Project Area		
Facility	**Existing Open Water Impacted (Acres)**	**New Open Water Created (Acres)**
CCLNG		
Berthing Area	67.35	10.65

2.2 CORPUS CHRISTI PIPELINE

Approximately six herbaceous wetlands were identified within the proposed Corpus Christi Pipeline project impact area. Table 2.2-1 identifies each wetland and the extent of construction (all temporary workspace, ATWS, and permanent easement impacts) and operation (permanent easement impacts) impacts within the Corpus Christi Pipeline project area. Approximately 1.356 acres of wetlands will be impacted by construction of the Corpus Christi Pipeline project. Of the 1.356 acres, 0.965 acre is classified as operational. However, after construction and restoration are completed, the 0.965 acre of wetlands will be allowed to revegetate within the operational area of the pipeline. There will be no permanent loss of wetlands due to the construction of the Corpus Christi Pipeline project.

Table 2.2-1 Wetlands Crossed by the Proposed Corpus Christi Pipeline Project							
Facility	**Wetland Identification[1]**	**Enter MP[2]**	**Exit MP[2]**	**Cowardin NWI Classification[3]**	**Construction Impacts (Acres)**	**Operation Impacts (Acres)**	**Permanent Conversion Wetland Impacts (Acres)**
Pipeline	WET A7	16.75	16.76	PEM1A	0.025	0.019	-
	WET A1	18.00	18.01	PEM1A	0.060	0.043	-
	WET A2	18.02	18.03	PEM1A	0.002	0.000	-
	WET A3	18.26 and 18.45	18.40 and 18.52	PEM1A	0.870	0.613	-
	WET A10	19.18	19.23	PEM1A	0.374	0.265	-
	WET A9	19.25	19.26	PEM1A	0.025	0.025	
	WET A8	Not Crossed	Not Crossed	PEM1A	-	-	-
	WET A4	Not Crossed	Not Crossed	PEM1A	-	-	-
Total					**1.356**	**0.965**	-

[1] Wetland Identification represents unique designations given to each wetland during field surveys.
[2] Mileposts are based on the latest line amendments as of April 30, 2004.
[3] Wetland Classification represents the wetland classes based on Cowardin, et al (1979) and are depicted as PEM = Palustrine Emergent
1 = Persistent
A = Temporarily Flooded

4 Construction impacts include temporary disturbance within the 120-foot construction work area ("CWA") and additional temporary workspaces ("ATWS").

5 Operation impacts include the 50-foot permanent easement. No wetlands will be impacted by aboveground facilities.

6 Permanent wetland impacts include all impacts that will result in permanent loss or conversion of wetland habitats as a result of placement of aboveground facilities (MLV, interconnects, meter stations, and permanent access roads).

In addition to wetlands, 10 waterbodies will be crossed by the proposed Corpus Christi Pipeline project. Table 2.2-2 identifies each waterbody crossed by the proposed pipeline.

Table 2.2-2
Waterbodies Crossed by the Proposed Corpus Christi Pipeline Project

Waterbody[1] (Field Designation)	Milepost	Stream Type[2]	Stream Designation[3]	State Water Quality Classification	Crossing Length (feet)	Surface Area Impact (acre)	Crossing Method
Drainage Ditch (A4)	1.4	C	Intermediate	N/A	35	0.10	Open Cut
Drainage Ditch (A5)	2.6	I	Intermediate	N/A	12	0.03	Open Cut
Drainage Ditch (A6)	4.9	I	Intermediate	N/A	20	0.06	Open Cut
Drainage Ditch (A7)	10.1	I	Minor	N/A	8	0.02	Bore
Drainage Ditch (B1)	12.6	I	Minor	N/A	10	0.03	Open Cut
Oliver Creek(A9)	16.8	P	Intermediate	N/A	15	0.04	Open Cut
Chiltipin Creek(A1)	18.0	P	Intermediate	N/A	18	0.05	Open Cut
Trib. to Chiltipin Creek(A2) Crossing 1	18.5	I	Minor	N/A	10	0.03[4]	Open Cut
Trib. to Chiltipin Creek(A2) Crossing 2	18.6	I	Minor	N/A	7	0.02	Open Cut
Trib. to Chiltipin Creek(A2) Crossing 3	18.7	I	Minor	N/A	5	0.01	Open Cut

1 Waterbody names are as depicted on USGS 7.5-minute topographic maps.

2 I=Intermittent, P=Perennial, as identified on the USGS 7.5-minute topographic maps.

3 Stream designation includes minor, intermediate, and major waterbodies crossed by the project. Minor waterbodies include all waterbodies less than or equal to 10 feet wide at the water's edge at the time of crossing; intermediate waterbodies include all waterbodies greater than 10 feet wide but less than or equal

to 100 feet wide at the water's edge at the time of crossing; and major waterbodies include all waterbodies greater than 100 feet wide at the water's edge at the time of crossing.

[4] Acreage for this creek crossing is accounted for in the Wetland A3 acreage impacts.

3.0 AQUATIC RESOURCE IMPACT ANALYSIS

3.1 CORPUS CHRISTI LNG TERMINAL

As indicated in Table 2.1-1, the proposed CCLNG terminal will temporarily impact approximately 12.35 acres of wetlands during construction. Of these, approximately 10.65 acres of wetlands will be permanently impacted. Cheniere's proposal to mitigate for aquatic resources impacted during the construction and operation phases of the CCLNG terminal is provided in Section 4.0, Aquatic Resources Mitigation. Below is a discussion of impacts as they relate to EFH within the proposed marine terminal.

The initial dredging of the berthing area will result in the alteration of EFH within existing open-water and wetland areas. However, the dredging will create additional EFH and aquatic habitat. The following proposed aquatic resources mitigation plan has been designed to offset any long-term or adverse impacts to the aquatic environment, including EFH. Please refer to Table 2.1-2 for an analysis of open water impacted or created by the proposed CCLNG terminal.

To minimize impacts to the aquatic environment, dredging of the berthing area will be accomplished by the use of "cutterhead" dredges, which will employ both mechanical and hydraulic means. The rotating cutterhead will displace the material to be dredged, and a suction pipe located directly behind the cutterhead creates a low-pressure field that pulls the material and water into the suction pipe, forming slurry. The slurry is pumped through the discharge pipe to a Dredged Material Placement Area ("DMPA"). Approximately 4,382,000 cubic yards of material will be dredged from the berthing area.

EFH found within the berthing area consists of tidally-influenced marsh (estuarine emergent wetlands), tidally-influenced waters (estuarine water column), and tidally-influenced water bottoms (estuarine mud bottoms).

Dredging associated with the berthing area will occur over approximately 67.35 acres of existing open-water habitat. According to NOAA Fisheries, this open-water area is considered to possess EFH described as tidally-influenced waters (estuarine water column), and tidally-influenced water bottoms (estuarine mud bottoms). These habitat types have been designated by NOAA Fisheries as EFH for post-larval, juvenile, and sub-adult life stages of brown shrimp, white shrimp, and red drum. Although increasing the depth will impact this open-water area, it will still remain as open-water habitat with a similar substrate type.

Dredging activities implemented to create the berthing area are also expected to permanently convert approximately 10.65 acres of tidally-influenced wetlands into open-water habitat. These tidally-influenced wetland areas are considered by NOAA Fisheries as EFH described as tidally-influenced marsh (estuarine emergent wetlands). This EFH habitat designation will be converted to tidally-influenced waters (estuarine water column) and tidally-influenced water bottoms (estuarine mud bottoms).

Initial dredging activities may result in temporary disturbances to EFH due to increased turbidity in the water column from fine materials resuspended during the dredging and consequent entrainment or burial of species (GMFMC, 1998). When using a cutterhead-type dredge, increases in suspended solids are typically restricted to the immediate area of the cutter due to material being cut but not sucked up by the dredge. This type of dredge is considered to produce less turbidity than other common dredge types, such as hopper and bucket dredges. Turbidity is most common near the bottom, and suspended solid concentrations decrease exponentially in the vertical water column. Thus, increased turbidity would likely be confined to the deeper water or the immediately adjacent water bottom of the La Quinta Channel, and not affect the surrounding shallow water areas of Corpus Christi Bay. If turbidity levels are increased within surrounding areas due to dredging, levels are not expected to exceed ambient conditions during natural disturbances.

Species with EFH in the La Quinta Channel that could be affected by initial dredging include post-larval, juvenile, and sub-adult life stages of brown shrimp, white shrimp, and red drum. Juvenile brown shrimp, white shrimp, and red drum typically utilize shallow water habitats. Although the aforementioned species may be impacted during dredging activities, they are considered to be motile during both juvenile and adult life stages and are highly capable of eluding adverse conditions. CCLNG's proposed mitigation plan for impacts to aquatic resource habitats that may harbor EFH within the CCLNG terminal berthing area is provided in Section 4.0, Aquatic Resources Mitigation.

3.2 CORPUS CHRISTI PIPELINE

As indicated in Table 2.2-1, the proposed Corpus Christi Pipeline project will temporarily impact approximately 1.356 acres of wetlands, of which approximately 0.965 acre occurs within the proposed permanent easement. However, these wetland impacts will not result in a net loss of wetland habitat since they will be restored to preconstruction contours and allowed to naturally revegetate, thereby restoring their natural function and value. As a result of the construction and operation of the proposed Corpus Christi Pipeline project, no wetlands will be permanently impacted.

As indicated in Table 2.2-2, 10 waterbodies will be crossed by the proposed Corpus Christi Pipeline project. Based on the field investigations, none of these waterbodies have been identified as containing potential EFH. All waterbodies will be crossed with the open-cut or bore method and will be restored to pre-construction status.

Although the various wetlands and waterbodies located within the proposed pipeline right-of-way may not be considered EFH, Corpus Christi Pipeline is committed to avoiding and minimizing impacts to the aquatic environment. All wetlands impacted by the proposed Corpus Christi Pipeline project will be considered for mitigation. Mitigation for impacted wetlands will either replace or restore the wetlands to their preconstruction functions and values. Corpus Christi Pipeline's proposed mitigation plan for impacts to wetlands resulting from the proposed Corpus Christi Pipeline project is provided in Section 4.0, Aquatic Resources Mitigation.

4.0 AQUATIC RESOURCES MITIGATION PLAN

4.1 CORPUS CHRISTI LNG TERMINAL

While reviewing the potential construction locations for the CCLNG project, Cheniere considered a variety of environmental constraints, including aquatic resource impacts. During the planning phase of the terminal facility, it was Cheniere's intent to avoid aquatic resources to the maximum extent practicable. As such, the proposed location of the terminal and berth is situated primarily in an industrial area and in a manner that minimizes impacts to aquatic resources and EFH to the maximum extent practicable. Although the proposed CCLNG terminal cannot avoid all aquatic resources located within the proposed CCLNG terminal area, impacts have been minimized to the greatest extent possible, and compensatory mitigation is proposed to offset the unavoidable impacts to aquatic resources.

4.1.1 ALTERNATIVES ANALYSIS

Five mitigation scenarios were considered in this alternatives analysis, and relative merits were discussed with representatives from NOAA Fisheries, Texas Parks and Wildlife Department ("TPWD"), U.S. Fish and Wildlife Service ("USFWS"), Texas General Land Office ("GLO"), and the USACE. The five scenarios considered by Cheniere are:

- On-site Mitigation – Mitigation sites associated with this option have been determined to be partially to mostly vegetated. The opportunity to enhance these areas exists; however, based on expected mitigation ratios, there is simply not enough area on-site to implement an appropriate mitigation plan.

- Goose Island State Park – Goose Island is located on Lamar Peninsula at the north end of Aransas Bay, approximately 15 miles from the CCLNG facility. TPWD has identified the protection of natural resources at Goose Island a priority and has expressed a need for funding. The mitigation plan for this alternative would include the design and construction of a 4,400-foot rock breakwater that would protect existing seagrass and coastal marsh habitat while creating new protected areas.

- Aransas Pass City Park – This alternative includes the creation of additional habitat at the Aransas Pass City Park, which is approximately 8 miles from the proposed facility. This option was subsequently eliminated from consideration due to other plans that the City of Aransas Pass has for the area.

- Nueces Bay Bird Islands – Colonial waterbird islands in Nueces Bay have been stabilized with the installation of riprap and geotextile tubes. This alternative focuses on the enhancement of these islands with habitat diversity and structure. This site is located approximately 30 miles from the proposed facility. This option was subsequently eliminated from consideration due to relatively poor access and because mitigation benefits were more "out-of-kind."

- Shamrock Island – This is the current mitigation site for the federal Packery Channel dredging project. The opportunity for additional restoration efforts has been identified and it is known that the Packery Channel project will not produce adequate funds to meet all of the proposed restoration plans. Preliminary restoration plans have been developed and are awaiting sufficient funds for design and construction. Plans include the installation of a rock breakwater that would allow a set acreage of submerged aquatic vegetation to establish within the area. Shamrock Island is located south of La Quinta Channel, in Corpus Christi Bay, approximately 8 miles from the CCLNG facility.

Cheniere has selected the Shamrock Island alternative as the preferred mitigation. Contributing factors to the decision to use Shamrock Island were its proximity to the site, value as one of the most important bird rookery islands located on the west side of Padre Island in Corpus Christi Bay, adequate mitigation area provided to meet the needs of the proposed CCLNG project, and the impending risk of loss of habitat at Shamrock Island if preservation efforts are not implemented in the near future.

4.1.2 SHAMROCK ISLAND CONCEPTUAL WETLAND MITIGATION PLAN

Based on the current wetland delineation as prepared by PBS&J on June 7, 2004, and accepted by the USACE on July 15, 2004 (D-16153), the proposed terminal will temporarily impact a total of 12.35 acres of wetlands, of which 10.65 acres will be impacted permanently (Table 2.1-1).

In order to mitigate for the unavoidable 10.65 acres of permanent wetland impacts, CCLNG proposes to mitigate for the wetlands with wetlands creation and preservation at Shamrock Island. Additionally, since the project construction schedule will occur over a two- to three-year timeframe, CCLNG is proposing to mitigate for all wetland impacts, temporary and permanent, at the same time. The proposed mitigation will compensate for any temporary loss of wetland function and value as well as any permanent impacts to the aquatic resources. Once the mitigation is completed, there will be a net gain of wetland function or value in Corpus Christi Bay.

Shamrock Island is located along the eastern shoreline of Corpus Christi Bay, Texas, approximately 2 miles west of Mustang Island. The island interior is uninhabited and is a complex mosaic of lagoons and wetlands. The island serves as an important rookery to a number of nesting bird species, in particular, the royal tern. It is Cheniere's belief that through wetland mitigation at Shamrock Island, wetlands will not only be protected and preserved, but there will also be additional wetland habitat created.

4.1.2.1 History

Shamrock Island formed as a series of spits that were connected to Mustang Island. A number of navigation channels were dredged in the 1950's, which severed the "land bridge" that connected the main spit to land. Erosion of the land bridge by Hurricane Celia in 1970 further dissected the island, and as a result of the detachment from Mustang Island, there is no significant sediment source for the island. This lack of sand has caused beach erosion and loss of wetlands along the northern end of the island as sand from the north continues to be transported to the south. The continued erosion of this island will diminish vital bird nesting habitat.

In 1998, a shoreline stabilization project was implemented to address the continued erosion and to stabilize the northern portion of the island. Components of this project included the installation of an offshore geotextile tube ("GT") breakwater that connected to the northwestern shoreline and continued around to the northeastern tip of the island. A feeder beach was constructed where the GT connected to the island in order to provide a continued sand supply to the southern beaches. In the lee of the breakwater, a marsh restoration project was implemented.

The feeder beach constructed in 1998 has reached its design life of five years. In addition, some of the GT's have been damaged, which has resulted in less protection of the island. The need to further protect the island and the requirement for mitigation as a result of the USACE nearby project at Packery Channel have resulted in the current Shamrock Island Habitat and Enhancement Project, and the formation of a team of representatives from the Coastal Bend Bays & Estuary Program, Inc. ("CBBEP"), The Nature Conservancy ("TNC"), GLO, TPWD, USFWS, and the Environmental Protection Agency ("EPA") (the Team).

The Shamrock Island Habitat and Enhancement Project initially identified and prioritized the needs for the island. The needs are as follows:

1. Protect the area where most damage is occurring based on predominant wave action (middle reach numbered 10-15).

2. Protect northern reach (numbered 16-25) to protect potential loss of northern end of island and critical habitats.

3. Protect southern reach (numbered 1-9) to protect potential breach of island and impact on protected lagoon.

4. Beach nourishment at two locations to act as feeder beaches and create additional tern habitat.

Due to budgetary constraints, it has been determined that the Packery Channel mitigation effort will address only the first priority identified. This first priority consists of the construction of a series of six low-crested detached rock breakwaters (numbered 10-15, see Attachment A, Figure 1). The primary goals for these breakwaters are:

- Facilitate the vegetative recruitment of approximately 15.6 acres of submerged aquatic vegetation ("SAV").
- Help stabilize the northern shoreline of Shamrock Island.
- Protect habitat and the ecological function of Shamrock Island

Final design stages of the project are currently underway, and construction is anticipated for Fall 2005 after the next bird nesting season.

On August 18, 2004, a meeting was held with the USACE, TPWD, USFWS, and NOAA Fisheries to discuss the option of mitigating at Shamrock Island for Cheniere's CCLNG project. The agencies decided that they would seriously consider a mitigation plan for Shamrock Island in lieu of on-site mitigation for CCLNG. However, it was decided that in order to quantify the potential mitigation sites at Shamrock Island, Cheniere would have to update the existing habitat characterization summary.

4.1.2.2 Habitat Characterization Summary

In order to develop the CCLNG conceptual mitigation plan, CCLNG referenced a preliminary habitat characterization for Shamrock Island, conducted in October 2002. Due to the limited nature of this assessment, as well as the time between the assessment and the current project, the agencies requested an update of the 2002 habitat characterization, as previously mentioned.

In June 2004, a site visit to Shamrock Island with representatives of CBBEP, USFWS, and TPWD was conducted. The island was not accessed so as to minimize the disturbance of nesting birds. Instead, observations were performed from a safe distance offshore. Existing conditions, in conjunction with the previously collected habitat data, were documented on an aerial photograph taken in June 2004 (Attachment A, Figure 2). This recent aerial photograph also served as a tool to extrapolate additional pertinent habitat information about the island.

The general characterizations indicated in Attachment A, Figure 2, should provide sufficient information for understanding the current habitats. Upon completion of the bird nesting season in early September 2004, a detailed habitat survey will be performed. This survey will also allow for a "ground-truthing" of the habitat currently present, as well as a more accurate estimate of the habitat that could occur as a result of the placement of the proposed breakwaters or other future project features. The following mitigation plan is based on the characterization provided in Attachment A, Figure 2.

4.1.2.3 CCLNG Conceptual Mitigation Plan

To continue the Shamrock Island Habitat and Enhancement Project, CCLNG proposes to construct the remaining breakwaters (numbered 16-25) bordering the northern end of Shamrock Island (Attachment A, Figure 1). This additional protection will create a sheltered area of approximately 16.76 acres of potential SAV habitat. In addition to this habitat creation, 19.04 acres of existing SAV habitat will be preserved, as well as 13.48 acres of marsh and 4.62 acres of adjacent uplands. The construction of the additional 10 breakwaters will also create 0.83 acre of submerged hard substrate (Table 4.1-1).

If this mitigation is not found to be sufficient, the next priority includes additional breakwaters to the south of the Packery Channel breakwaters (numbered 5-9) (Attachment A, Figure 1). These breakwaters will create an additional 9.75 acres of SAV habitat and preserve an additional 25.00 acres of SAV habitat, 2.00 acres of smooth cordgrass (*Spartina alterniflora*), 0.25 acre of mangroves, 1.00 acre of unvegetated tidal flats, 20.00 acres of marsh, and 10.00 acres of uplands. The construction of the additional five breakwaters will also create an additional 0.41 acre of submerged hard substrate (see Table 4.1-1).

The combination of breakwaters numbered 16-25 and numbered 5-9 creates 26.51 acres of SAV habitat and 1.24 acres of submerged hard substrate. It also preserves 44.04 acres of SAV, 2.00 acres of smooth cordgrass, 0.25 acre of mangroves, 1.00 acre of unvegetated tidal flat, 33.48 acres of marsh, and 14.62 acres of uplands (see Table 4.1-1).

The creation and preservation of these habitats will help offset potential impacts to EFH found within the berthing area in the tidally-influenced marsh (estuarine emergent wetlands), tidally-influenced waters (estuarine water column), and tidally-influenced water bottoms (estuarine mud bottoms).

If bids come in lower than expected or more funds are available for construction for the Packery Channel mitigation project, additional breakwaters numbered 1-4 could be constructed from north to south. The addition of these four breakwaters would add 1.89 acres of SAV habitat and preserve an additional chunk of the island. The construction of the breakwaters will also create 0.33 acre of submerged hard substrate.

Table 4.1-1
Mitigation Requirements and Proposed Created and Preserved Habitat Areas

[illegible] MITIGATION PLAN (CONSTRUCTION OF NORTH REACH BREAKWATERS [illegible])

HABITAT TYPE	CC LNG IMPACTS	ASSUMED MITIGATION RATIO	REQUIRED MITIGATION	PROPOSED CREATED MITIGATION	ADDITIONAL PRESERVED HABITATS	TOTAL CREATED AND PRESERVED HABITAT
Submerged aquatic vegetation (SAV)	5.99	3:1	17.97	16.76	19.04	35.8
Smooth Cordgrass (Spartina)	2.76	2:1	5.52			
Mangroves	2.01	3:1	6.04			
Unvegetated tidal flats	0.45	1:1	0.45			
Vegetated tidal flats	1.14	1:1	1.14			
Hard substrate		na	0	0.83		0.83
Marsh					13.48	13.48
Uplands					4.62	4.62

[illegible] MITIGATION PLAN (CONSTRUCTION OF SOUTH REACH BREAKWATERS [illegible])

HABITAT TYPE	CC LNG IMPACTS	ASSUMED MITIGATION RATIO	REQUIRED MITIGATION	PROPOSED CREATED MITIGATION	ADDITIONAL PRESERVED HABITATS	TOTAL CREATED AND PRESERVED HABITAT
Submerged aquatic vegetation (SAV)	5.99	3:1	17.97	9.75	25	34.75
Smooth Cordgrass (Spartina)	2.76	2:1	5.52		2	
Mangroves	2.01	3:1	6.04		0.25	
Unvegetated tidal flats	0.45	1:1	0.45		1	
Vegetated tidal flats	1.14	1:1	1.14			
Hard substrate		na	0	0.41		0.41
Marsh					20	20
Uplands					10	10

[illegible] MITIGATION PLANS (CONSTRUCTION OF NORTH REACH BREAKWATERS [illegible] AND SOUTH REACH [illegible])

HABITAT TYPE	CC LNG IMPACTS	ASSUMED MITIGATION RATIO	REQUIRED MITIGATION	PROPOSED CREATED MITIGATION	ADDITIONAL PRESERVED HABITATS	TOTAL CREATED AND PRESERVED HABITAT
Submerged aquatic vegetation (SAV)	5.99	3:1	17.97	26.51	44.04	70.55
Smooth Cordgrass (Spartina)	2.76	2:1	5.52	0	2	0
Mangroves	2.01	3:1	6.04	0	0.25	0
Unvegetated tidal flats	0.45	1:1	0.45	0	1	0
Vegetated tidal flats	1.14	1:1	1.14	0	0	0
Hard substrate		na	0	1.24	0	1.24
Marsh				0	33.48	33.48
Uplands				0	14.62	14.62

4.1.3 Dredged Material Placement Area Plan

The CCLNG terminal drawings provided as Attachment B, Figures 1-17 illustrate the berth layout, including dredging limits, side slopes, and elevations. Approximately 4,382,000 cubic yards of material will be dredged from the berth area. Dredging will be accomplished by the use of "cutterhead" dredges, which employ both mechanical and hydraulic means. The rotating cutter will displace the material to be dredged, and a suction pipe located directly behind the cutterhead creates a low-pressure field that pulls the dredged material and water into the pipeline and into the discharge pipe. Raising and lowering the cutterhead will control the depth of cut. Two spuds will be located at the aft of the vessel, one each on the port and starboard. These spuds will work in tandem with two forward cables, as well as with one each on the port and starboard sides. The cables will be anchored away from the vessel and connected to winches. The winches will be used to alternate pulling the front of the barge on the port and starboard sides. By alternating which spud is lowered into the bottom, the barge can step forward into the cut and advance on the dredging area.

Cutterhead dredges are sized by their pipeline discharge diameter, which normally ranges from 6 to 34 inches. Dredge size currently is unknown; however, because of the size of the project and projected pumping distances, dredge size is anticipated to be between 20 and 30 inches in discharge pipeline diameter. All cutterhead dredges have a centrifugal pump to create the pressure field and move the dredged slurry through the pipeline. In addition, the cutterhead will have a separate power plant to turn the mechanical cutter. Cutter horsepower (hp) normally ranges between 200 to 700 hp, and the pump horsepower can range from 2,000 to over 10,000 hp. Some dredges are equipped with submerged pumps that are located on the ladder that supports the cutterhead. The submerged pump provides additional efficiency to the pumping process. Submerged pumps can range from 300 to 600 hp.

During the dredging operation, potential effects on water quality may include a temporary decrease in water quality from increased turbidity surrounding the hydraulic cutterhead of the dredge, as well as around the mixing zone where the water from the dredging activities reenters the Gulf. Although there will be a temporary increase in turbidity, the effects of this turbidity are expected to be short-term and will return to background levels a short distance from the point of disturbance. Other than turbidity surrounding the dredge, no other water quality impacts are anticipated.

Preliminary Disposal Materials Placement Area Plan

Most of the material dredged to create the marine basin will be used to cap the existing bauxite residue storage beds located on the property owned by Alcoa, Inc., within the proposed CCLNG terminal, and immediately north of the terminal property. Please refer to the enclosed DMPA figure (Attachment C, Figure 1). Two beds (Beds 22 and 24) and the "V-ditch" will first be filled and capped using this material. An area known as Facility 200 has an area of 385 acres and sufficient capacity to accept the remainder of the dredged material.

Cheniere Facility	Alcoa Facility	Acreage	Distribution of Dredge Material (cubic yards)
DMPA 1	Bed 22	45	1.2 MM
	Bed 24	28	
	V- Ditch	8	
DMPA 2	Facility 200	200-385	3.2 MM

The filling and capping of Beds 22 and 24 will be part of a Texas Risk Reduction Program ("TRRP") closure plan due to concentrations of arsenic in the ground water at the Bed 22 area that exceed applicable risk-based standards. In November 2003 the Affected Property Assessment was conducted by Alcoa and approved by Texas Commission on Environmental Quality ("TCEQ"). Currently, Alcoa is in the process of developing a Response Action Plan ("RAP"). The RAP will propose the manner in which Alcoa will address the groundwater contamination at Bed 22. In the context of the CCLNG project, the Bed 22 area will be covered with dredged material that will act as an infiltration barrier. The other component of the RAP will be the development of a Plume Management Zone ("PMZ"), a regulatory mechanism that will allow for management of the groundwater plume through modeling and groundwater monitoring.

Additionally, Alcoa has conducted extensive analyses of the bauxite residue at the site. These data indicate that the residue is a non-hazardous, Class 2 industrial solid waste according to the waste classification system currently used in the state of Texas. The bauxite residue and the waste management units utilized for disposal have been registered with the TCEQ on Reynolds Metals Company's industrial soil waste, Notice of Registration ("NOR") No. 32027. Two Class 1 wastes that have been placed in Bed 22 have also been characterized. However, no hazardous wastes have been placed in Bed 22, 24, or Facility 200.

Alcoa has discussed the concept of placing the dredged material from the CCLNG facility construction on bauxite residue Beds 22, 24, and Facility 200 with the lead state agency (TCEQ). Alcoa has submitted two permit applications to TCEQ to authorize the placement of the dredged material and subsequent discharge of dredge decant water (TCEQ Sludge Disposal Permit No. 03966 and TCEQ TPDES Wastewater Discharge Permit No. 04606).

The following site improvements would be required in order for the dredged material to be placed in DMPA1 and DMPA2:

X Raise the existing levee elevations to provide adequate freeboard, ponding depth, and residence time during dredging operations.

X Regarding the existing side slopes in DMPA2 to reduce existing slopes and enhance dike stability.

X Install decant weir boxes to provide a means for controlling ponding depth and for managing the discharge of dredge decant water.

The material to be dredged is composed of mostly virgin stiff clays with interbedded sand and silty layers. Dispersion rates of suspended sediments in the bay are expected to be minimal, and turbidity control methods are not expected to be required based on the following factors:

X The materials to be dredged are primarily stiff clays with some sandy deposits. These types of soils typically do not create high turbidity levels during dredging.

X The dredging will be performed with a hydraulic cutterhead dredge, which generally creates less turbidity than other types of dredges (i.e., mechanical bucket or hopper dredges).

X With a cutterhead dredge, the cutter speed can be adjusted to match the sediment properties, thus minimizing turbidity.

Considering the hydraulic characteristics of the site and the depth of excavation, most of the sediment that does become suspended during the dredging process is expected to settle within the dredging footprint as opposed to migrating to adjacent areas.

DMPA Plan Benefits

A primary benefit associated with the proposed project results from the creation of additional open bay habitat from the proposed dredging activities. An additional 10.65 acres of open water habitat will be created during the excavation and dredging of upland and marsh areas to a depth of minus 42 feet msl. This new habitat has the capacity to function as EFH for various marine species. Additionally, the bauxite pits to be filled will assist Alcoa in capping the beds as part of the TRRP closure plan. Once the beds are capped, the area will be vegetated with native species, increasing wildlife habitat within the area. Furthermore, the vegetative cover will lead to positive dust control from the site to the surrounding project vicinity. Lastly, the capping of the beds will increase the visual aesthetics of the project vicinity.

Maintenance Dredging

In April 2003, the Environmental Impact Statement for the Corpus Christi Ship Channel ("CCSC") widening and deepening project stated that the USACE estimates approximately 28 million cubic yards will be dredged during the 50-year maintenance life of the La Quinta Ship Channel ("LQSC"). This will require the USACE to perform maintenance dredging every five to seven years within the LQSC. Maintenance dredging of the CCLNG berth will be conducted on an as-needed basis, but will most likely take advantage of the dredge contracted by the USACE.

All maintenance dredging locations will be limited to the footprint of the original dredged area. Based on shoaling rates projected for the federal channel, 25,000 to 40,000 cubic yards/year of shoaling could be expected. All dredge material will be placed in the Alcoa/Reynolds Metals DMPA2.

4.2 CORPUS CHRISTI PIPELINE

The regional ecosystem of south Texas is predominantly agricultural fields and upland scrub/shrub habitat. During the pipeline routing analysis, the pipeline was routed along existing pipeline corridors in an attempt to minimize impacts to wetlands or other Waters of the U.S., and avoid residential areas and other existing land uses to the greatest extent practicable.

During the routing analysis, Corpus Christi Pipeline considered various ways to minimize impacts to wetlands, of which construction techniques, right-of-way width, and placement of the pipeline provided the greatest chance of minimizing impacts. As a result of evaluating various wetland construction techniques, Corpus Christi Pipeline has proposed to utilize conventional open-cut technology since the soil consistency in this region can support heavy equipment while still minimizing impacts to the environment. With this technique, the pipeline trench is excavated with backhoe equipment and the soil is temporarily side cast to allow the pipe to be installed. During the trench excavation activities, the topsoil, or upper 12 inches, is separated from the subsoil to protect the seed source found in the topsoil. During the backfilling of the trench, the subsoil is placed first in the trench and the topsoil is placed back on top of the trench to facilitate increased restoration success of the pipeline right-of-way. If soils are saturated but can still support construction equipment, wood mats are placed along the right-of-way to support the equipment and further minimize impacts to the soil.

Based on the results of the planning process, field surveys, and agency correspondence, Corpus Christi Pipeline identified a route that will temporarily impact 1.356 acres of wetland habitat. However, the wetlands that will be impacted are expected to recover rapidly with proper construction and restoration techniques. Ten stream crossings were identified along the route, and all stream crossings will be restored to pre-construction contours and elevations.

During the field review and discussions with the agencies, Corpus Christi Pipeline agreed to implement best management practices during construction and has agreed to the following aquatic resources mitigation plan to minimize unavoidable wetland impacts associated with the proposed pipeline:

- Segregate the topsoil or upper 12 inches of soil during construction and replace the spoil in the order it was removed.

- Restore the Corpus Christi Pipeline project area to its pre-construction contours and elevations.

- Chip or remove all woody vegetation within wetlands (or burn the debris in upland areas).

- Allow the Corpus Christi Pipeline project area to revegetate naturally unless after one year the Corpus Christi Pipeline project area or portions of the Corpus Christi Pipeline project area are not regrowing with at least 50 percent regrowth. If the Corpus Christi Pipeline project area is not recovering, Corpus Christi Pipeline will replant or seed the work area or portion of the work area until the project area exhibits a minimum of 80 percent recovery as compared to an undisturbed area adjacent to the Corpus Christi Pipeline project area.

- Submit monitoring reports beginning after the first year following restoration with subsequent reports provided every six months until 80 percent recovery is achieved.

5.0 CONCLUSION

As a result of the alternatives analyses and field surveys, CCLNG and Corpus Christi Pipeline believe that the terminal and pipeline facilities are located in a manner such that aquatic resource impacts are avoided and/or minimized to the maximum extent practicable. However, because the CCLNG terminal and Corpus Christi Pipeline project facilities are located in the coastal zone of Texas, a region that is dominated by aquatic habitat, some impacts to these communities are unavoidable.

In order to compensate for the aquatic resource impacts associated with the CCLNG Terminal and Corpus Christi Pipeline projects, CCLNG and Corpus Christi Pipeline are proposing mitigation via restoration of temporarily impacted aquatic resources (on both the terminal and pipeline), and by creating and preserving tidally-influenced aquatic resources at Shamrock Island.

Appendix A

Shamrock Island

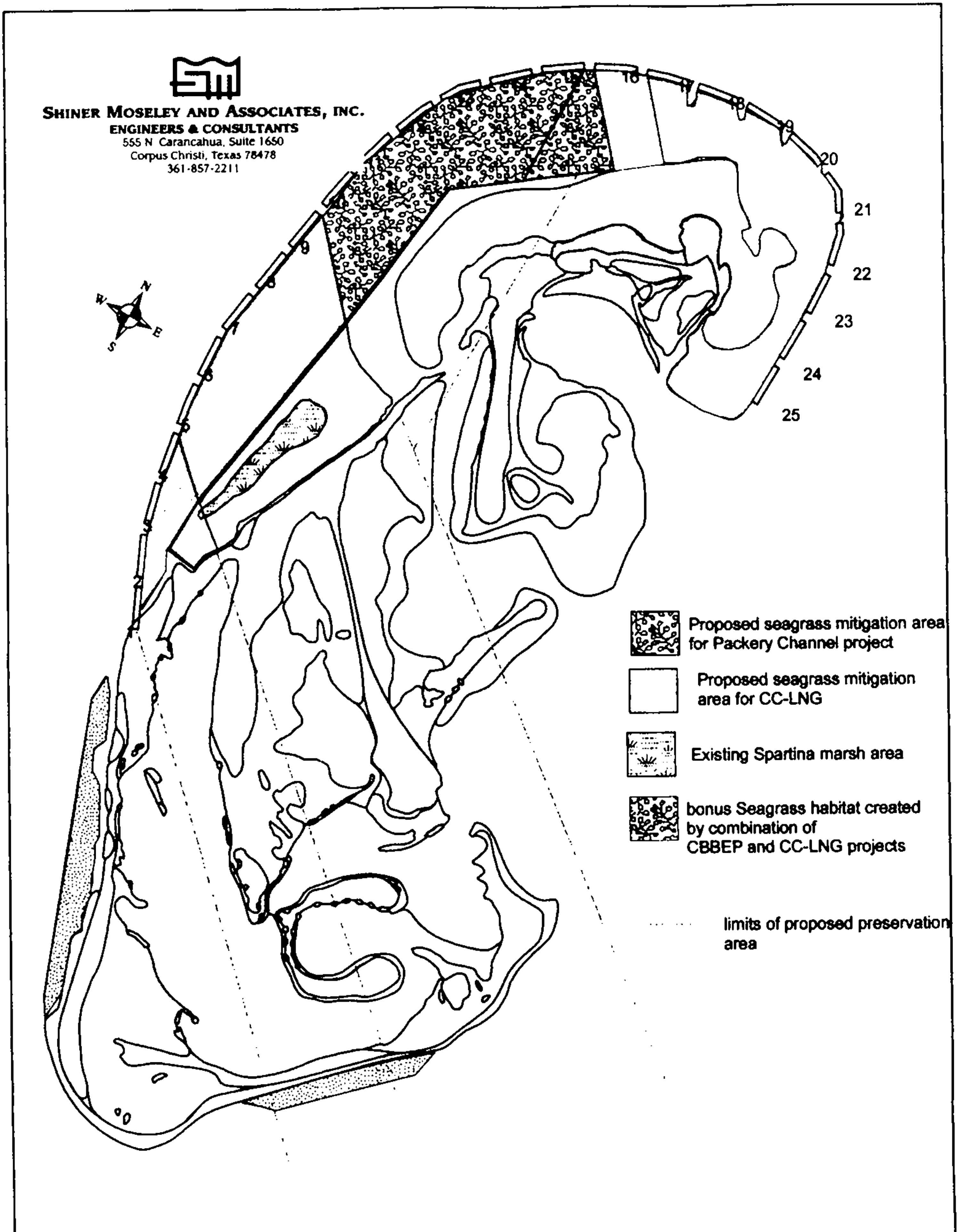
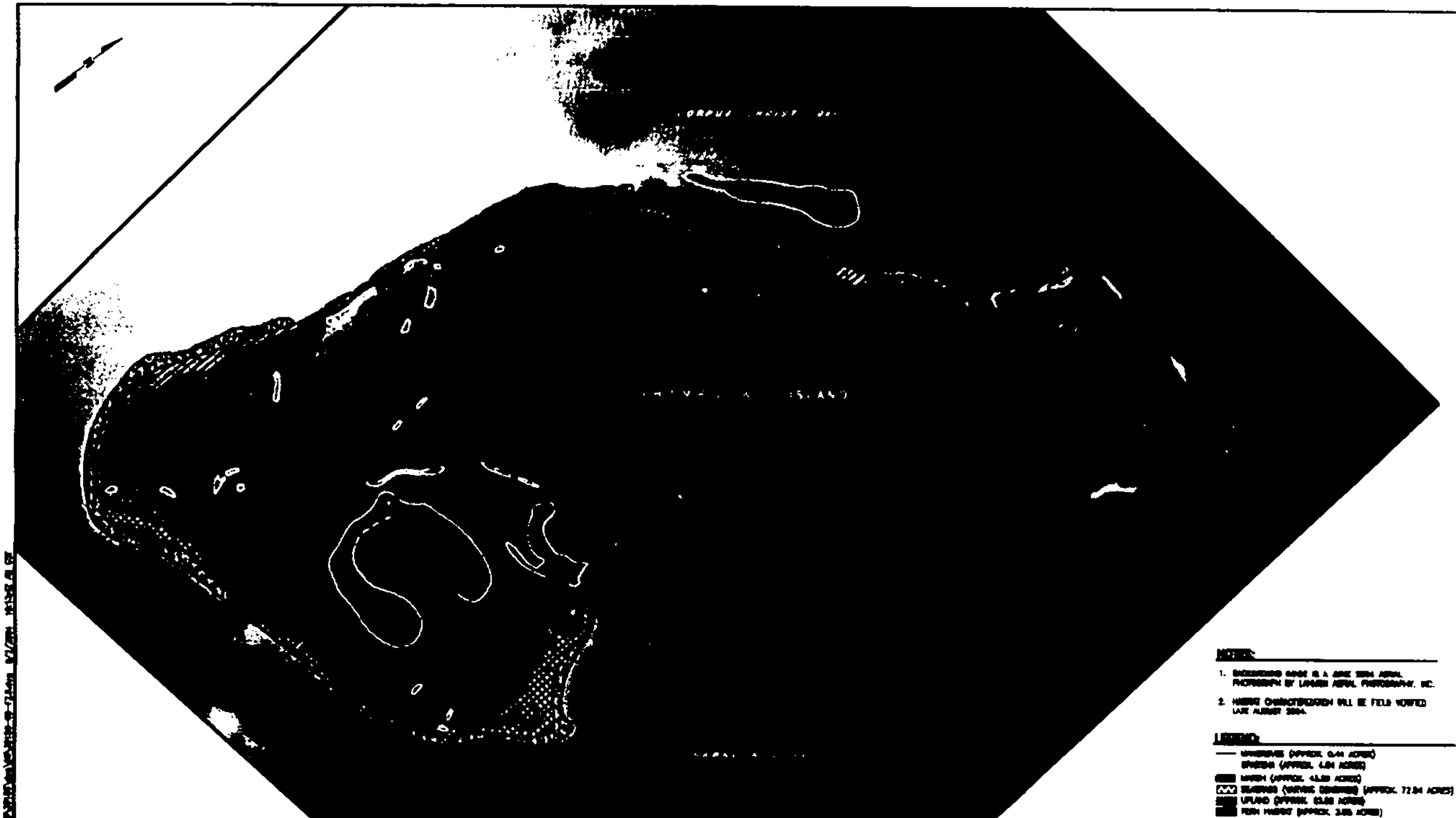


FIGURE 1

C:\Transfer\Projects\CCLNG\Shamrock Mitigation\Cheniere - CC-LNG Mitigation options



HABITAT AREAS

SMA JOB NO.: 200.30156

COASTAL BEND BAYS & ESTUARIES PROGRAM

HABITAT AREAS

SHAMROCK ISLAND

FIGURE 2

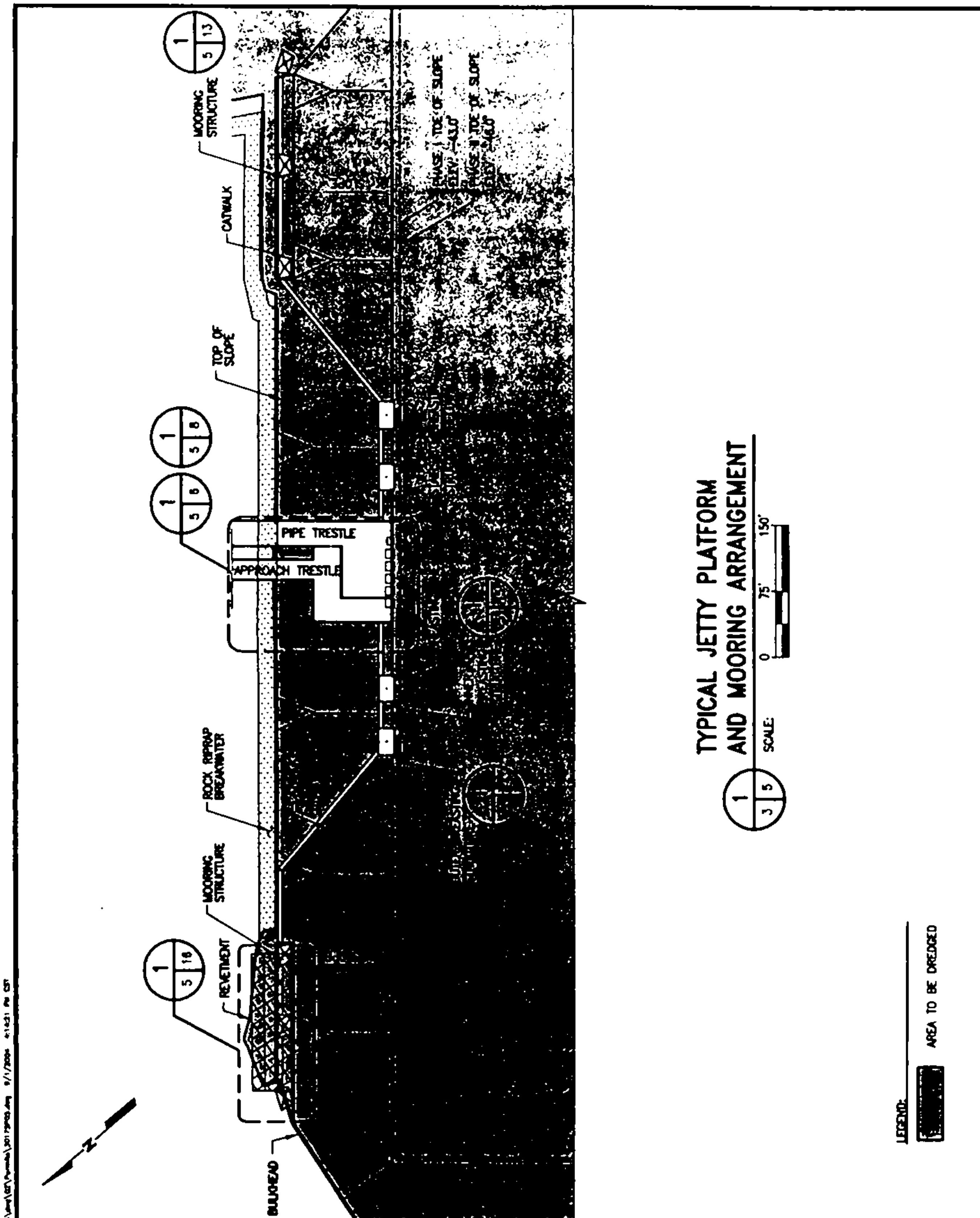
Non-Internet Public

Appendix D (subsection appendix B)
Maps – Sheets 1 through 4 of 17

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov

Appendix B

CCLNG Terminal Drawings



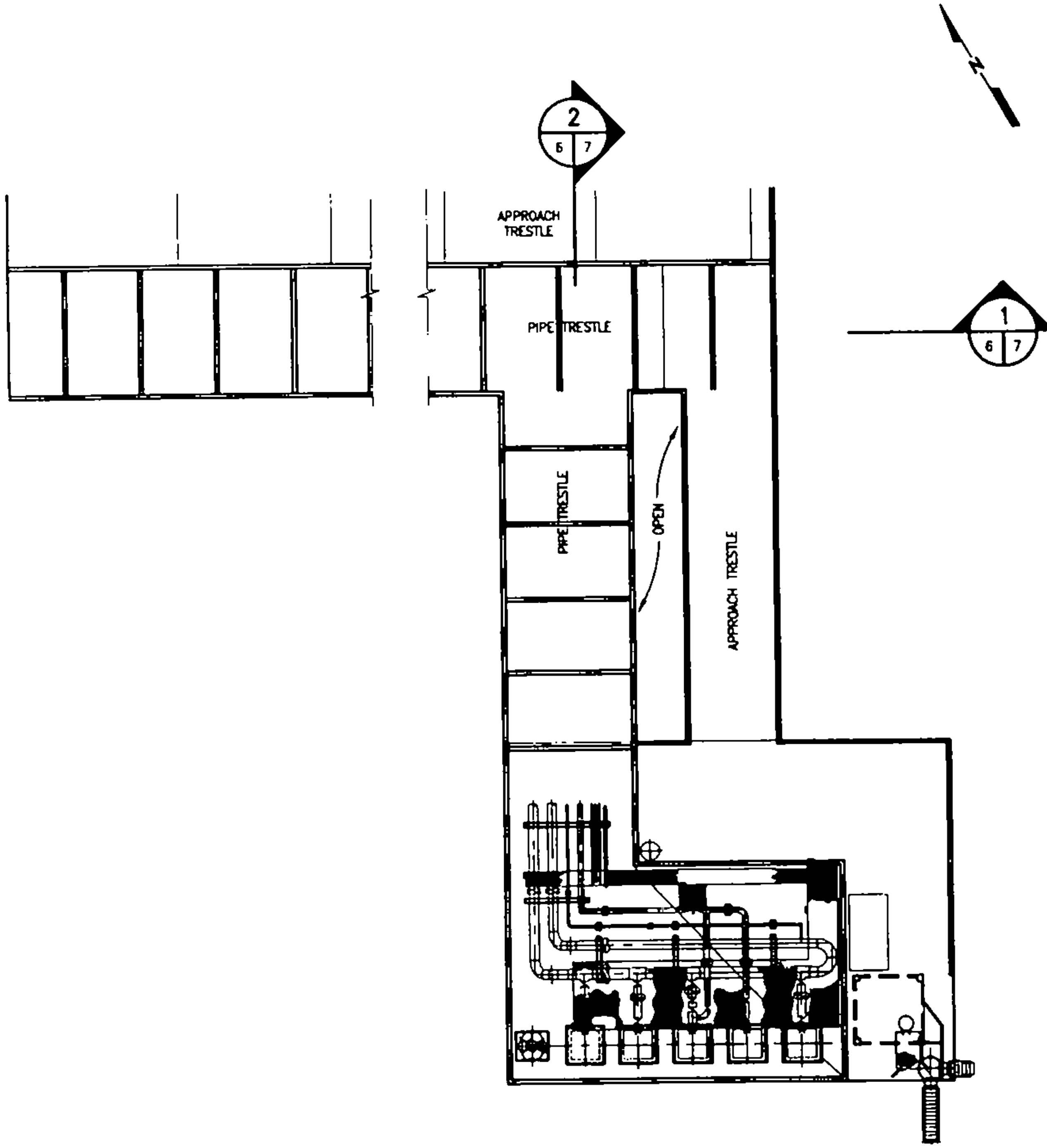
ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)

APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29

DATE: 06/04 REV. DATE: 08/04

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

SMA Job No: 200.30175.02 SHEET 5 of 17



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5 6

ENLARGED PLAN - EAST JETTY PLATFORM, APPROACH & PIPE TRESTLES

SCALE: 0 20' 40'

ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)

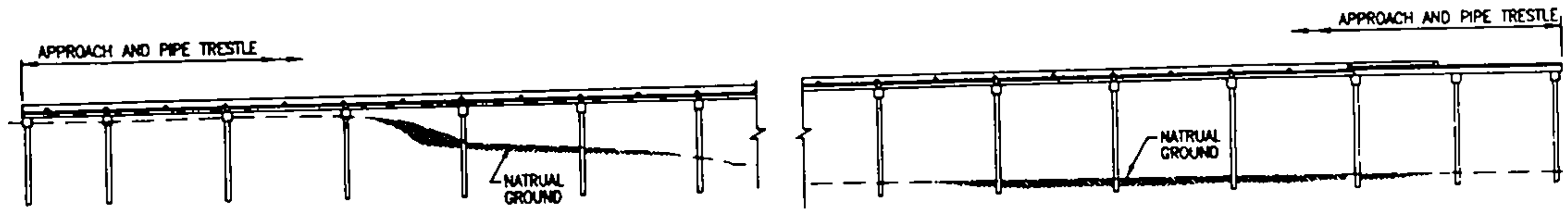
APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29

DATE: 06/04 REV. DATE: 08/04

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS

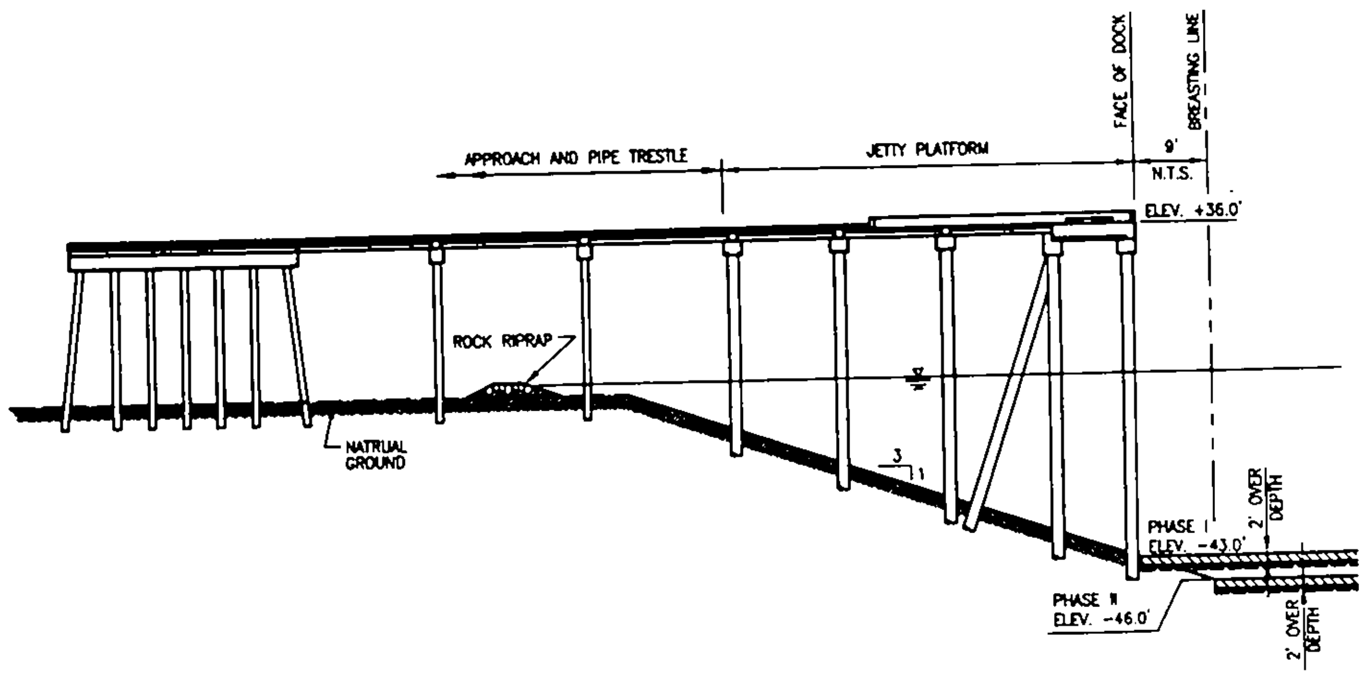
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

SMA Job No: 200.30175.02 SHEET 6 of 17



1 (6 | 7) EAST APPROACH AND PIPE TRESTLE SECTION

SCALE: N. T. S.



2 (6 | 7) EAST APPROACH AND PIPE TRESTLE SECTION

SCALE: 0 20' 40'

ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)

APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29

DATE: 06/04 REV. DATE: 08/04

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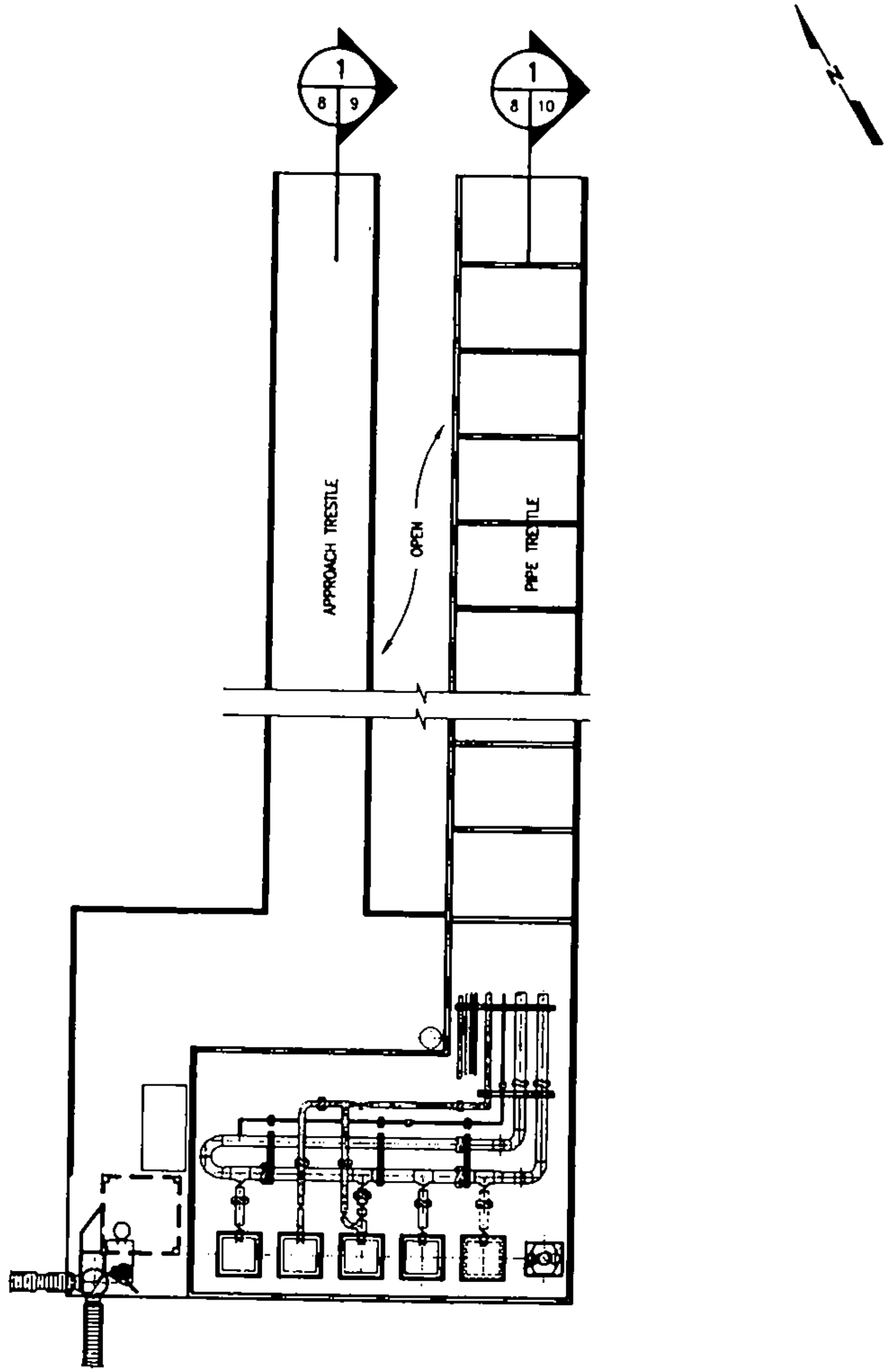
SMA Job No: 200.30175.02 SHEET 7 of 17



ENLARGED PLAN – WEST JETTY PLATFORM, APPROACH & PIPE TRESTLES

1
5 | 8

SCALE: 0 20' 40'

ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)

APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29

DATE: 06/04 REV. DATE: 08/04

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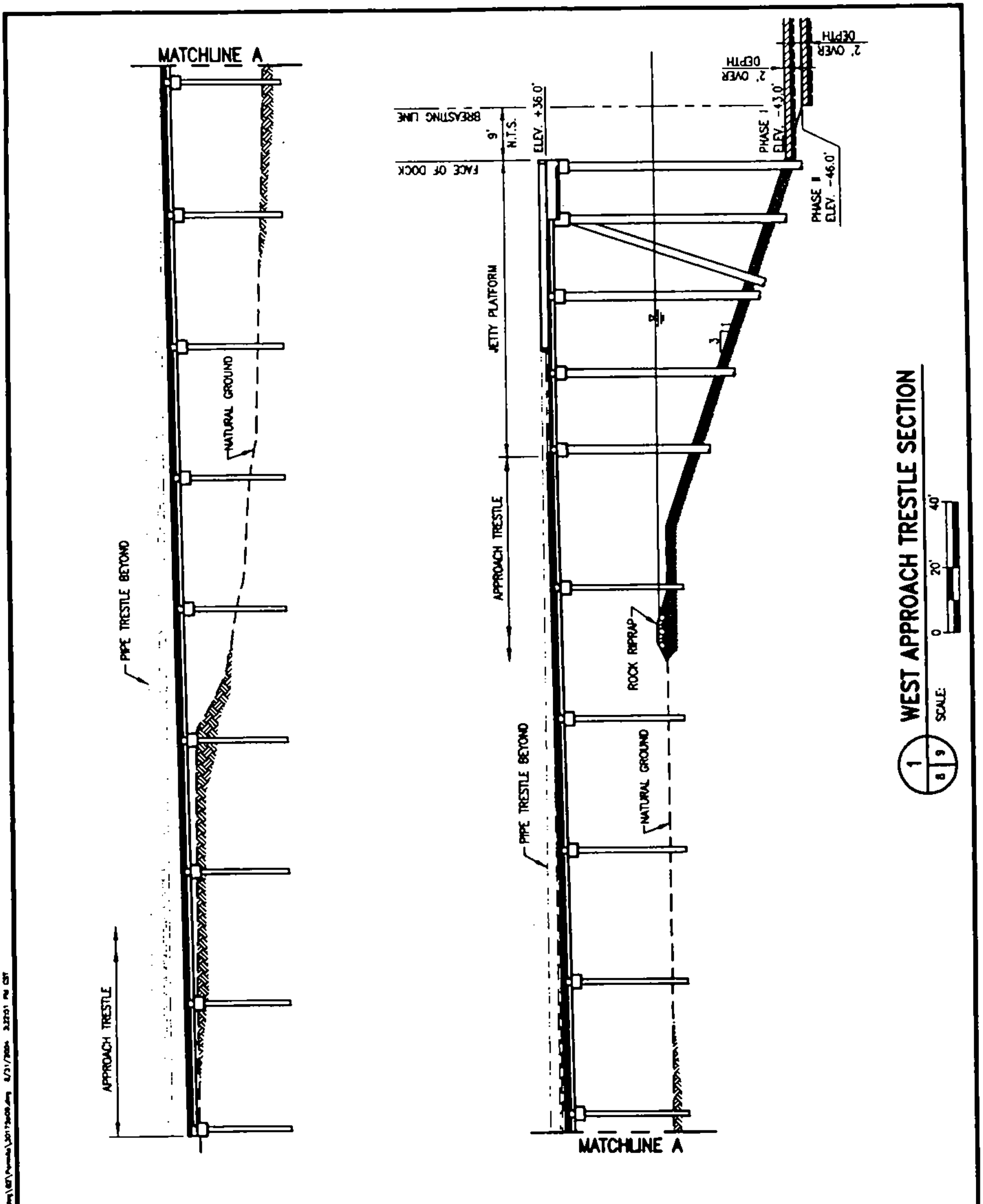
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

SMA Job No: 200.30175.02 SHEET 8 of 17



ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS 555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29	
DATE: 06/04 REV. DATE: 08/04	SMA Job No: 200.30175.02 SHEET 9 of 17

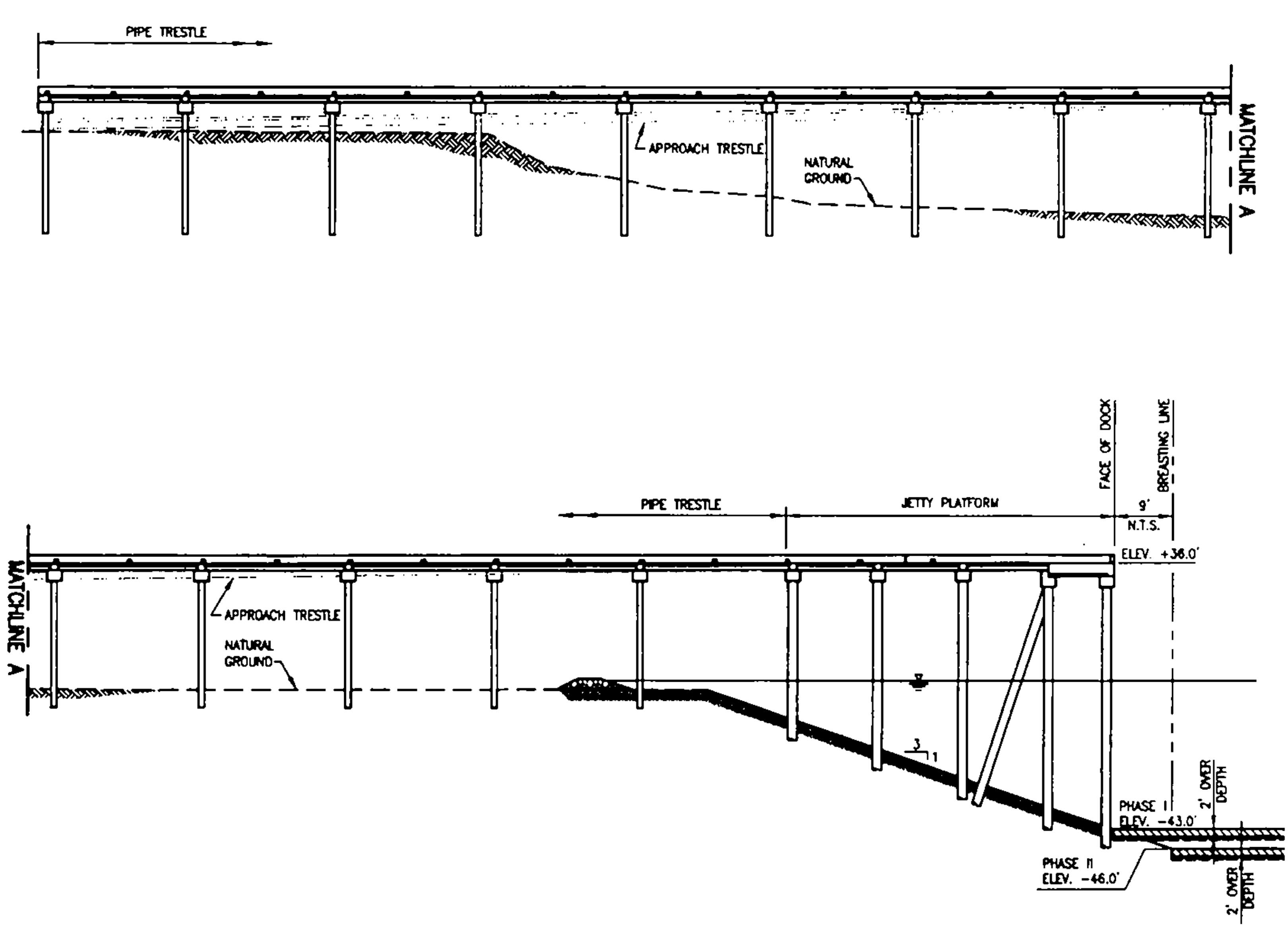
ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)

APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29

DATE: 06/04 REV. DATE: 08/04

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

SMA Job No: 200.30175.02 SHEET 10 of 17



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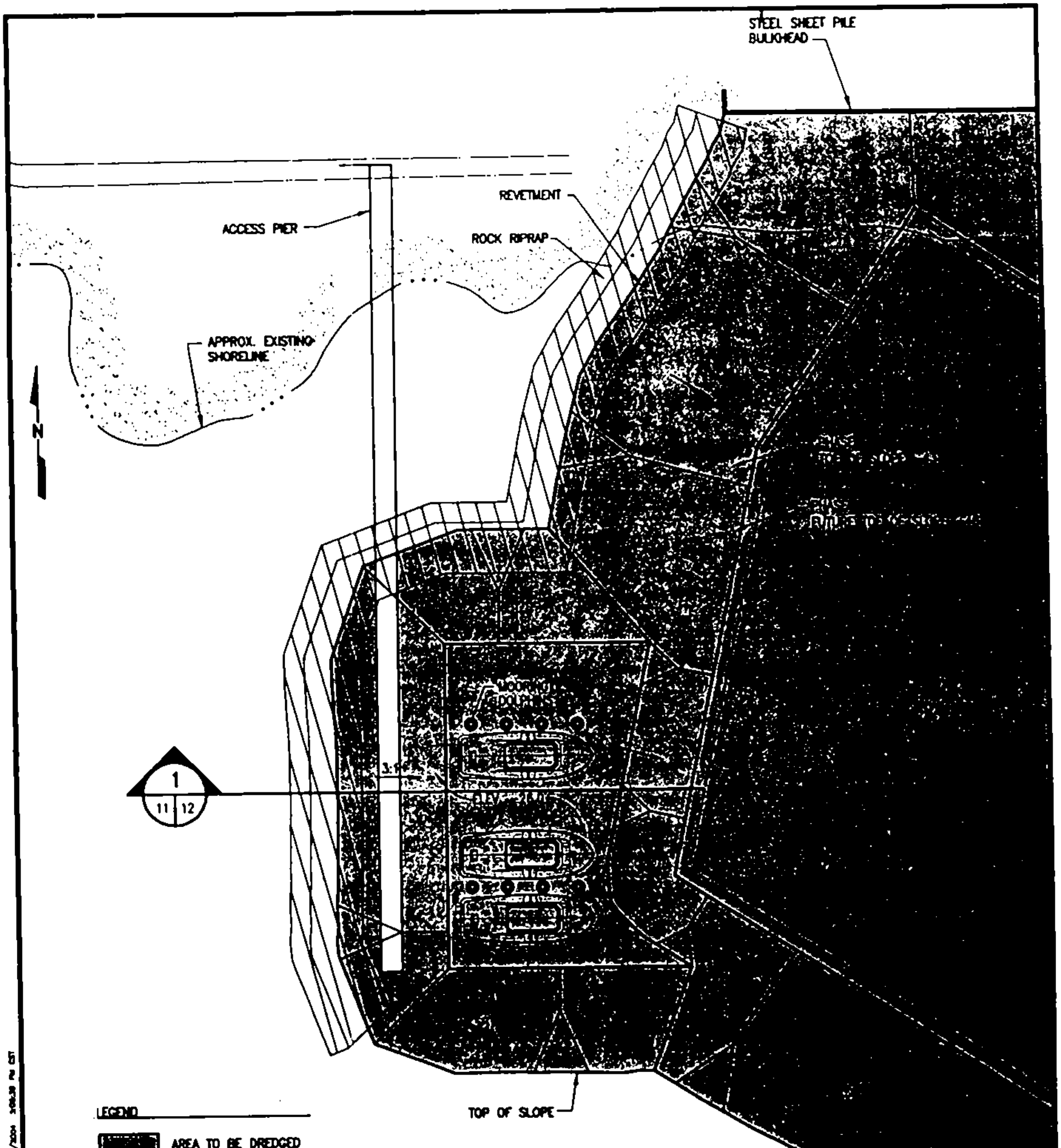
8 | 10

WEST PIPE TRESTLE SECTION

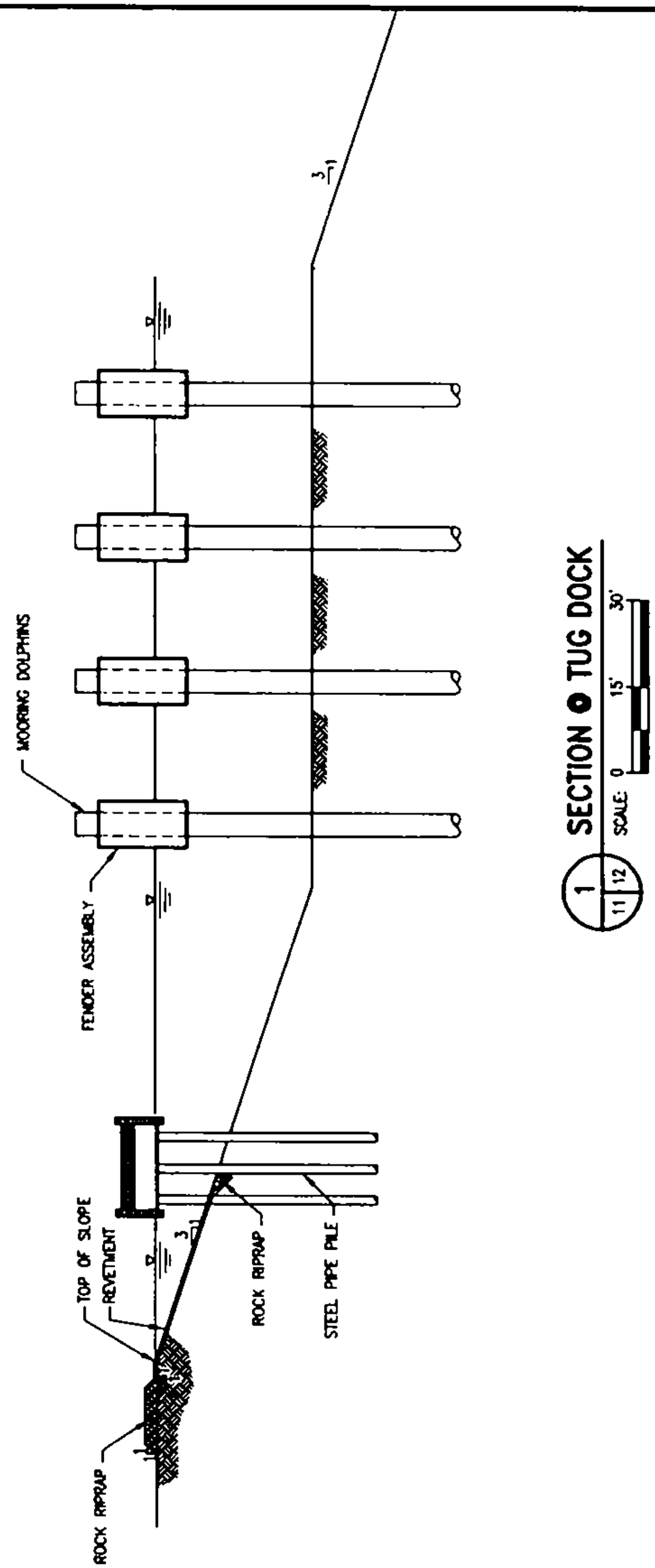
SCALE: 0 20' 40'



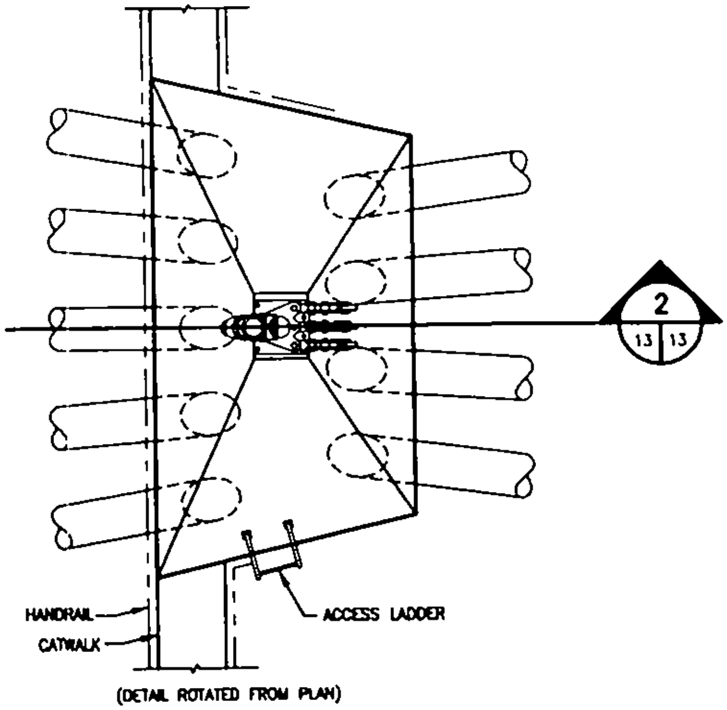
1 / 3 11 ENLARGED TUG/LINE HANDLER DOCK PLAN

SCALE: 0 50' 100'

ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS
APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29	555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
DATE: 06/04 REV. DATE: 08/04	SMA Job No: 200.30175.02 SHEET 11 of 17

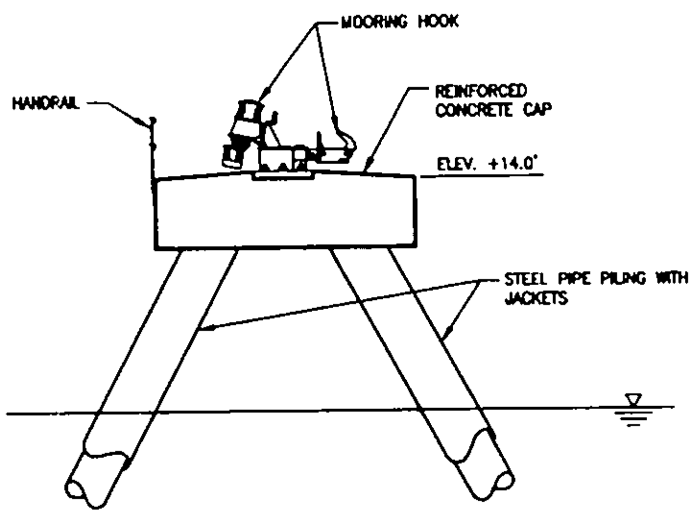


ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS
APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29	555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
DATE: 06/04 REV. DATE: 08/04	SMA Job No: 200.30175.02 SHEET 12 of 17



1 (5 | 13) PLAN - MOORING STRUCTURE

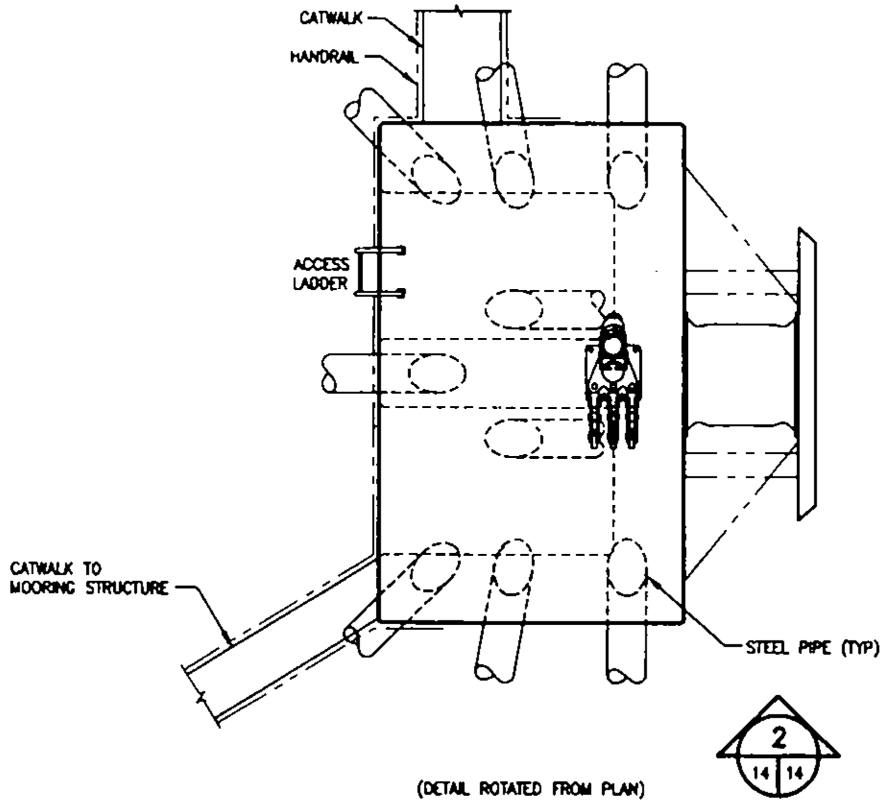
SCALE: 3/32" = 1'-0"



2 (13 | 13) SECTION - MOORING STRUCTURE

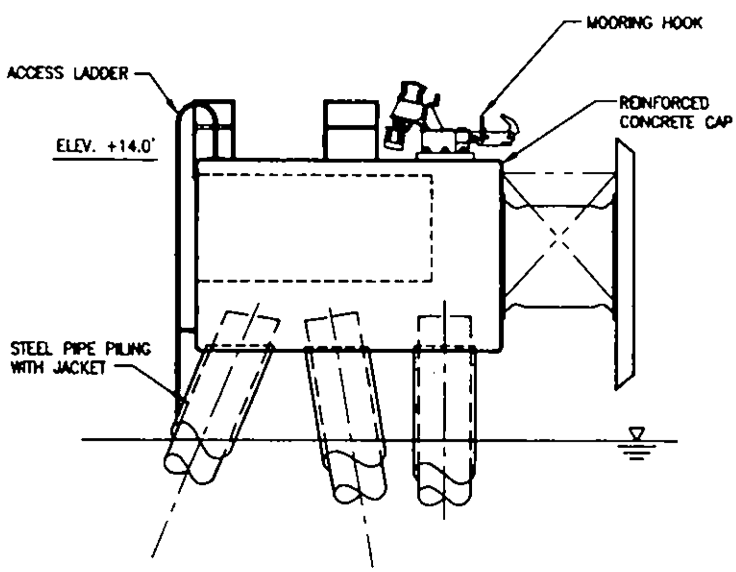
SCALE: 3/32" = 1'-0"

ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS 555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29	
DATE: 06/04 REV. DATE: 08/04	SMA Job No: 200.30175.02 SHEET 13 of 17



1 5 14 PLAN – OUTER BREASTING STRUCTURE

SCALE: 3/32" = 1'-0"



2 14 14 ELEVATION – OUTER BREASTING STRUCTURE

SCALE: 3/32" = 1'-0"

ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS
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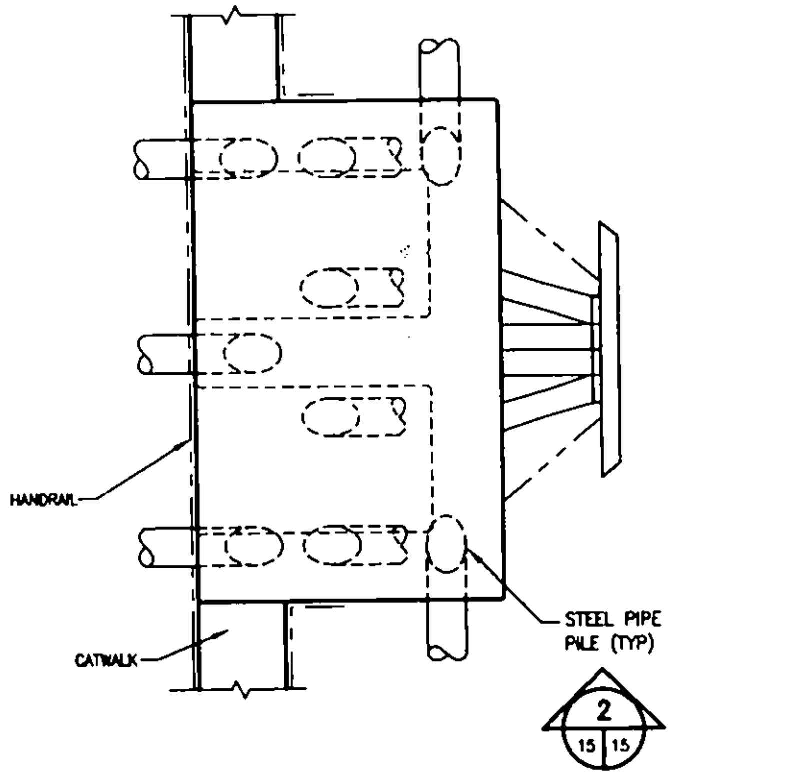
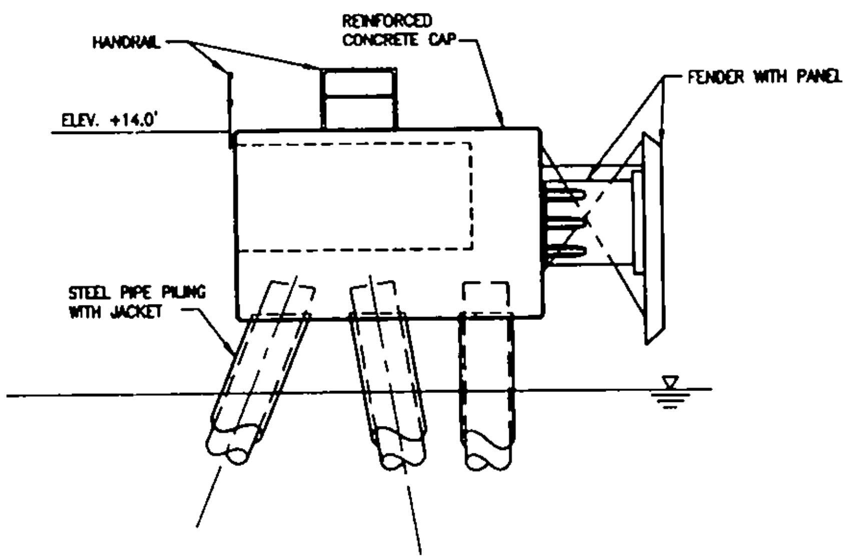
DATE: 06/04 REV. DATE: 08/04	SMA Job No: 200.30175.02 SHEET 14 of 17

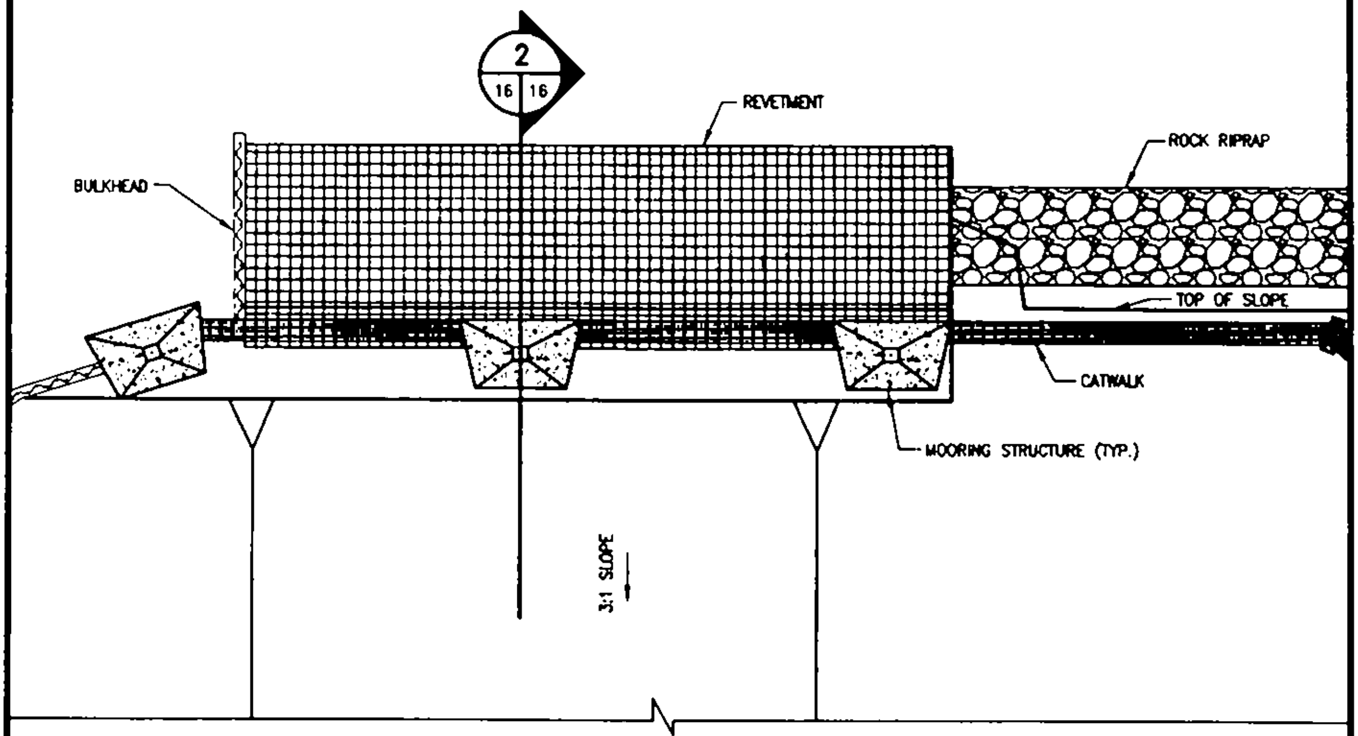


1 / 5 15 PLAN – INNER BREASTING STRUCTURE
SCALE: 3/32" = 1'-0"



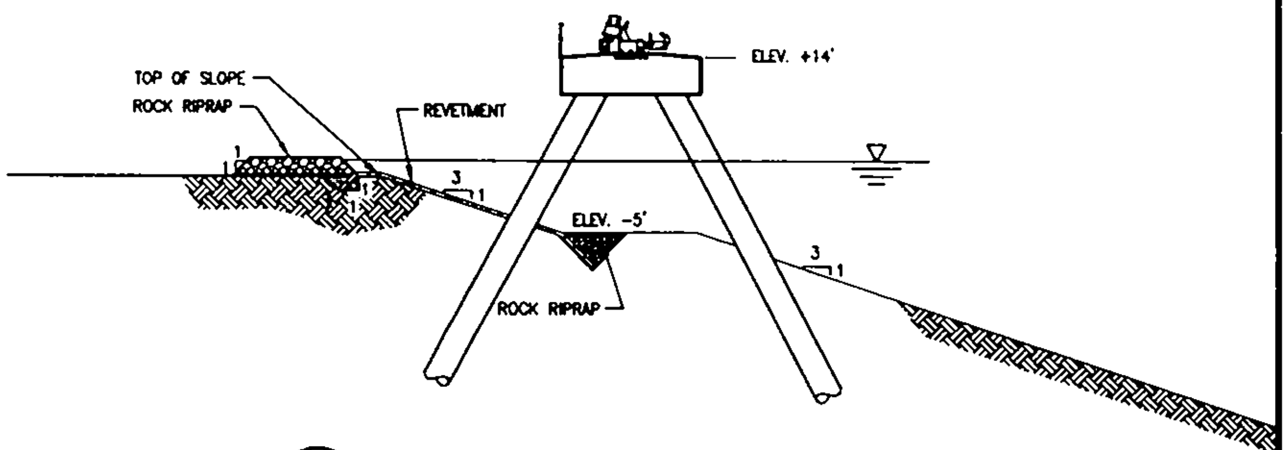
2 / 15 15 ELEVATION – INNER BREASTING STRUCTURE
SCALE: 3/32" = 1'-0"

ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS 555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29	
DATE: 06/04 REV. DATE: 08/04	SMA Job No: 200.30175.02 SHEET 15 of 17



1 (5 | 16) PLAN @ MOORING STRUCTURES

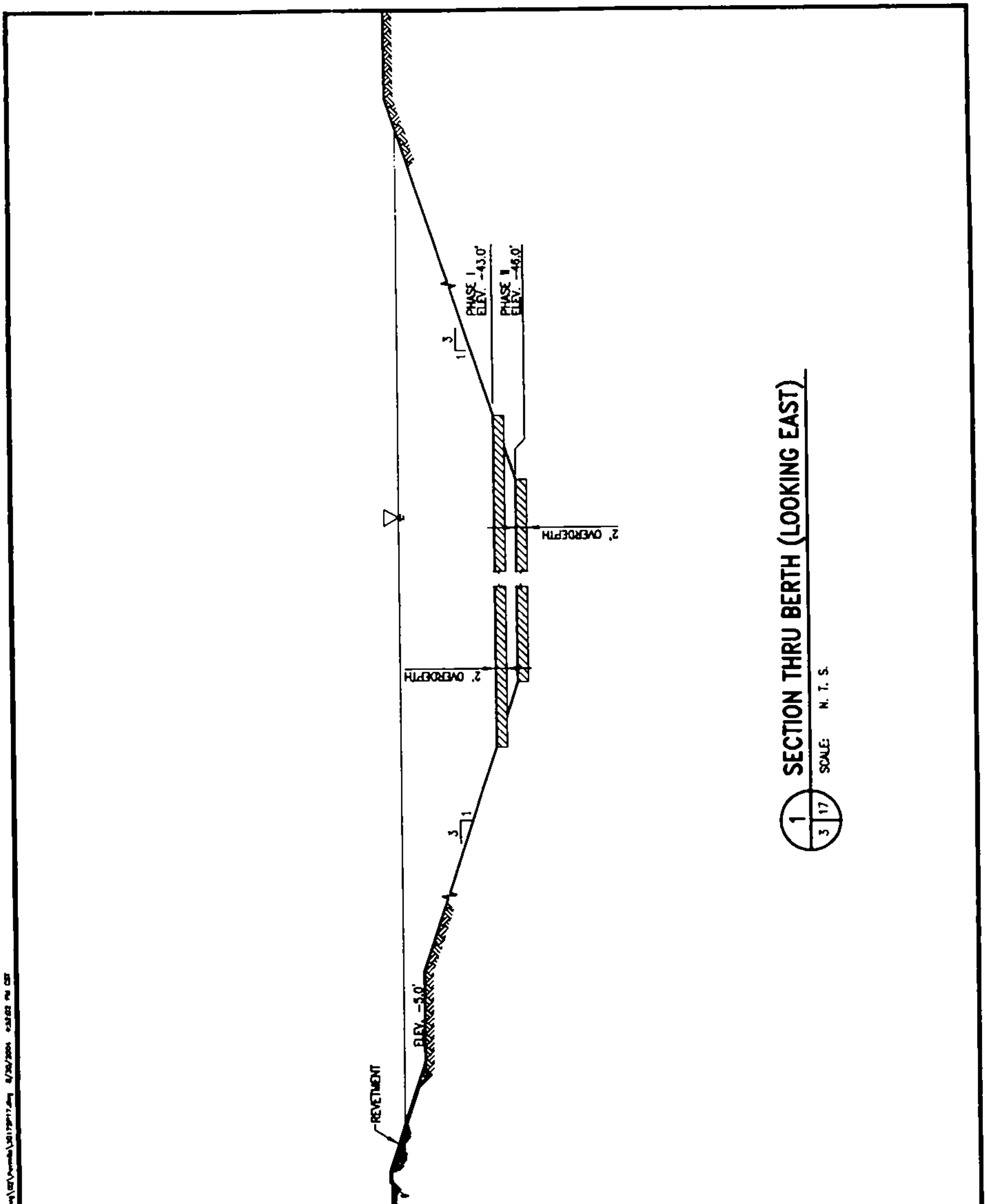
SCALE: 0 20' 40'



2 (16 | 16) SECTION @ MOORING STRUCTURE

SCALE: 0 10' 20'

ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS
APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29	555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
DATE: 06/04 REV. DATE: 08/04	SMA Job No: 200.30175.02 SHEET 16 of 17



ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR OFF-LOADING OF LIQUID NATURAL GAS (LNG)	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS
APPLICANT: CHENIERE CORPUS CHRISTI LNG, L.P. DATUM: NGVD '29	555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
DATE: 06/04 REV. DATE: 08/04	SMA Job No: 200.30175.02 SHEET 17 of 17

Appendix C

Dredged Material Placement Area

Non-Internet Public

Appendix C
Location Map

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

APPENDIX E

ESSENTIAL FISH HABITAT ASSESSMENT

CHENIERE CORPUS CHRISTI LNG PROJECT
DRAFT EIS
APPENDIX E

ESSENTIAL FISH HABITAT ASSESSMENT

1.0 INTRODUCTION

In 1976, the Magnuson-Stevens Act (MSA) was passed in order to promote fish conservation and management. The MSA granted the National Marine Fisheries Service (NOAA Fisheries) legislative authority for fisheries regulation in the United States within a jurisdictional area located between three miles to 200 miles offshore, depending on geographical location. NOAA Fisheries established eight regional fishery management councils, each responsible for the proper management and harvest of finfish and shellfish resources within their respective geographic regions. Fishery management councils have developed Fisheries Management Plans (FMP), which outline measures to ensure the proper management and harvest of the finfish and shellfish within these waters.

Recognizing that many marine fisheries are dependent on nearshore and estuarine environments for at least part of their life cycles, new habitat conservation provisions to the MSA (Public Law 94-265, as amended in 1996 and Public Law 104-297 as amended in 1998) were added, along with other goals, to promote more effective habitat management and protection of marine fisheries. The protection of the marine environments important to marine fisheries, referred to as essential fish habitat (EFH), is required in the review of projects conducted under Federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). All estuaries and estuarine habitats in the northern Gulf of Mexico are considered EFH (GMFMC, 1998).

Federal agencies that authorize, fund, or undertake activities that may adversely impact EFH must consult with the NOAA Fisheries. Although absolute criteria have not been established for conducting EFH consultations, NOAA Fisheries recommends consolidated EFH consultations with interagency coordination procedures required by other statutes, such as the National Environmental Policy Act (NEPA) and Endangered Species Act (ESA), in order to reduce duplication and improve efficiency. Generally, the EFH consultation process includes the following steps:

> 1) **Notification** - The action agency should clearly state the process being used for EFH consultations (*e.g.*, incorporating EFH consultation into the Environmental Impact Statement (EIS) or Rivers and Harbors Act Section 10 permit).
>
> 2) **EFH Assessment** - The action agency should prepare an EFH Assessment that includes both identification of affected EFH and an assessment of impacts. Specifically, the EFH should include: 1) a description of the proposed action; 2) an analysis of the effects (including cumulative effects) of the proposed action on EFH, the managed fish species, and major prey species; 3) the Federal agency's views regarding the effects of the action on EFH; and 4) proposed mitigation, if applicable.

3) **EFH Conservation Recommendations** – After reviewing the EFH Assessment, NOAA Fisheries would provide recommendations to the action agency regarding measures that can be taken by that agency to conserve EFH.

4) **Agency Response** The action agency may respond to NOAA Fisheries within 30 days of receiving NOAA Fisheries' recommendations to conserve EFH. The action agency will notify NOAA Fisheries that a full response to the conservation recommendations will be provided by a specified completion date agreeable to all parties. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH.

We[1] incorporate EFH consultations for the Cheniere Corpus Christi LNG Project with the interagency coordination procedures required under the NEPA. For purposes of reviewing this Project under NEPA, the Federal Energy Regulatory Commission (FERC) is the lead Federal agency. As such, the FERC requests that NOAA Fisheries consider this draft EIS as notification of initiation of EFH consultation.

NOAA Fisheries has agreed to be a cooperating agency for this project. In a letter dated March 24, 2004 NOAA Fisheries advised the FERC that the proposed Project site is adjacent to areas that have been identified as EFH. The FERC and NOAA Fisheries staff participated in a coordination meeting on April 28, 2004. On September 13, 2004 NOAA Fisheries, Habitat Conservation Division, provided comments on an administrative draft of the EIS, and these comments have been incorporated into this draft EIS and EFH Assessment.

An assessment of potential effects of the Cheniere Corpus Christi LNG Project on EFH is included below. We will address NOAA Fisheries' comments on the draft EIS and/or conservation recommendations in the final EIS.

2.0 FEDERALLY MANAGED SPECIES

Information regarding EFH was obtained through correspondence with NOAA Fisheries and from the Gulf of Mexico Fisheries Management Council (GMFMC).

GMFMC has identified EFH for the Gulf of Mexico (Gulf), including the Project area, as required by the 1998 amendment to the MSA (GMFMC, 1998). The EFH information from NOAA Fisheries on species habitats and lifestages is available at a scale such that Corpus Christi Bay is grouped into a single area of consideration. The GMFMC report indicates that EFH is available for four shellfish species (juveniles and adults of brown, pink, and white shrimp, and stone crab) and three species of finfish (juveniles and adults of gray snapper, red drum, and Spanish mackerel) within Corpus Christi Bay (GMFMC, 2003). The proposed Project is located in an area that has been identified by GMFMC as potentially containing EFH for some of the aforementioned species. Adult gray snapper and adult pink shrimp are completely absent from Corpus Christi Bay (E&E, 2003).

[1] "We," "us," and "our" refer to the environmental staff of the FERC's Office of Energy Projects.

In a September 3, 2003, letter to Cheniere's consultant (Attachment E-1), NOAA Fisheries identified post-larval, juvenile and subadult white shrimp, brown shrimp, red drum, post-larval and juvenile pink shrimp, and subadult Spanish mackerel as the EFH species of concern in the Project area (NOAA Fisheries, 2003). The letter further states that the categories of EFH in the vicinity of the Project include estuarine emergent marsh, seagrass, estuarine water column, and estuarine mud and sand substrates. The following assessment of potential effects of the Cheniere Corpus Christi LNG Project on EFH addresses these five species and life stages as identified in the September 3, 2003, letter from NOAA Fisheries.

A detailed description of life history characteristics and habitat preferences of each species, based primarily on the research referenced in Cheniere's application to the FERC, is provided below. No field surveys were conducted to verify the presence or absence of these species in the Project area.

White Shrimp

The white shrimp is one of the important penaeids along the Atlantic and Gulf coasts. White shrimp are found in estuaries and out to depths of approximately 40 meters (m) offshore in the coastal waters extending from Florida to Texas and are most abundant in the central and western Gulf. Non-spawning adult white shrimp inhabit offshore waters in the winter and move inshore in the spring. Spawning generally occurs offshore in water depths of less than 27 m from spring to late fall peaking during June and July. Eggs are demersal and share the same distribution as spawning adults. Larval white shrimp hatch within 12 hours of spawning and begin to migrate through passes toward estuaries as they develop into post-larvae. Estuarine migration peaks between June and September.

Juvenile white shrimp are most abundant in turbid estuaries along the western coast of the Gulf and, within these estuarine nurseries, reach their greatest densities in marsh edge habitats and in areas with submerged aquatic vegetation. However, juvenile white shrimp are also common in marsh ponds, channels, inner marshes, shallow subtidal areas and oyster reefs. In non-vegetated areas, postlarvae and juveniles inhabit mostly muddy substrates with large quantities of detritus (GMFMC, 1998). Sub-adult white shrimp move from the estuaries to coastal areas in late August and September.

Brown Shrimp

Adult brown shrimp inhabit neritic waters (over the continental shelf from low tide to a depth of approximately 110 m) throughout the Gulf, but are more abundant off the coasts of Texas, Louisiana, and Mississippi. Non-spawning adults prefer turbid waters to soft sediments (*i.e.*, mud and sand). In the spring and fall, adult brown shrimp move to slightly deeper water (46 to 91 m) to spawn. Brown shrimp eggs are demersal and usually hatch when temperatures are greater than 24° C. Larval brown shrimp are most abundant offshore but do occur in waters that range from 0 to 82 m deep. Post-larval brown shrimp migrate toward estuaries in the spring, typically reaching their destination between February and April. Late post-larval and juvenile brown shrimp are most abundant in shallow (<1 m) estuarine habitats in the spring and early summer but typically are present through the fall.

Juvenile brown shrimp reach their greatest abundances in turbid estuaries but tolerate waters with less suspended material. Within the estuarine environment, juvenile brown shrimp prefer marsh edges and areas with submerged vegetation, but occur throughout the vegetated and non-vegetated portions of the estuary and in the lower reaches of its tributaries. Sub-adults are most abundant in slightly deeper waters of 1 to 18 m and prefer sand, mud and shell substrates to the vegetated bottoms preferred by juveniles. As they develop, sub-adult brown shrimp continue to migrate toward deeper waters, eventually leaving the estuarine nurseries in mid-summer.

Pink Shrimp

Adult pink shrimp typically inhabit offshore marine waters, where they reach their greatest densities over depths of 9 to 44 m. Adults prefer coarse sand and shell substrates with relatively little organic material. Spawning occurs offshore at depths between 4 and 48 m. Pink shrimp have demersal eggs that give rise to planktonic larvae.

Larvae migrate toward estuarine nursery areas in the spring and late fall. Upon reaching these nurseries, post-larval pink shrimp assume a benthic lifestyle, burrowing into the substrate during the day and foraging above the substrate at night. Juvenile pink shrimp inhabit nearly all U.S. estuaries in the Gulf, but reach their greatest abundances in Florida where they prefer non-turbid waters with an abundance of seagrass, which provides cover and habitat for prey, and avoid marsh habitats. Post-larvel, juvenile and sub-adults also prefer coarse substrates, such as sand, shell and mud mixtures (GMFMC, 1998).

Red Drum

The red drum occurs in a variety of habitats over different substrates throughout the Gulf. Habitats range in depth from about 40 m offshore to very shallow in estuarine wetlands with substrates that include sand, mud and oyster reefs. Adult red drum are roving predators that opportunistically feed on a variety of invertebrate and vertebrate prey including crab, shrimp and other fishes. Spawning occurs from September through November over deeper waters protected from currents such as the mouths of bays and inlets, and on the Gulf side of barriers islands. Eggs typically hatch between late summer and early fall in the open waters of the Gulf and are subsequently transported on tides and currents into estuarine nursery areas.

Larval red drum are most abundant is estuaries from mid-August through late November. Within these estuarine nurseries, larvae, post-larvae, and juveniles prefer habitats protected form currents with submerged and emergent vegetation and muddy substrates, but also tolerate non-vegetated hard and soft-bottomed areas. Larval and post-larval red drum feed primarily on copepods whereas juveniles feed on a wide variety of small invertebrates. Juvenile red drum become most abundant in early winter. Much like the adult red drum, late juveniles utilize a wide variety of habitats. However, they still prefer protected waters and do not become abundant in open waters until mid-September to early October. Estuarine wetlands are very important to larval and juvenile red drum and while adult red drum use estuaries they tend to spend more time offshore as they age (GMFMC, 1998).

Spanish Mackerel

The Spanish mackerel is a coastal pelagic fish that typically occurs in waters up to 75 m deep in coastal areas throughout the Gulf. Adults are most prevalent in coastal waters, but will inhabit estuarine areas, especially those with higher salinity, during seasonal migrations, and in pursuit of prey. They are, however, considered rare and occur infrequently in Gulf estuaries (GMFMC, 1998). Important spawning areas are located in waters over the inner continental shelf of northeastern and north-central Gulf, where spawning occurs from May through September.

Eggs are pelagic, occurring in waters over the inner continental shelf of the northern Gulf with depths of greater than 50 m during the spring and summer. Larvae are common from May to October in these same offshore areas over depths ranging from nine to 84 m, but are most common in waters less than 50 m deep. Estuaries and coastal waters serve as year-round nurseries for juvenile Spanish mackerel.

EFH Species Distribution in Corpus Christi Bay

NOAA's Estuarine Living Marine Resources (ELMR) Program has developed synoptic species distribution and relative abundance data for fishes and macroinvertebrates in the Gulf. Relative abundance ranking was performed based on a variety of data include surveys, gray literature, peer review literature, and reviews by academic and government fisheries experts. Five categories of abundance were developed, including, not present, rare, common, abundant, and highly abundant.

Results of this evaluation are available in tabular form on the ELMR website (http://galveston.ssp.nmfs.gov/efh/elrm.html). The abundance data is further broken down into lifestages, salinity seasons, months, and locale. For the species and lifestages identified in the September 3, 2003, NOAA Fisheries letter, the data was collected for Corpus Christi Bay. A summary of the Corpus Christi Bay estuary EFH species lifestage and seasonal abundance information is provided in table 2-1.

EFH distribution maps showing the seasonal breakdown of relative abundance for the adult and juvenile stages for each of the species with EFH potentially occurring in the Project area in Nueces and San Patricio Counties, Texas can be obtained from the NOAA Fisheries Galveston Laboratory web site (http://galveston.ssp.nmfs.gov/research/fisheryecology/EFH/Relative/estuaries/ index.html).

Spawning and larval development of the penaeid shrimp occur in the Gulf. They have similar life history stages, are estuarine-dependent and vary seasonally in abundance. Adult white shrimp begin to appear in Corpus Christi Bay with a major peak of abundance beginning in August during the high salinity season extending through the end of March, are common in the spring as salinity decreases and begin to migrate back to the sea during June when bay salinities begin to increase. Juveniles are common in the bay during decreasing and low salinities from November to June becoming abundant from July to October. Brown shrimp utilize the same nursery grounds as the white shrimp during the growth period from the post-larval stage to the adult stage. Adult brown shrimp distribution from April to October is rare and they are not present in the bay between March and November. The juvenile shrimp population is highly abundant in the upper portion of Nueces Bay from April to June and commonly found in the entire Corpus Christi Bay system throughout the year. For the pink shrimp, adults are not present whereas juveniles commonly occur almost year-round except during July when they are rarely present in the bay.

TABLE 2-1

Summary of Corpus Christi Bay EFH Information
Nueces and San Patricio Counties, Texas

Species b/	Life stage c/	Relative Abundance a/ Low Salinity (April-June)	Increasing Salinity (July)	High Salinity (Aug.-Oct.)	Decreasing Salinity (Nov.-Mar.)
Brown Shrimp (*Farfantepenaeus aztecus*)	A	Rare	Rare	Rare	Not present
	J	Common	Common	Common	Common
White Shrimp (*Litopenaeus setiferus*)	A	Common	Not present	Abundant	Abundant
	J	Common	Abundant	Abundant	Common
Pink Shrimp (*Farfantepenaeus duorarum*)	A	Not present	Not present	Not present	Not present
	J	Common	Rare	Common	Common
Red Drum (*Sciaenops ocellatus*)	A	Common	Common	Common	Common
	J	Common	Common	Common	Common
Spanish Mackerel (*Scomberomorus maculatus*)	A	Common	Common	Common	Rare
	J	Rare	Rare	Rare	Not present

Source: GMFMC, 2003

a/ Seasonal relative abundances provided by GMFMC (EFH maps). Determined as the highest monthly relative abundance value in the ELMR database for that salinity season.
b/ Species for which EFH maps are provided by the GMFMC
c/ Life stages for which EFH is mapped include adults (A) and juveniles (J).

Adult and juvenile forms of red drum are common throughout the year. Adult Spanish mackerel are common throughout the year except the November through March period of decreasing salinity when they are rarely present in Corpus Christi Bay. Conversely, the juvenile Spanish mackerel do not occur in Corpus Christi Bay during the November through March period and only rarely occur during the time between April and October.

Due to their life history strategies, there is a temporal component to the probability of occurrence of most shellfish and finfish species (table 2-1). Most estuarine species spawn offshore and move inshore to take advantage of rich estuarine waters while they develop before emigrating offshore as adults. Seagrass and coastal marsh habitats typically serve as nursery areas for juvenile penaeid shrimp and red drum, therefore these species are likely to occur in these habitats during the early phase of their life cycle. Red drum inhabit estuaries throughout their life cycle but exhibit less affinity towards vegetated areas as they age and therefore have a moderate probability of occurrence in all Project area habitat types. Other species, such as the Spanish mackerel, utilize estuaries opportunistically in pursuit of prey mainly as adults.

3.0 POTENTIAL EFFECTS ON EFH

Based on comparisons of habitat preferences as described above and the aforementioned characteristics of the major habitat types, open bay habitat and seagrass habitat near the proposed LNG terminal site could potentially function as EFH for the following species: adult and juvenile brown shrimp, pink shrimp, white shrimp, red drum, and Spanish mackerel. Of these, adult brown shrimp, pink shrimp, and Spanish mackerel are considered rare or not present in Corpus Christi Bay (GMFMC, 2003) and therefore are not likely to occur in the vicinity of the proposed Project.

Coastal marsh habitat and tidal flat habitat near the proposed LNG terminal site could potentially function as EFH during periods of inundation for the following species: adult and juvenile brown shrimp, pink shrimp, white shrimp, red drum and Spanish mackerel. Of these, adult brown shrimp, pink shrimp, and Spanish mackerel are considered rare or not present in Corpus Christi Bay (GMFMC, 2003) and therefore are not likely to occur in the vicinity of the proposed Project.

In addition to being designated as EFH, the tidally influenced wetlands, seagrass, mud and sand substrates and shallow water habitats in the Project area provide nursery, foraging and refuge habitats that support various recreationally and economically important marine fishery species such as spotted seatrout (*Cynoscion nebulosus*), flounder (*Paralichthys spp.*), Atlantic croaker (*Micropogonias undulatus*), black drum (*Pogonias cromis*), Gulf menhaden (*Brevoortia patronus*), striped mullet (*Mugil cephalus*) and blue crab (*Callinectes sapidus*). Such estuarine-dependent species serve as prey for other fisheries managed by GMFMC (*e.g.*, red drum, mackerels, snappers and groupers) and highly migratory species managed by NOAA Fisheries (*e.g.*, billfishes and sharks).

Cheniere proposes to use a hydraulic pipeline dredging system to remove approximately 4.4 million cubic yards of mostly virgin stiff clays with interbedded sand and silty layers to create the berthing area and maneuvering basin at the LNG terminal. During the dredging operation, potential effects on water quality could include temporary increased turbidity surrounding the hydraulic cutterhead of the dredge as well as around the mixing zone where the water from the dredging activities reenters the bay. Disturbance of bottom sediments during dredging can significantly increase turbidity and down-current deposition of re-suspended sediments. Very high levels of turbidity can result in the physical impairment of estuarine species (*e.g.*, turbidity induced clogged gills resulting in suffocation, or abrasion of sensitive epithelial tissue). Dredging with a hydraulic cutterhead dredge generally creates less turbidity than other types of dredges (*i.e.*, mechanical bucket or hopper dredges). With a cutterhead dredge, the cutter speed can be adjusted to match the sediment properties, thus minimizing turbidity. Herbich and Brahme (1984) discuss the mechanism of turbidity generation around the cutterhead, and based on model studies reported that turbidity at the cutterhead moved horizontally in all directions but its vertical movement was very limited.

Ward (1997) describes the tidal flushing in Corpus Christi Bay as a restricted flow, tidal regime switching from a semi-diurnal to diurnal. The tides are wind dominated which results in relatively higher tides in summer and spring with lower tides in winter and fall because of the prevailing wind. Because of the change in the width to depth ratio of the La Quinta Channel, overall currents would be expected to be relatively low, particularly at or near the bottom where dredging would occur.

Cheniere proposes to dispose of dredged material in upland areas on and immediately north of the proposed LNG terminal site. Return water from the dredged material disposal areas would flow into an existing drainage canal along the western boundary of the LNG terminal site and back into Corpus Christi Bay. Dredged material return water would be addressed in Cheniere's Section 401 permit.

Based on the general hydraulic characteristics of the site and the proposed depth of dredging, most of the sediment that would become suspended during the dredging process is expected to be short term and the water quality would return to background levels a short distance from the point of disturbance (McLellan et. al., 2004). Impacts to EFH due to water quality impacts from dredging are therefore expected to be short term and minimal, and turbidity control methods are not expected to be required.

Entrainment of aquatic organisms by dredging machinery can impact EFH species directly, or indirectly through the removal of prey species (*e.g.*, benthic invertebrates) or food species (*e.g.*, macroalgae), disrupting energy flow and biotic interactions. Entrainment of benthic organisms during the dredging of the proposed berthing and maneuvering areas is expected, however, entrainment would not be extensive enough to have a significant impact on the fishery resources of Corpus Christi Bay. In addition, benthic organisms typically have rapid re-colonization rates that would limit impacts to the biota of these areas due to entrainment to short-term impacts.

Dredging can also result in the chemical impairment of the water column due to the suspension of contaminated sediments. The Final Environmental Impact Statement for the Corpus Christi Ship Channel Improvement Project (COE, 2003) reported the results of sediments that were sampled and analyzed for organic and metallic chemicals. The COE's EIS included samples from the La Quinta Channel extension that would overlap the area of the proposed dredging. In addition, Cheniere collected three sediment cores from the proposed dredging area and had them analyzed for metals. In the COE's Final EIS, the results were compared to the Effects Range Low (ERL), which are used by NOAA as screening levels for assessing sediment quality. These are conservative concentration levels and are considered the lowest concentrations where effects on the marine ecology have been observed. These levels are used to identify sediment that may require additional evaluations before decisions on disposal or beneficial re-use are made.

In 1985 samples from the La Quinta Channel, arsenic ranged from 12 to 15 milligrams per kilogram (mg/kg) in all six samples, which is above the ERL of 8.2 mg/kg. Six samples were taken from the same stations in 1990 and again in 2000, and all metals were below the ERL levels. Three samples were taken in 2000 from the La Quinta extension and analyzed for metals, and all metals were below the ERLs. The samples taken in 1985 were analyzed for PCBs and pesticides and all detections were below ERL levels. The samples taken in 1990 and 2000 were analyzed for PCBs, pesticides, and PAHs, and all detections were below ERL levels. The COE concluded that, overall, there is no indication of current water quality problems in the La Quinta Channel reach, or problems that would result from dredging to extend the La Quinta Channel (COE, 2003).

The results of the analysis of Cheniere's core samples were compared to the Protective Concentration Levels (PCL) for Tier 1 commercial/industrial soil protective of Class 3 groundwater. All concentrations were below the PCL level.

Dredging and the direct removal of suitable benthic substrates can impact EFH by removing suitable cover or settlement structure. Dredging typically homogenizes bottom substrates, reducing the structural complexity of habitats. Field surveys of the Project site revealed that the open bay habitats that would be dredged already consist of a homogenous bed of fine substrates. Dredging of these areas would therefore not significantly alter the existing bottom type, with the exception of vegetated areas, discussed below.

Approximately 78 acres would be affected by the proposed project dredging. Of the 78 acres, approximately 72 acres is currently shallow open water habitat that would be deepened to 42 feet below mean sea level (MSL) to match the adjacent La Quinta Turning Basin. The Project would therefore permanently alter this habitat, changing it from shallow water to deep water Impact on EFH species would depend on the species use of deeper water habitats. Many of the species that occupy shallow-water habitats may also inhabit the deeper water habitats that currently exist in the adjacent La Quinta Channel and Turning Basin sometime during their life cycle. Many species reside or migrate through both inshore and offshore areas at different stages of their lives and during different seasons throughout the year.

Of the 72 acres of shallow open water habitat that would be dredged, approximately 5.4 acres is currently submerged aquatic seagrass beds, and another 5.3 acres is currently coastal marsh and tidal flat. These habitats would be permanently converted to open water habitat. The existing EFH functions of these 10.9 acres of seagrass, coastal marsh, and tidal flat would be lost. These habitats are valuable habitat types relative to fish and EFH as they provide a food rich environment for productive foraging and refuge to juveniles and prey species from predators. Alteration of these habitats can cause a reduction or loss of juvenile or prey species' rearing habitats and an alteration in the timing of life history stages. See additional discussion in sections 4.4 and 4.5 of the EIS.

While the existing functions of the permanently impacted seagrass, coastal marsh, and tidal flat would be lost, this area would function as open water habitat (EFH for adult and juvenile brown shrimp, pink shrimp, white shrimp, red drum and Spanish mackerel).

The permanent conversion of wetlands as a result of the proposed dredging would require compensatory mitigation to comply with the COE's Section 404(b)1 guidelines. The specific type and amount of compensatory mitigation would be determined by the COE as part of the Section 404 permit process. On June 7, 2004 Cheniere filed with the COE a revised wetlands delineation report and request for formal verification of Waters of the U.S. The revised wetlands delineation report was accepted by the COE on July 15, 2004. On September 9, 2004 Cheniere filed with the COE a Section 404/10 Individual Permit application.

Cheniere has prepared a conceptual wetlands mitigation plan in consultation with a number of resource agencies addressing measures to mitigate for unavoidable impact to 10.7 acres of wetlands from construction of the LNG terminal (see appendix D of the Cheniere draft EIS). The plan identifies five potential mitigation options and identifies an offsite mitigation option – Shamrock Island alternative as its preferred mitigation. The Shamrock Island alternative would include wetland creation and preservation at Shamrock Island that is the current mitigation site for the federal Packery Channel dredging project. The conceptual mitigation plan would result in a net gain of wetland functions and values in Corpus Christi Bay. The conceptual mitigation plan will be reviewed by the COE during review of the Section 404/10 individual permit application.

In addition to impacts from dredging during construction of the Project, sound pressure waves produced during pile driving activities to construct the marine terminal may result in impacts on nearby fish species with EFH designations and their prey. Although the effects of pile driving are poorly studied and there appears to be substantial variation in a species' response to sound, intense sound pressure waves can change fish behavior or injure/kill fish through rupturing swim bladders or causing internal hemorrhaging. The intensity of the sound pressure levels produced during pile driving depends on a variety of factors including, but not limited to, the type and size of the pile, the firmness of the substrate into which the pile is being driven, the depth of water, and the type and size of the pile-driving hammer. The degree to which an individual fish exposed to sound waves would be affected is dependent upon variables such as the peak sound pressure level and frequency as well as the species, size, and condition of a fish (*e.g.*, small fish are more prone to injury by intense sound waves than are larger fish of the same species). Depending on the specific conditions at the site, pile driving activities could generate underwater sound levels great enough to injure some fish or cause them to be more susceptible to predation.

In a review of studies documenting fish kills associated with pile driving, NOAA Fisheries (2003) reported that all have occurred during use of an impact hammer on hollow steel piles. Cheniere has not yet identified the type of hammer that would be used to drive piles during construction of the marine terminal. However, because the piles would be located in a recently dredged unloading slip, it seems likely that construction noise and activities would cause many fish to avoid the area of the most intense sound levels.

Ship and boat traffic associated with construction and operation of the project would also generate underwater sounds. Although vessel sounds would not generally be of the intensity produced from driving steel piles, project vessels (LNG carrier ships, tugs, construction barges) operating in the La Quinta Channel could result in sounds that illicit responses in fish. Most research suggests that fish exhibit avoidance behavior in response to engine noise (ICES, 1995). At the same time, research conclusions tend to suggest that since the effects are transient (*i.e.*, once the ship passes, behavior returns to normal), then the long-term effects on populations are negligible (Stocker, 2001).

Operation of the Project may result in impacts on aquatic organisms as a result of ballast water intake by ships calling on the LNG terminal. The LNG vessels would be fully loaded with LNG when arriving at the terminal and no ballast would be on board the vessels. No ballast would be discharged into the bay, therefore there should be no impact to EFH or managed species as a result of discharge of ballast water. Nevertheless, it is expected that any LNG carrier calling at the Cheniere Corpus Christi LNG terminal would be in full compliance with the domestic requirements for ballast water management as specified in the National Invasive Species Act of 1996 and international standards that were adopted on February 13, 2004

Once at the terminal each vessel would discharge its entire cargo to LNG storage tanks on shore. While the vessel is discharging its LNG cargo, it would be taking on seawater ballast to maintain a constant draft at the berth. Aquatic species in the immediate vicinity of the ship berths could therefore be impacted by entrainment during ballast water intake.

4.0 CONSERVATION MEASURES

Cheniere has attempted to avoid or minimize impact on coastal resources, including EFH, by identifying a site for the proposed LNG terminal that is adjacent to an existing deep water shipping channel, a site with existing industrial activity or history of industrial activity, and a site that would minimize impact on coastal wetlands. Because the proposed site is immediately adjacent to the existing La Quinta Turning Basin and Channel, the need for dredging would be limited to that required for the terminal maneuvering basin and berths. No dredging would be required to widen or deepen any portion of the shipping channel that would be used to access the proposed terminal site.

Unavoidable adverse impacts as a result of the proposed Project are described above. To mitigate for unavoidable impact on wetlands, Cheniere has prepared a conceptual wetlands mitigation plan to avoid or reduce wetland impacts and to avoid a net loss of wetlands as necessary to comply with the COE's Section 404(b)1 guidelines. Approval of the proposed compensatory mitigation would take place by the COE as part of the Section 404/10 permit process.

As stated in NOAA Fisheries letter dated September 3, 2003, Section 305(b)(4)(A) of the MSA requires that NOAA Fisheries provide EFH Conservation Recommendations for any Federal agency action that may result in adverse impacts to EFH. As a cooperating agency NOAA Fisheries reviewed an administrative draft of this EIS and EFH Assessment and in a letter to FERC dated September 13, 2004, stated that generally the draft EFH assessment adequately describes the potential adverse project impacts to EFH. NOAA Fisheries also requested that the draft EIS include the detailed wetland/aquatic resources mitigation plan. This is now included as appendix D of the draft EIS.

5.0 CONCLUSIONS OF THE EFH ASSESSMENT

Construction and operation of the proposed Project would have temporary and long-term effects on EFH. In general, temporary impacts are not expected to be significant considering the proposed dredging method and the localized effect of the actions compared to the area of Corpus Christi Bay that would be unaffected. Dredging of the proposed berthing and maneuvering basin would temporarily affect EFH by disturbing bottom sediments and increasing turbidity in the vicinity of dredging activity, which can have adverse physiological affects on finfish and shellfish species. Hydraulic dredging would also directly affect some benthic species that would be entrained during dredging. However, considering the nature of the sediments that would be dredged and the use of hydraulic cutterhead dredging and the temporary nature of the dredging, these impacts should not be significant.

Impacts to EFH from the deposition of sediments re-suspended by dredging activities are expected to be minimal. Considering the hydraulic characteristics of the site and the depth of excavation, most of the sediment that does become suspended during the dredging process is expected to settle within or near the dredging footprint as opposed to migrating to adjacent areas. Field studies (McLellan et. al., 1986) of cutterhead dredges indicated that elevated turbidity is limited to the lower portion of the water column and turbidity levels are at background within several hundred feet of the cutterhead dredging operation. Because of the design of the channel, suspended sediments would be expected to stay within the confines of the dredged channel.

With the exception of areas of seagrass, dredging of open bay habitats is not expected to result in a significant alteration of habitat structure, as the area of the bay near the LNG terminal site generally lacks habitat structure/cover. Also, considering the re-colonization rates of potentially affected benthic species and the relatively limited area affected by dredging, these losses would not be extensive enough to have a significant impact on the fishery resources of Corpus Christi Bay.

The primary impact on EFH would be the permanent loss of approximately 10.7 acres of seagrass, coastal marsh, and tidal flat. These habitats provide valuable habitat for EFH managed species as they provide a food-rich environment for foraging, and refuge for juveniles and prey species utilized by EFH species. To compensate for this permanent loss of habitat, Cheniere would implement wetland mitigation designed to avoid a net loss of wetlands as necessary to comply with the COE's Section 404(b)1 guidelines. The specific type and amount of compensatory mitigation would be determined by the COE as part of the Section 404 permit process. Cheniere has prepared a conceptual wetlands mitigation plan that is currently being reviewed by the COE.

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ATTACHMENT E-1

Letter from the National Marine Fisheries Service (NOAA Fisheries) Habitat Conservation Division to Ecology and Environmental, Inc.
Essential Fish Habitat Designation
Federally Managed Species

September 3, 2003

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
9721 Executive Center Drive N.
St. Petersburg, Florida 33702

September 3, 2003

Mr. Michael Johns
Project Director
Ecology and Environment, Inc.
720 North Post Oak Road, Suite 200
Houston, Texas 77024

Dear Mr. Johns:

The National Marine Fisheries Service (NOAA Fisheries) Habitat Conservation Division has reviewed the plans for the proposed Corpus Christi Liquified Natural Gas (LNG) Terminal Project, in San Patricio, Texas, to be located east of the City of Portland adjacent to the La Quinta Ship Channel. The applicant, Cheniere LNG, Inc. is preparing to file an application with the Federal Energy Regulatory Commission (FERC) for a proposed LNG terminal. Your letter requests site specific information on essential fish habitat and critical habitat within the project vicinity.

The project site is located in an area that has been identified as Essential Fish Habitat (EFH) by the Gulf of Mexico Fishery Management Council (GMFMC) for postlarval, juvenile, and subadult white shrimp (*Litopenaeus setiferus*), brown shrimp (*Farfantepenaeus aztecus*), red drum (*Sciaenops ocellatus*), postlarval and juvenile pink shrimp (*Farfantepenaeus duorarum*), and subadult Spanish mackerel (*Scomberomorous maculatus*). Categories of EFH in the vicinity of the project area include estuarine emergent marsh, seagrass, estuarine water column and estuarine mud and sand substrates. Detailed information on red drum, Spanish mackerel, shrimp, and other Federally managed fisheries and their EFH is provided in the 1998 amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the GMFMC. The 1998 EFH amendment was prepared as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (P.L. 104 - 297).

In addition to being designated as EFH, the tidally influenced wetlands, seagrass, mud and sand substrates and shallow water habitats in the project area provide nursery, foraging and refuge habitats that support various recreationally and economically important marine fishery species, such as spotted seatrout (*Cynoscion nebulosus*), flounder (*Paralichthys spp.*), Atlantic croaker (*Micropogonias undulatus*), black drum (*Pogonias cromis*), gulf menhaden (*Brevoortia patronus*), striped mullet (*Mugil cephalus*), and blue crab (*Callinectes sapidus*). Such estuarine-dependent organisms serve as prey for other fisheries managed under the MSFCMA by the GMFMC (e.g:, red drum, mackerels, snappers, and groupers) and highly migratory species managed by NOAA Fisheries (e.g., billfishes and sharks).

Section 305(b)(4)(A) of the MSFCMA requires that NOAA Fisheries provide EFH Conservation Recommendations for any Federal agency action or permit that may result in adverse impacts to EFH. We will provide the required official EFH Conservation Recommendations, as needed, after FERC has provided us with a detailed report on the potential impacts of the project on EFH.

Finally, the project area may be within the known distribution limits of Federally listed threatened species that are under purview of NOAA Fisheries. In accordance with the Endangered Species Act of 1973, as amended, it is the responsibility of the Federal Energy Regulatory Commission to identify actions that may affect endangered or threatened species or their habitat. Determinations involving species under NOAA Fisheries' jurisdiction should be reported to Ms. Georgia Cranmore of our Protected Resources Division (PRD) at the letterhead address. If it is determined that the activities may adversely affect any species listed as endangered or threatened and under PRD purview, then formal consultation must be initiated.

If we may be of further assistance, please contact Mr. Rusty Swafford of our Galveston Facility at (409) 766-3699.

Sincerely,

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

APPENDIX F

REFERENCES AND CONTACTS

APPENDIX F

REFERENCES AND CONTACTS

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APPENDIX F

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APPENDIX G

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