4.0 ENVIRONMENTAL ANALYSIS

The environmental consequences of constructing and operating the proposed Calhoun LNG Project would vary in duration and significance. Four levels of impact duration were considered: temporary, short-term, long-term, and permanent. Temporary impact generally occurs during construction with the resource returning to preconstruction condition almost immediately afterward. Short-term impact could continue for up to 3 years following construction. Impact was considered long-term if the resource would require more than 3 years to recover. A permanent impact could occur as a result of any activity that modifies a resource to the extent that it would not return to preconstruction conditions during the life of the project, such as the construction of an LNG terminal. We considered an impact to be significant if it would result in a substantial adverse change in the physical environment.

In this section, we discuss the affected environment, general construction and operational impact, and proposed mitigation for each resource. We have also included a brief discussion on the transit corridor for the LNG ships. Calhoun Point Comfort, as part of its proposal, agreed to implement certain measures to reduce impact. We evaluated Calhoun Point Comfort's proposed mitigation to determine whether additional measures are necessary to reduce impact. These additional measures appear as bulleted, boldfaced paragraphs in the text. We will recommend that these measures be included as specific conditions to authorizations that the Commission may issue to Calhoun Point Comfort.

Conclusions in this EIS are based on our analysis of the environmental impact and the following assumptions:

- Calhoun Point Comfort would comply with all applicable laws and regulations;
- the proposed facilities would be constructed as described in chapter 2.0 of this document; and
- Calhoun Point Comfort would implement the mitigation measures included in the application and supplemental filings to the FERC.

4.1 GEOLOGIC RESOURCES

4.1.1 Geologic Setting

The proposed Calhoun LNG Project would be located in the West Gulf Coastal Plain subregion of the Coastal Plain physiographic province (USGS, 2005). This region consists of tertiary and quaternary sedimentary deposits from marine and fluvial sources that have been uplifted and dipped toward the Gulf of Mexico. The region is characterized by a series of increasing depositional plains that range from the shoreline to about 200 miles inland and range in elevation from sea level to about 600 feet. The upper sediments consist of the Pleistocene Beaumont Formation that is underlain by the Pleistocene Lissie Formation.

The Beaumont Formation consists of interbedded layers of clay, sandy clays, and silty and clayey sands that were deposited on the back bay of an ancient barrier island. In the Central Gulf Coast region this formation is composed of up to 90 percent clay with medium to fine grained sands. The Beaumont formation is generally more than 100 feet thick. The underlying Lissie Formation consists of alluvial deposits of sand, silt, clay and small amounts of gravel. About 60 percent of this formation is composed of fine to coarse-grained sand while the remaining 40 percent consists of sandy clay (20 percent) and gravel and clay (10 percent each). The Lissie Formation typically contains very stiff to hard clays, dense to very dense sands, and thin weakly cemented layers of sandstone.

The LNG terminal would be within a bay-estuary system and located on a peninsula of fill and spoil material. The origin of the fill and spoil material is from the disposal of dredged material that was removed from Lavaca Bay for the construction of the CCND's existing turning basin. As fill and spoil was deposited over time the elevation of the peninsula was raised to about 29 feet above MSL. The proposed pipeline would cross the Beaumont formation, which consists of clayey sand and silt deposits and alluvial deposits associated with Navidad River (MP 16.5) and Lavaca River (MP 23.4) floodplains. The alluvial deposit consists of clay, silt, sand, gravel and organic matter that have been deposited by these river systems and reworked by the interaction between the rivers and the associated estuary and bay processes.

Because no bedrock occurs at or near the surface of the LNG terminal site or along the pipeline route, no blasting would be required to construct the LNG terminal or excavate the pipeline trench.

4.1.2 Extractive Resources

There are three primary types of resources potentially occurring on or beneath the project area: oil and gas, lignite and coal, and mineral and gravel.

4.1.2.1 Oil and Gas

Oil and gas production occurs within the project area. Several production wells occur in Cox Bay and are supported by small wellhead platforms. None of these wells are within 1,500 feet of the LNG terminal site. The TPWD indicated that several natural gas production wells (Neuman Production) were planned near the Enhanced Recovery Project DMPA. Calhoun Point Comfort is in the process of consulting with Neuman Productions, and applicable state and federal

agencies, to determine if a reconfiguration of the Enhanced Recovery Project DMPA would be required to allow for potential future gas well installation. **We recommend that:**

- **Calhoun Point Comfort provide the results of its consultation with Neuman Production, and applicable state and federal agencies, regarding planned natural gas production wells near the Enhanced Recovery Project DMPA. Calhoun Point Comfort should file its consultation results and any proposed reconfiguration of the Enhanced Recovery Project DMPA with the Secretary prior to construction.**

Calhoun Point Comfort reviewed TRRC maps and found one dry well within the construction footprint of the LNG terminal and another within the proposed KM-Tejas interconnect site (MP 12.0). Twelve wells were identified within 150 feet of the pipeline construction right-of-way. Of these wells, eight are dry and the remaining four may be operational. The four potentially operational wells are near MPs 11.3, 17.6, 19.0, and 19.4 and would be between 0.9 and 147.9 feet from the construction right-of-way. Construction of the LNG terminal and the KM-Tejas interconnect would affect two individual dry wells. Prior to construction, Calhoun Point Comfort would coordinate with the TRRC to confirm whether the wells would be located within the boundaries of the LNG terminal and KM-Tejas interconnect site and that the wells have been properly plugged and abandoned. Construction of the proposed pipeline would not affect the four wells within 150 feet of the construction right-of-way. Prior to construction, Calhoun Point Comfort would conduct a detailed survey of the pipeline route and the construction right-of-way would be adjusted in order to avoid any obstacles encountered, including existing oil and gas wells. With the implementation of these measures, we conclude that the Project would have minimal impact on existing productions wells and abandoned wells.

4.1.2.2 Lignite and Coal

Commercial deposits of lignite, or brown coal, occur as sedimentary deposits in the Cockfield-Yegua Formation and Wilcox Group whereas commercial deposits of bituminous coal are found in Late Cretaceous beds of Maverick County, Texas, about 235 miles west of the Point Comfort area. Both lignite and coal are extracted by strip mining methods. No lignite or coal extraction operations have been identified in the project area.

4.1.2.3 Mineral and Gravel

Sand, clay, salt, and gravel are mined in the Gulf Coast region; however, no mineral or gravel extraction operations have been identified in the project area.

4.1.3 Paleontological Resources

Calhoun Point Comfort indicated that 39 fossil records have been recorded at Nobels Point in Port Lavaca, Texas, about 3.0 miles west of the project area. No sensitive paleontological resources have been identified in the project area; however, should such resources be encountered during construction of the Project, Calhoun Point Comfort would contact the Texas Memorial Museum, and other applicable agencies, to develop and implement appropriative mitigation measures.

4.1.4 Geologic Hazards

The following section provides a summary of the site conditions with respect to seismicity and faulting, soil liquefaction, subsidence, karst terrain, 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.

Calhoun Point Comfort conducted a site-specific seismic evaluation to further assess seismic hazards at its proposed LNG terminal site. This evaluation included a probabilistic seismic hazard analysis to produce hazard curves based on peak ground acceleration and a site response analysis to determine the effects of the soil profile on the earthquake ground motion. The evaluation was conducted in accordance with the NFPA guidelines for stationary LNG storage containers. Results of this study indicate that potential seismic hazards at the LNG terminal site are low (PSI, 2005).

Although numerous faults exist in the Gulf Coast region, review of the physiographic and historical data for the project area indicates that movement along these faults in modern times is low. A low risk of seismic activity and faulting effects can be reasonably anticipated for the LNG terminal and the pipeline.

4.1.4.2 Soil Liquefaction

Soil liquefaction occurs in saturated soils; that is, soils in which the space between individual particles is completely filled with water and the soils are subject to intense and prolonged ground shaking from seismic events. When liquefaction occurs, the strength of the soil decreases and the ability of a soil deposit to support foundations for structures is reduced. Soils that are composed of particles that are about the same size, such as water or wind-deposited sediments, are more susceptible to liquefaction than soils with a wide range of particle sizes.

Calhoun Point Comfort evaluated the liquefaction potential at its LNG terminal site and determined that this potential would be low (PSI, 2005). While sediments and landforms present in the project area have soil liquefaction potential 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 Calhoun 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. Although several oil and gas wells exist in the project area, there is no significant oil extraction in the area. In addition, extraction of

groundwater in the area is negligible. Various degrees of subsidence have been documented along the entire Texas coast, with the most significant subsidence in the Houston-Galveston area.

Subsidence is typically a concern when designing LNG storage tank foundations. Calhoun Point Comfort would construct each LNG storage tank on a foundation that consists of a 265-foot-wide, 4-foot-thick concrete pile cap supported by concrete piles driven on a 4-foot by 4-foot matrix. The concrete pile cap would be designed to act as a two-way slab to distribute vertical loads laterally. Subsidence would not likely affect the integrity of the proposed pipeline. Required periodic monitoring of the pipeline right-of-way during operation would help to identify subsidence-related situations that might require maintenance. We believe that subsidence would not be a significant hazard to the proposed LNG terminal or pipeline facilities.

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 Calhoun LNG Project.

4.1.4.5 Flooding/Storm Damage

The Calhoun 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 V20. The eastern portion of the site would be located within the Moderate Flood Hazard Zone (Zone B). The entire Point Comfort Pipeline would lie within Zone B. Table 4.1.4.5-1 includes definitions of FEMA flood hazard zone designations in the project area.

Under significant weather events, such as hurricanes and tropical storms, the LNG terminal facilities would be subjected to severe flooding, storm surge, high winds, erosion along the shoreline and docking facilities, and potential site access interruptions. Each of the LNG terminal components would have to be designed to withstand these forces so that factors such as wind shear, flooding and water damage, and erosion of land area have minimal affects on the operation and safety of the facilities. Calhoun Point Comfort designed its LNG terminal to mitigate the potential effects of flooding/storm damage. Calhoun Point Comfort indicated that the base flood elevation for the project area is about 15 feet. The shoreline facilities would be designed to withstand storm surge and flooding and the LNG terminal would be at an elevation of 29 feet above MSL. Because the structural and mechanical elements have been designed into the LNG terminal facilities to withstand coastal flooding and storms, we conclude that flooding due to storm events is not likely to adversely affect the project facilities.

Calhoun Point Comfort would avoid potential for erosional exposure of pipelines by directionally drilling large waterbodies and burying pipelines at least 5 feet below small waterbody channel bottoms. Flooding and storm damage are not expected to pose a hazard to the proposed pipeline facilities.

TABLE 4.1.4.5-1

Federal Emergency Management Agency Flood Hazard Zone Designations in the Calhoun LNG Project Area

Zone Designation	Description
Zones B	Zones B is 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 and V20	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. Zone V20 is the area inundated by 100-year flooding with velocity hazard (wave action); no base flood elevations have been determined.

4.2 SOILS AND SEDIMENTS

4.2.1 Soil Composition and Limitations

The Calhoun LNG Terminal would be within the Ijam soil series while the Point Comfort Pipeline would cross the Dacosta, Edna, Lake Charles, Midland, Placedo, Telferner, Aransas, Chicolete, Fordtran, Ganado, Inez, Laewest, Marcado, Navidad, and Texana soil series. These soil series include clay, loam, clay loam, fine and very fine sandy loam, loamy fine sand, and sandy clay loam.

The LNG terminal site would be located on 73 acres of manmade, industrial land that was created by the placement of dredged material from Lavaca Bay and Cox Bay. Calhoun Point Comfort conducted a geotechnical investigation of the dredge material, or sediments, that currently make up the manmade, industrial land on which the proposed LNG terminal would be located. Calhoun Point Comfort drilled a total of six soil borings at the LNG dock, tank, and process areas (PSI, 2005b). The sampling and physical testing was done in accordance with standard methods published by the American Society of Testing Materials (ASTM).

The LNG tank and process area contains dredged spoils and fill soils that form the upper 26 feet of the soil profile. Dredged spoils and fill soils are mainly very soft to soft silty sands, fat clays, and sandy fat clays. Undrained shear strength of dredge spoils and fill soils is 150 pounds per square feet (psf). Below the fill soils, firm to hard lean clays and sandy lean clays exist within a depth of 44 feet to 47 feet. Undrained shear strength of these soils is in the range of 700 psf to 2,200 psf. A medium dense to very dense clayey sand layer with undrained shear strength of 1,800 psf to 2,200 psf extends at depths of 47 feet to 100 feet below ground surface. Groundwater level was measured at depths of 1 foot to about 4 feet below the existing ground surface at the process area. The moisture content of dredged spoils varied from 22 percent to 199 percent and the liquid limit of these soils ranged from 28 to 104.

The dock area contains predominately fat clays and sandy lean clays, with very soft to very stiff clayey sand layers extending to a depth of 60 feet. This layer has an in-situ moisture content of 15 percent to 94 percent, liquid limit of 21 to 52, plasticity index of 26 to 48, and undrained shear strength of 800 psf to 1,000 psf. Clayey sands, medium dense to very dense with clayey layers and seams extends below 60 feet to about 120 feet with in-situ moisture content of 18 percent to 32 percent, liquid limit of 30 to 58, plasticity index of 14 to 37, and undrained shear strength of 2,000 psf to 2,500 psf. Several of the recovered cohesive samples were slicken sided with shell fragments, and calcareous and ferrous nodules which are the features of typical Beaumont clays.

Table 4.2.1-1 provides a summary of soil characteristics and limitations associated with the proposed LNG terminal, pipeline, and laterals. Major soil characteristics and limitations for the pipelines and laterals are discussed below.

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. Prime farmland can include 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.*, using artificial drainage or irrigation).

Construction of the pipeline would temporarily impact about 221.7 acres of prime farmland soil. These impacts could include interference with agricultural drainage, loss of soil through erosion, mixing of topsoil and subsoil, 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.

We evaluated prime farmland where proposed permanent aboveground facilities would result in the loss of significant amounts of prime farmland. Five meter stations associated with the proposed pipeline would be located on prime farmland soil: the Channel/HPL meter station at MP 5.1, the KM-Tejas meter station at MP 12.0, the Valero meter station at MP 12.1, the Gulf South/KM Texas meter station at MP 21.4, and the Tennessee meter station at MP 27.1.

Operation of these aboveground facilities would result in the permanent removal of a total of 1.7 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. Since each of the meter stations would require only from 0.1 to 0.5 acre for operation, impact at each site would be minimal. We believe the unavoidable conversion of 1.7 acres of prime farmland as a result of operation of the proposed meter stations would not be a significant impact.

TABLE 4.2.1-1

Soils Affected by the Calhoun LNG Project

Facility/Soil Series	Percent of Affected Area	Erosion Potential	Revegetation Potential	Compaction Potential	Drainage Characteristics	Hydric	Prime Farmland
LNG Terminal							
Ijam Clay	100	Low to Moderate	Poor	Low to Moderate	Very Poorly Drained	Yes	n/a
Point Comfort Pipeline and Laterals							
Dacosta	39.0	Slight	Poor to High	Moderate to High	Somewhat Poorly to Moderately Well Drained	No	Yes
Edna	3.0	Slight	Moderate to High	Low to Moderate	Poorly to Somewhat Poorly Drained	No/Yes a/	No
Lake Charles	4.0	Slight	High	High	Somewhat Poorly Drained	No	No
Midland	2.0	Slight	Moderate to High	Moderate	Poorly Drained	Yes	No
Placedo	2.0	Slight	Poor	High	Very Poorly Drained	Yes	No
Telferner	1.0	Slight	High	Low to Moderate	Somewhat Poorly Drained	No	No
Aransas	1.0	Slight	Moderate to High	High	Poorly Drained	Yes	No
Chicolete	3.0	Slight	High	High	Moderately Well Drained	No	No
Fordtran	2.0	Slight	High	Low to Moderate	Moderately Well Drained	No	No
Ganado	4.0	Slight	High	High	Somewhat Poorly Drained	Yes	No
Inez	1.0	Slight	High	Low to Moderate	Moderately Well Drained	Yes	No
Laewest	25.0	Low to High	High	High	Moderately Well Drained	No	Yes
Marcado	5.0	High	High	Moderate	Moderately Well Drained	No	No
Navidad	1.0	Slight	High	Low to Moderate	Well Drained	No	No
Texana	7.0	Slight	High	Moderate	Poorly Drained	Yes	Yes

a/ Not listed as a hydric soil in Calhoun County but listed as hydric soil in Jackson County.

Calhoun Point Comfort would adhere to the measures contained in our Plan which are designed to minimize impact on agricultural soils. Construction measures include postponing soil disturbances when soils are excessively wet and separating subsoils from topsoils when grading and trenching (for residential, wetland, and agricultural soils). Calhoun Point Comfort would also develop specific procedures in coordination with the appropriate agencies to prevent the introduction or spread of noxious weeds and soil pests resulting from construction and restoration activities.

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.

Hydric soils do occur on the LNG terminal site and the Point Comfort Pipeline would affect eight soil series that have hydric characteristics. These soils are generally poorly drained soils with a high clay content, and very slow permeability. Calhoun Point Comfort would construct the Project in accordance with our Procedures, which include provisions for construction in areas of saturated soils, including postponing soil disturbances when soils are excessively wet. We believe that Calhoun Point Comfort's implementation of these measures, as well as use of Best Management Practices (BMPs) during construction (*e.g.*, use of appropriate erosion and sedimentation control measures), would minimize impacts on hydric soils.

Erosion Potential

Erosion is a continuing natural process that can be accelerated by human disturbance. 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.

The LNG terminal site is currently sparsely vegetated. The potential for erosion of soils and discharge of sediments off-site would be relatively moderate during construction. Since Calhoun Point Comfort has adopted our Plan and Procedures for erosion and sedimentation control during construction, these concerns would be minimal.

Along the Point Comfort Pipeline, the Laewest and Marcado soil series with a slope of 1 to 8 percent may exhibit erosion potential. During pipeline construction, Calhoun Point Comfort would use erosion control structures, temporary seeding and revegetation, and erosion control fabric in accordance with our Plan and Procedures. For waterbody crossings, Calhoun Point Comfort would use the waterbody crossing methods contained in our Procedures and erosion and sedimentation 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, the use of mulch and erosion control fabrics, and restoration within 20 days of backfilling the trench,

weather permitting. We conclude that implementation of these measures would minimize overall soil erosion that could result from construction of the Project.

Revegetation Potential

Successful restoration and revegetation in areas that are not permanently developed is important to maintain ecosystem productivity and to protect underlying soil from potential damage, such as erosion. Soils on the LNG terminal site are currently sparsely vegetated and two soil series along the pipeline route, Dacosta and Placedo, were identified as having a low potential for revegetation. Areas where aboveground facilities would be built would not be revegetated. This would encompass about 73 acres at the LNG terminal, including roads. The aboveground facilities along the pipeline would cover about 3.5 acres.

Calhoun Point Comfort would implement the requirements in our Plan for revegetation of disturbed areas. These measures include compensation or restoration of all turf, ornamental shrubs, and specialized landscaping at the landowners request and addition of fertilizers and soil pH modifiers and seedbed preparation or seeding at the local soil conservation authority, land management agency, or landowners request. Calhoun Point Comfort indicated it would revegetate and restore disturbed areas using mixtures recommended by appropriate state and federal agencies. Landscaping and surface treatments built at the LNG terminal site should prevent wind and water erosion from the site during operation. We conclude that if revegetation is conducted in accordance with these measures, areas disturbed by construction would be successfully revegetated. See section 4.4.3 of this EIS for further information on revegetation.

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.

The LNG terminal may have the potential to experience some level of compaction; however, the potential impacts associated with compaction on the LNG terminal site would be minimal given that the site would be highly developed. The Point Comfort Pipeline would cross six soil series with high compaction potential; however, based on soil texture and drainage characteristic, essentially all of the soils that would be disturbed by pipeline construction activities have the potential to experience some level of compaction.

Calhoun Point Comfort would mitigate for potential compaction in agricultural areas by following measures contained in our Plan. Mitigation for soil compaction would include segregating topsoil, postponing soil disturbances when soils are excessively wet, and using deep tillage operations during right-of-way restoration using a paraplow or similar implement. We believe that use of these measures during construction would minimize soil compaction resulting from construction of the proposed Project.

4.2.2 Contaminated Soils

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 of spills and leaks. Calhoun Point Comfort developed a *Water Quality Management Plan* which includes a SPCC Plan. These plans describe spill prevention practices, spill handling and emergency notification procedures, and training requirements and would be implemented during construction of the LNG terminal and pipeline.

As part of Calhoun Point Comfort's determination of the likelihood to encounter contaminated soils at the LNG terminal site or along the pipeline route, Environmental Data Resources, Inc. (EDR) conducted a search of available environmental database records within 0.25 mile of the LNG terminal site and pipeline route. EDR found that eight potentially contaminated sites and facilities with historic releases of hazardous substances occur in the vicinity of the Project (table 4.2.2-1).

TABLE 4.2.2-1

Potentially Contaminated Sites and Facilities within 0.25 mile of the LNG Terminal and Pipeline Route

Site/Facility Name and Location	MP Location/Approximate Distance and Direction from the Proposed Pipeline	Potential Contamination Issue
ES Joslin Power Station – 135 County Road 319	MP 0.0-0.2/1,320 feet to the southeast	One 500 gallon underground storage tank - removed in 1994.
Aluminum Company of America (Alcoa) – State Highway 35	MP 0.3-2.3/0 feet to the east and west	Alcoa (Point Comfort)/Lavaca Bay Superfund Site.
Enclean – State High 35 and Lamar	MP 2.3/350 feet to the west	Two 2,000 gallon and two 4,000 gallon underground storage tanks – removed in 1993.
Village Grocery – 104 Highway 35	MP 2.3/350 feet to the west	Two 8,000 gallon and one 6,000 gallon underground storage tanks – currently in use.
City Waterhouse – Julia Lane	MP 2.7/260 feet to the west	One 2,000 gallon underground storage tank - removed in 1997.
Formosa Plastic Corporation – 101 Formosa Drive	MP 3.4/260 feet to the east and 2,270 feet to the north	Hazardous materials released to the soil or surface waters and generator of hazardous wastes.
The Inteplast Group – 101 Inteplast Boulevard	MP 10.5/425 feet to the east	Generator of industrial wastes.
Edna Compressor Station – FM 1882	MP 27.1/650 feet to the north	Generator of industrial wastes.

In the event that contaminated soils are encountered during project construction, Calhoun Point Comfort would implement its *Contaminated Soils Management Procedures*. These procedures would be employed during construction within 0.25 mile of the sites/facilities identified in table 4.2.2-1 and include: visual and olfactory inspection all disturbed soils; segregation of any contaminated soils encountered and proper containerization, labeling, and storage; sampling and characterizing of contaminated soils; transportation and disposal at an approved disposal facility; or, if approved by the Texas Commission of Environmental Quality (TCEQ) and TRRC, treated *in situ*.

Although the proposed pipeline would cross through the Alcoa (Point Comfort)/Lavaca Bay Superfund Site from approximately MP 0.29 to MP 2.27, the releases of hazardous materials that

caused the site to be classified as a Superfund site occurred about 0.5 mile west of the pipeline route. Calhoun Point Comfort indicated that no contaminated soils issues occur along this segment of the proposed pipeline.

NOAA has established a set of guidelines in conjunction with the EPA that evaluates sediments contaminated with toxic chemicals to determine its ecological risk. These guidelines are based on a number of evaluation methods and aid in decisions as to whether a certain amount of toxic chemicals is likely to harm the ecosystem. The Screening Quick Reference Tables present screening concentrations for inorganic and organic contaminants in various environmental media and include guidelines for preserving samples and analytical technique options (NOAA, 2005).

Calhoun Point Comfort sampled the soils at four locations within the LNG terminal site, one at each LNG tank site and two within the process area, including the firewater tank site. These samples were tested for polycyclic aromatic hydrocarbons (PAHs) and mercury.

The results of the analyses revealed that PAHs did not exceed the reportable limit; however, mercury did exceed the reportable limit in one sample, taken at a depth between 13 and 15 feet, from the process area. Calhoun Point Comfort indicated that the value detected in this sample, 147 parts per billion (ppb), is between the threshold effects level (TEL) and effects range low (ERL), 130 ppb to 150 ppb, respectively, of NOAA's Screening Quick Reference Tables. The ERL represents the value at which toxicity may begin to be observed in sensitive species. Because the value of 147 ppb detected at the LNG site is below the ERL of 150 ppb, it is unlikely that any toxic effects on terrestrial or marine organisms would occur from disturbance of soils at the LNG site.

Should contaminated soils be encountered within the LNG terminal site and along the Point Comfort Pipeline, Calhoun Point Comfort would implement its *Contaminated Soils Management Procedures* to minimize the spread of contaminated soils and to properly remove, dispose of or decontaminate such soils. We believe that using the measures detailed in this procedure would minimize spread of contaminated soils.

4.2.3 Shoreline Erosion

The shoreline along the Gulf Coast exists in various states of erosion, accretion, or equilibrium. These processes are dynamic and vary with time as well as location. In the Port area, the shoreline is classified as deltaic headlands, peninsulas, and barrier islands. Deltaic headlands are primarily comprised of mud with relatively low percentages of sand, which would contribute to higher erosion rates. Bay shore erosion rates in the Port area vary based on wind, hurricanes, and other tropical storms that can alter the shoreline in a short period of time. Since the Port's peninsula and coastline is within a protected bay area, major shoreline erosion has not been noted. Between 1856 and 1957, Brown *et al.* found that the amount of land accretion on Cox Bay equaled the amount of eroded land. McGowen and Brewton noted that as promontories were eroded, sediment was deposited in small reentrants, or valleys, and that the dredging of turning and boat basins has created about 110 acres of new land.

A portion of the shoreline within the proposed LNG terminal site would be modified by dredging of the proposed LNG ship berth. The shoreline of the berth area would be protected from

erosion by installing erosion controls such as rip-rap or articulated concrete mats or other slope stabilization materials.

LNG ship traffic and frequency of passage is discussed in detail in section 4.9.2 of this EIS. Up to 120 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 Matagorda Ship Channel and Point Comfort Channels two to three times per week. Given the current volume of large ship traffic in the channels, the additional incremental ship traffic resulting from operation of the Calhoun LNG Terminal is not expected to substantially increase shoreline erosion.

4.2.4 Sediments

The sediments that would be affected by the Calhoun LNG Project are located within the CCND's new turning basin and Calhoun Point Comforts LNG ship berth. Both the turning basin and ship berth would be dredged to a depth of minus 40 feet MLLW, or 4 feet deeper than the existing channels. Construction of the turning basin and ship berth would require dredging about 4.2 million cubic yards of material from Lavaca Bay. Of this amount, about 3.5 million cubic yards would be for the CCND's turning basin and 0.7 million cubic yards would be for Calhoun Point Comfort's ship berth.

Dredge Material Disposal

Calhoun Point Comfort has proposed to use dredged material from the CCND's new turning basin and Calhoun Point Comfort's ship berth to aid in capping contaminated sediments, creating coastal marsh habitat, and stabilizing shorelines within Lavaca Bay and Cox Bay. As described in section 2.4.1.2 of this EIS, the placement of material is proposed at five proposed DMPAs located between 0.6 and 1.9 miles of the LNG terminal site. These DMPAs include: Dredge Island Expansion North, Dredge Island Expansion South, Dredge Island Marsh, Enhanced Recovery Project Area, and Central Cox Bay Marsh and Shoreline Protection Area (see figure 2.4-2). In total, the DMPAs have the capacity to accommodate the 4.2 mcy of material that would be dredged for the turning basin and the ship berth (table 2.4.1.2-1). The CCND proposes to remove the dredged material from its new turning basin and Calhoun Point Comfort's ship berth using a cutterhead suction dredging system. Typically for a dredging project of this size, a 24- to 30-inch-diameter, high-density polyethylene pipeline would be used for the dredge. The slurry would be transported through a discharge pipeline to the disposal areas (see figure 2.4-2). Depending on the length of the discharge pipeline, a booster pump may be used.

Contaminated Sediments

On April 20, 1988, the Texas Department of Health (TDH) issued a fish closure of a 1 square mile area of Lavaca Bay to the taking of finfish and crabs and on January 13, 2000, the TDH reopened a portion of the closure area, Cox Bay, located due south of the LNG terminal site. The closure for Cox Bay was reopened based on the reduced contaminants in surface sediments and reduced burden of mercury in fish tissues (EPA ROD, 2001). During a treatment study, Alcoa dredged and disposed approximately 80,000 cubic yards of mercury-contaminated sediments which resulted in the removal of about 2,300 pounds of mercury from the Lavaca Bay

system (EPA, 2004). An engineering evaluation, cost analysis and design that presents removal action alternatives to protect Dredge Island in the event of a severe storm has also been completed. As a result of this evaluation, about 10,700 linear feet of the levees or dikes used to contain the contaminated material were refurbished to a height of 30 feet and the slopes were reinforced (EPA ROD, 2001).

Since the early 1990s, Lavaca Bay, Cox Bay, and the Matagorda Ship Channel have been investigated as part of the Alcoa (Point Comfort)/Lavaca Bay Superfund Site. The source of the contaminants within the Superfund Site is attributed to the release of PAHs and mercury due to the operations of Witco Chemical Corporation and Alcoa's chlor-alkali processing from the 1960s to 1980s. In 1994, investigative and remedial activities began under an Administrative Order on Consent for Alcoa signed by Alcoa and the EPA. The remedial investigation included major sampling of sediments and surface water in a "Closed Area" of Lavaca Bay immediately adjacent to the Calhoun LNG Project site. Remedial investigation concluded that the primary contaminants of concern in the bay system include mercury and PAHs (EPA, 2004).

During 2000, the COE's Galveston District conducted additional research in Lavaca Bay and in 2002 published in the report of *Environmental Assessment Assumption of Maintenance for Point Comfort Turning Basin*. The COE's research included analysis of water and sediment samples from the Point Comfort Turning Basin and solid phase bioassays and bioaccumulation tests. In this research, the concentrations of mercury in 23 sediment samples collected ranged from below detection level (<0.02 milligrams per kilogram [mg/kg]) to a high of 0.28 mg/kg. The higher values are above the EPA's TEL of 130 ppb and the ERL of 150 ppb; however, all values were below probable effects level (PEL) of 696 ppb and below the apparent effects threshold (AET) of 410 ppb. The PEL is the sediment benchmark concentration above which impacts on benthic communities are probable, whereas the AET is the calculated benchmark concentration where some degree of biological effects have been confirmed in benthic communities.

After reviewing the results of this study, consulting with the EPA, and performing a risk evaluation, the COE concluded that the increased potential for encountering excessive concentrations of hazardous materials during dredging within the Point Comfort Turning Basin would be remote. The EPA agreed with the COE's assessment regarding bioaccumulation studies and stated that it believes that toxic effects are not expected on benthic or water-column organisms exposed to the sediments. The EPA also stated that it believes that there is no potential for undesirable effects due to bioaccumulation as a result of the presence of contaminants in the sediments from the Turning Basin (COE, 2002).

In 2001, the EPA issued a ROD on the Alcoa (Point Comfort)/Lavaca Bay Superfund Site including a Selected Remedy which had the following major components for the Lavaca Bay system:

- Extraction and treatment of the chlor-alkali process area groundwater by a series of extraction wells. Treatment included aeration using air stripper and carbon adsorption for mercury removal.
- Installation of a Dense Non-Aqueous Phase Liquid (DNAPL) collection or treatment system at the Witco Area to intercept potential DNAPL migration to Lavaca Bay.

- Dredging of the Witco Channel to remove approximately 200,000 cubic yard of mercury contaminated sediments.
- Remediation of Witco Marsh by dredging or filling to address the concern of biological uptake of mercury.
- Accelerate the natural recovery of sediments north of Dredge Island by placing a thin cap of clean materials over the area.
- Institutional controls to manage exposure to finfish/shellfish.
- Long-term monitoring of sediments and fish to confirm natural recovery of sediment and fish tissue to an acceptable level.

Remedial activities in Lavaca Bay and Dredge Island are ongoing. While the surface sediments of Lavaca Bay have not been restored to background levels, remediation efforts have positive results. The TCEQ monitors water quality in Lavaca Bay and reports that mercury and dissolved oxygen in water have been removed from the 303d list, dated 2002, of impaired waterbodies based on the monitoring results (TCEQ, 2005).

The CCND's dredging activities associated with its new turning basin and Calhoun Point Comfort's ship berth would require approval by the COE. The COE is required to follow specific protocols regarding the toxicity of sediments to be dredged and the possible contamination that results in the surrounding waters. Dredged materials placed in proposed cap areas would comply with all sampling, testing, reporting, or other requirements articulated in the EPA's ROD for the Alcoa Site remedial action objectives. Pre-dredging soil sampling would be performed to ensure that mercury or PAH levels would not adversely affect the proposed placement areas. In addition, the dredging work would be performed in accordance with TCEQ water quality certification. The issues regarding mercury in Lavaca Bay are well documented and the procedures to handle contaminated sediments have been established. Where sediments have a mercury concentration over 0.50 mg/kg (dry weight), silt fences would be installed to contain the sediment within an authorized disposal area. Decant water from the dredged material could only be discharged if the mercury concentration is less than 0.5 milligrams per liter (COE, 2002).

Calhoun Point Comfort would conduct dredging operations according to its comprehensive DMMP to be developed as part of the Section 10/404 permit application process with the COE. The DMMP would contain specifications for dredging, placement of dredged material, and the testing for and handling of contaminated sediments. The DMMP would address dredging contamination issues including:

- monitoring of disposed dredged material for contaminants;
- steps to be taken for any hazardous material/contaminated sediments encountered during dredging;
- handling of clean versus contaminated dredge material;
- control of discharge water from dredge decanting;
- capacity of areas in Dredge Island to accept contaminated dredge material;
- impacts associated with sedimentation or contaminant movement from a dredging plume within Lavaca Bay; and
- description of what measures would be implemented to avoid, minimize, or mitigate dredging plume impacts.

4.3 WATER RESOURCES

4.3.1 Groundwater

The Calhoun LNG Project area is underlain by the Gulf Coast Aquifer, which is characterized as an unconfined aquifer with unconsolidated sand, silt, and clay deposits that are vertically connected. Numerous retreats and advances of ancient shorelines have resulted in a complex, overlapping mixture of sand, silt, and clay (Ryder, 1996). The formations of the Gulf Coast Aquifer system are hydrologically connected to form a large, artesian aquifer system comprised of four major units: the Catahoula, Jasper, Evangeline and Chicot aquifer formations, with the Evangeline and Chicot being the shallowest, mostly sandy portions. In most areas, the Evangeline aquifer is separated from the overlying Chicot aquifer by clay beds. The Chicot aquifer consists of five alluvial deposits including the Lissie and Beaumont formations. The Beaumont formation underlies the project area and is about 200 to 300 feet deep. The majority of the groundwater used in Calhoun and Jackson Counties is obtained from wells completed in the Lissie formation, Beaumont clay, and recent alluvium.

The groundwater supply in Calhoun County is of shallow depth, lacks availability of fresh water, and is not a major water source. The groundwater supply in southwestern Jackson County is generally of poor quality. Fresh groundwater supplies are available in the remaining areas of Jackson County except along the Lavaca River from Lavaca Bay northward to the confluence of the Lavaca and Navidad Rivers. Cities such as Edna and Ganado, located about 3.0 and 12.0 miles northeast of the pipeline terminus, receive its water supply from a public well. The Lavaca-Navidad River Authority provides water to a number of cities and industrial facilities in both Calhoun and Jackson Counties from Lake Texana, located about 6.0 miles east of the project area. The EPA has not designated the Gulf Coast Aquifer as a sole source aquifer. The Project crosses no locally zoned aquifer protection areas. No municipal or commercial water wells would be within 400 feet of the proposed construction workspaces of the LNG terminal, pipeline, or laterals.

One unused, industrial water supply well is located within 150 feet of the proposed LNG terminal. This well is on CCND property and owned by the Delta Drilling South Texas Division. If necessary, Calhoun Point Comfort indicated that the CCND would plug and abandon the well pursuant to state requirements. No other public or private water supply wells are within 150 feet of the LNG terminal. Groundwater would not be used during construction or operation of the LNG terminal.

Four private water supply wells are near the Point Comfort Pipeline construction right-of-way. A 130-foot-deep, livestock well near MP 7.7 would be 80 feet from the right-of-way and an unregistered well near MP 11.2 would be inside the right-of-way. Calhoun Point Comfort stated that this well is pumped by a windmill and appears to be used for livestock or irrigation, or it may be abandoned. A 125-foot-deep, household well near MP 19.0 would be within 218 feet of the construction right-of-way and a 475-foot-deep, irrigation well near MP 26.5 would be within 3 feet of the right-of-way.

Prior to construction, Calhoun Point Comfort would stake and flag the wells near MP 11.2 and MP 26.5, and they would be avoided during construction. Blasting is not anticipated by Calhoun

Point Comfort. Refueling of equipment would be prohibited within 200 feet of all known wells and BMPs, to be identified in Calhoun Point Comfort's Storm Water Pollution Prevention Plan (SWPP Plan), would be implemented to direct surface water runoff from areas disturbed by construction away from existing wells. Calhoun Point Comfort would conduct pre- and post-construction testing of well yield and water quality for the wells near MP 7.7, MP 11.2, and MP 26.5, and for any other wells or springs found to be within 150 feet of the construction right-of-way for the pipeline. Should these wells be impacted during construction, Calhoun Point Comfort would employ interim measures and provide temporary sources of potable water. If significant impacts on these wells occur after construction, Calhoun Point Comfort would restore or replace the wells or, if necessary, provide an alternate source of water.

Some dewatering may occur in areas of the LNG terminal during construction; however, relatively small volumes would be expected and effects on the overall groundwater system would be small and temporary. Calhoun Point Comfort reported that water levels measured within the process area ranged from 1 to 4 feet below the existing ground surface and standing water was observed within the tank area. Although stabilized groundwater at the terminal site would be at sea level, seasonal variations due to precipitation and tidal variations could result in higher or lower water elevations (PSI, 2005b).

If shallow groundwater is encountered during excavations along the Point Comfort Pipeline, it may be necessary to dewater during construction. Trench dewatering operations would be brief, typically lasting several days or less. Potential impacts on the groundwater would include minor fluctuations in groundwater levels and/or increased turbidity within the aquifer adjacent to the activity. 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. Calhoun Point Comfort would follow our Plan and Procedures that provide guidance on the location of dewatering structures so that there would be no deposition of sediments into wetlands and waterbodies, and no impacts on cultural resources or habitat for sensitive species. We believe that effects of dewatering on groundwater would be localized, temporary, and insignificant.

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. Spills or leaks of hazardous liquids could contaminate groundwater and affect users of the aquifer. This type of impact could be avoided or minimized by restricting the location of refueling or storage facilities and by requiring immediate cleanup of spills. Calhoun Point Comfort has agreed to implement our Procedures, which include the preparation and implementation of Spill Prevention and Response Procedures that meet state and federal requirements. As part of its draft *Water Quality Management Plan*, Calhoun Point Comfort developed an SPCC Plan that would be implemented during construction of the facilities. The SPCC Plan addresses potential spills of fuel, lubricants, and other hazardous materials and describes spill prevention practices, spill handling and emergency notification procedures, and training requirements. It also describes mitigation measures, including containment and cleanup, to minimize potential impacts should a spill occur. We believe that using the measures detailed in Calhoun Point Comfort's draft *Water Quality Management Plan* and SPCC Plan would minimize or eliminate the potential for adverse impacts on groundwater resources.

Although Calhoun Point Comfort's *Water Quality Management Plan* and SPCC Plan would include measures that would be taken should a spill occur in onshore areas within the LNG terminal site, there are no procedures specified for spills that could occur in waters of Lavaca Bay during construction of the marine terminal. Therefore, **we recommend that:**

- **Calhoun Point Comfort develop a Marine SPCC Plan to include procedures that would be implemented should spills of oil, gas, lubricants, or other hazardous materials occur during construction and operation of the marine terminal. In addition to addressing emergency spill response and clean-up procedures, this plan should include a description of general spill prevention measures such as material handling practices, personnel training, and inspection. The Marine SPCC Plan should be filed with the Secretary for review and approval by the Director of OEP prior to the start of site preparation at the LNG terminal.**

4.3.2 Surface Water

4.3.2.1 LNG Terminal

No natural fresh water ponds, lakes, or streams occur on or adjacent to the LNG terminal site. The LNG terminal would be bounded by Lavaca Bay to the west and Cox Bay to the south and east. Lavaca Bay is a broad, flat, and shallow microtidal estuary within the upper Matagorda Bay system (Bronikowski, 2004). Matagorda Bay is the third largest estuarine system in Texas and contains a number of defined embayments including Lavaca and Cox Bays. Matagorda Bay is separated from the Gulf of Mexico by the Matagorda Peninsula and water exchange occurs through five main tidal inlets, one of which includes the Matagorda Ship Channel. Freshwater input to the system comes from a large drainage basin entering the bay from the Colorado and Lavaca Rivers and a number of creeks and bayous. The entire Matagorda Bay system covers 270,085 acres and includes 85,992 acres of coastal wetlands and 6,918 acres of submerged aquatic vegetation with an average depth of about 7 feet (GulfBase, 2005).

Lavaca Bay covers 40,959 acres and is classified by the TCEQ as water quality limited with recreation, exceptional aquatic life, and oyster waters as designated uses. Cox Bay covers 5,119 acres and is TCEQ classified as effluent limited with contact recreation, exceptional aquatic life use, and oyster waters as designated uses. Both bays are shallow with an average depth of 4 feet (EPA ROD, 2001). Since the early 1990s, Lavaca Bay, Cox Bay, and the Matagorda Ship Channel have been investigated as part of the Alcoa (Point Comfort)/Lavaca Bay Superfund Site (see section 4.2.4 of this EIS for information on the impact of the Superfund Site on Lavaca and Cox Bays).

The LNG vessel transit route would extend from the Gulf of Mexico through the Matagorda Ship Channel. From an outer bar and jetty, the Matagorda Ship Channel extends for about 21 miles to the Point Comfort Channel and the Alcoa Industrial Channel. The existing authorized depth of the Matagorda Ship Channel and the Point Comfort Channel is 36 feet and channel widths range between 200 and 300 feet. Areas of Lavaca and Cox Bays are dredged periodically to allow for ship and barge passage to the Port as well as the approach channel and existing turning basin.

The primary impacts on Lavaca Bay from construction and operation of the Project would be from dredging of the CCND's turning basin and Calhoun Point Comfort's ship berth and from

stormwater runoff. There is also the potential for impacts on the bay from accidental spills of hazardous materials during construction, or LNG spills during operation. Fresh water for this Project would be obtained from the CCND or purchased from Formosa Plastic Corporation or the City of Point Comfort.

Approximately 79.3 acres would be affected by the proposed dredging of CCND's turning basin and Calhoun Point Comfort's ship berth. Calhoun Point Comfort indicates that most of the material at CCND's turning basin and Calhoun Point Comfort's ship berth consist of virgin clay (see section 4.2.4 of this EIS for information on contaminated sediments). The new turning basin would require the removal of 3.5 million cubic yards, while about 0.7 million cubic yards would be removed from the LNG berth.

In addition, as part of its maintenance plan, the CCND and Calhoun Point Comfort estimate that 300,000 cubic yards of material would be dredged from the turning basin and ship berth on an annual basis. Therefore, over a 50-year planning period for maintenance dredging about 15.0 mcy of material would be dredged from these areas. As currently proposed, the five DMPAs that would be used for the project DMPAs could not accommodate an additional 6.53 mcy of material. Calhoun Point Comfort indicated that it could place this excess volume at Alcoa's bauxite impoundments or process water ponds or an identified upland confined placement area as described above. We have recommended that the CCND, on behalf of Calhoun Point Comfort, determine the final placement location of this maintenance dredge material before dredging operations begin.

The CCND would use a hydraulic cutterhead dredging system to remove sediment to create the necessary depth at its turning basin and Calhoun Point Comfort's ship berth. 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 four to eight 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 five DMPAs within Lavaca Bay and Cox Bay. The dredged material would be pumped through a discharge pipeline to the disposal areas. The sediment particles would settle by gravity to the bottom of the disposal areas and be separated from the overlying water (called return water). Further details on Calhoun Point Comfort's proposed dredging are described in section 2.4.1.2 of this EIS.

Dredging of the turning basin and ship berth would result in temporary siltation and sedimentation impacts similar to those that occur during maintenance dredging activities within the Port. Dredging activities would temporarily stir up sediment and degrade the water quality in the area of the dredging. The hydraulic cutterhead dredge system that would be used to excavate the material generally creates less turbidity than other types of dredges, and the cutter speed can be adjusted to match the sediment properties, thus minimizing turbidity. The CCND and Calhoun Point Comfort expect that the pumps used to convey the material from the cutterheads, in a hydraulic dredging operation, would contain most of the suspended solids caused by the dredging and that they would be conveyed with the dredged material to the DMPAs within Lavaca Bay and Cox Bay. Once on the DMPAs, the suspended solids would settle out prior to the excess water being discharged back to Lavaca Bay and Cox Bay

The suspended solids and turbidity levels eventually would decline to ambient levels following completion of dredging activities. Turbidity resulting from dredging could reduce light

penetration and the corresponding primary production of aquatic plants, algae, and phytoplankton in the slip area. The suspension of organic materials and sediments could cause an increase in biological and chemical oxygen demand in the slip area. Lower dissolved oxygen concentrations could cause a temporary displacement of motile organisms and could stress or kill sessile benthic organisms within the affected area. Calhoun Point Comfort would work closely with the COE to identify and incorporate the appropriate specifications and guidelines governing dredging activities into the dredging contract. Turbidity impacts related to dredging are expected to be short-term and to have minimal adverse effects on water quality and aquatic life. Calhoun Point Comfort would monitor and manage suspended solids and turbidity at the dredge site and employ mitigation measures including the use of silt curtains and absorbent boom, shallower dredge cuts, containment structures, or stop dredging activates until turbidity levels have declined.

The CCND 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 TRRC under Section 401 of the CWA. A NPDES permit under Section 402 of the CWA issued by the TRRC would be necessary to regulate return water emanating from the DMPAs within Lavaca Bay and Cox Bay. Dredge discharge and/or decant liquids would be collected and tested during dredge operations to ensure permit compliance. Typically, such permits would establish limits on the concentration and area of suspended solids during dredging, and would likely require monitoring during dredging and establish criteria for maximum suspended sediment concentrations allowed in the return water. These specifications would be included in Calhoun Point Comfort's DMMP for the Project. Calhoun Point Comfort would be required to finalize its DMMP with the appropriate agencies, including the COE, prior to the start of construction of the LNG terminal. Since the COE has not yet commented on the DMPP, **we recommend that:**

- **<u>Prior to construction of the LNG terminal</u>, Calhoun Point Comfort should file with the Secretary its finalized DMMP.**

During site preparation and construction at the LNG terminal site, disturbed soils would be exposed to erosion. To minimize erosion impacts on surface waters, Calhoun Point Comfort would comply with the Texas Pollutant Discharge Elimination System, Construction General Permit for stormwater discharges during construction. This would include preparation and implementation of a Stormwater Pollution Prevention Plan and Erosion and Sedimentation Control Plan. Stormwater collected at the LNG terminal site would be discharged through two stormwater discharge points located at the southern corner of the terminal site and southeast shoreline from the process area. 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. Water removed would be discharged in the vicinity of the removal area via overland flow to reduce sedimentation. Calhoun Point Comfort would implement our Procedures in addition to its Stormwater Pollution Prevention Plan.

In the event of an accidental spill of oil, gas, lubricants, or other hazardous materials during construction or operation, Calhoun Point Comfort would follow the measures outlined in its draft *Water Quality Management Plan* and SPCC Plan. In addition, LNG vessels calling at the LNG

terminal would be required to have a vessel response plan that satisfies Coast Guard requirements and applicable international standards.

Calhoun Point Comfort has designed its LNG terminal to account for an accidental spill of LNG during operation of the facility, and prevent the LNG from entering Lavaca Bay. The LNG facilities would include safety and hazard detection systems, three LNG containment sumps and two LNG process sumps and associated LNG spill collection system. In the unlikely event that LNG is spilled into the water, the cryogenic liquid would vaporize rapidly upon contact with the warm air and water. Being less dense than water, LNG would float on the surface prior to vaporizing. Because LNG is not soluble in water and the LNG would completely vaporize shortly after being spilled, there would be no liquid left that could mix with and/or contaminate the water.

4.3.2.2 Pipeline

The proposed Point Comfort Pipeline would cross 65 surface waterbodies. 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. However, the crossing of the Lavaca River (MP 23.4) would be at the boundaries of two Texas water quality stream segments and one of the segments, upstream of the Point Comfort Pipeline crossing, has low dissolved oxygen levels and partially supports aquatic life. A list of the waterbodies crossed by the proposed pipeline is included in table 4.3.2.2-1 and shows the location by waterbody name, MP, type, crossing width, water quality classification, and proposed crossing method. Only four natural, permanently flowing waterbodies would be crossed by the pipeline: a slough (MP 4.5), Navidad River (MP 16.5), Lavaca River (MP 23.4), and tributary to Lavaca River (MP 23.5).

TABLE 4.3.2.2-1

Waterbodies Crossed by the Point Comfort Pipeline

Milepost	Waterbody	Type[1]	Crossing Width (ft)	Crossing Method
Point Comfort Pipeline				
0.25	Ditch	CD/ Intermittent	<10	open cut
0.29	Ditch	CD/ Intermittent	<10	open cut
0.29	Ditch	CD/ Intermittent	<10	open cut
0.30	Ditch	CD/ Intermittent	<10	open cut
0.31	Ditch	CD/ Intermittent	<10	open cut
0.79	Industrial pond	CD/ Perennial	90	HDD
1.87	Ditch	CD/ Perennial	15	open cut
4.46	Lake tributary	ND/ Perennial	45	open cut
5.18	Ditch	CD/ Perennial	9	open cut
5.96	Ditch	CD/ Intermittent	31	open cut
6.58	Gully	CD/ Intermittent	46	open cut
7.63	Ditch	CD/ Perennial	7	open cut
9.86	Gully	ND/ Intermittent	156	open cut
9.94	Gully	ND/ Intermittent	46	open cut
11.15	Gully	ND/ Intermittent	13	open cut
12.12	Ditch	CD/ Intermittent	<10	bore
12.45	Ditch	CD/ Intermittent	<10	bore
12.63	Ditch	CD/ Intermittent	<10	open cut
12.77	Ditch	CD/ Intermittent	15	open cut

TABLE 4.3.2.2-1

Waterbodies Crossed by the Point Comfort Pipeline

Milepost	Waterbody	Type[1]	Crossing Width (ft)	Crossing Method
12.89	Channelized creek	CD/ Intermittent	25	open cut
13.28	Ditch	CD/ Intermittent	<10	bore
13.59	Ditch	CD/ Intermittent	<10	HDD
13.61	Ditch	CD/ Intermittent	<10	HDD
13.62	Ditch	CD/ Intermittent	<10	HDD
13.63	Ditch	CD/ Intermittent	<10	HDD
14.02	Ditch	CD/ Intermittent	50	open cut
14.81	Channelized creek	CD/ Intermittent	20	open cut
14.99	Drainage canal	CD/ Intermittent	30	open cut
15.92	Drainage	CD/ Intermittent	30	open cut
16.54	Navidad River	ND/ Perennial	140	HDD
16.94	Dry Creek	ND/ Intermittent	30	HDD
17.05	Dry Creek	ND/ Intermittent	20	open cut
17.50	Ditch	CD/ Intermittent	<10	open cut
17.54	Ditch	CD/ Intermittent	<10	open cut
19.13	Ditch	CD/ Intermittent	<10	open cut
19.45	Ditch	CD/ Intermittent	<10	open cut
19.49	Ditch	CD/ Intermittent	<10	open cut
19.64	Ditch	CD/ Intermittent	<10	bore
19.93	Ditch	CD/ Intermittent	<10	open cut
20.02	Ditch	CD/ Intermittent	<10	bore
20.03	Ditch	CD/ Intermittent	<10	bore
20.54	Ditch	CD/ Intermittent	<10	bore
20.68	Ditch	CD/ Intermittent	<10	open cut
20.93	Ditch	CD/ Intermittent	<10	open cut
20.94	Ditch	CD/ Intermittent	<10	open cut
21.27	Ditch	CD/ Intermittent	<10	open cut
21.82	Creek	ND/ Intermittent	28	open cut
22.74	Creek	ND/ Intermittent	45	open cut
23.13	Borrow pit	Pond/ Perennial	600	HDD
23.42	Lavaca River	ND/ Perennial	77	HDD
23.46	Creek	ND/ Perennial	12	HDD
23.78	Creek	CD/ Intermittent	13	open cut
24.21	Ditch	CD/ Intermittent	25	open cut
24.79	Ditch	CD/ Intermittent	14	open cut
25.33	Channelized creek	CD/ Intermittent	40	HDD
25.74	Ditch	CD/ Intermittent	44	open cut
25.93	Ditch	CD/ Intermittent	58	open cut
26.17	Ditch	CD/ Intermittent	<10	bore
26.19	Ditch	CD/ Intermittent	<10	bore
26.47	Ditch	CD/ Intermittent	<10	open cut
26.67	Ditch	CD/ Intermittent	<10	bore
26.69	Ditch	CD/ Intermittent	<10	bore
26.72	Ditch	CD/ Intermittent	<10	bore
26.75	Ditch	CD/ Intermittent	20	bore
26.99	Ditch	CD/ Intermittent	030	bore

[1] Type: CD = channelized drainage; ND = natural drainage

Pipeline construction could impact surface waters in a variety of ways. Clearing and grading of stream banks, in-water trenching, trench dewatering, and backfilling could result in modifications to aquatic habitat, increased sedimentation and turbidity, decreased dissolved oxygen levels, increased stream warming, releases of chemical and nutrient pollutants from sediments, and accidental release of chemical contaminants such as fuels and lubricants. The greatest potential impacts for the waterbody crossings would result from suspension of sediments caused by in-stream trenching and backfilling. The extent of the impact would depend on sediment loads, stream velocity, and sediment particle size at the time of construction. These factors would determine the density, downstream extent, and persistence of the sediment plume. In general, impacts on the in-stream aquatic biota and the habitat value of the waterbody would be temporary and short-term during construction. Through the transport of sediment and recruitment of aquatic biota from upstream sources, these resources would be expected to return to preconstruction conditions soon after the completion of in-stream work, backfilling, and restoration.

In order to minimize impacts to water quality, Calhoun Point Comfort would cross 11 of the 65 waterbodies using the HDD crossing method. The HDD method involves boring a pilot hole beneath the waterbody to the opposite bank and then enlarging the hole with one or more passes of a reamer until the hole is the necessary diameter. A prefabricated pipe segment is then pulled through the hole to complete the crossing. A successful drill generally results in no impact on the waterbody being crossed. For this reason, directional drilling is considered to be a preferred crossing method for waterbodies, especially those that are sensitive. However, there are certain impacts that could occur as a result of the drilling, such as an inadvertent release of drilling mud. This could occur in the area of the mud pits or tanks, or along the path of the drill due to unfavorable ground conditions. Drilling mud is most often comprised of naturally occurring materials, such as bentonite, which in small quantities would not be detrimental to vegetation, fish, or wildlife. However in larger quantities, the release of drilling mud into a waterbody could affect fisheries and vegetation; although impacts would be significantly less than those associated with an open-cut crossing. Calhoun Point Comfort submitted a draft project-specific HDD Frac-Out Monitoring and Response Plan that addresses how potential frac-outs would be minimized, procedures for detecting a frac-out, measures to be implemented should a frac-out occur, remediation of an affected area, how an abandoned drill hole would be sealed, and measures of notification of downstream users, and reporting and notification.

Calhoun Point Comfort has not yet conducted geotechnical investigations of all of the waterbodies that would be directionally drilled. These investigations must be conducted to determine the feasibility of completing directional drills at these waterbody crossings. Once the geotechnical investigations are completed, Calhoun Point Comfort would prepare final site-specific drilling plans. Calhoun Point Comfort would file its final *Water Quality Management Plan,* SPCC Plan, and HDD Frac-Out Monitoring and Response Plan approximately one year prior to commencement of construction of the pipeline.

In the event that an HDD of a waterbody is unsuccessful, Calhoun Point Comfort would install the crossings using the open-cut method. Calhoun Point Comfort would be required to file a plan for the crossing of each waterbody if the directional drill is unsuccessful. This would be a site-specific plan that includes scaled drawings identifying all areas that would be disturbed by construction. Calhoun Point Comfort would be required to file this plan concurrent with its

application to the COE for a permit to construct using this plan. The Director of OEP must review and approve this plan in writing before construction of the crossing.

Fourteen waterbodies that would be affected by the proposed pipeline are channelized intermittent roadside ditches. These waterbodies would be crossed by the bore method. The remaining 40 waterbodies that would be affected are both channelized and natural intermittent drainages and would be crossed by the open-cut method. It is possible that no flow would be present during construction across these intermittent waterbodies, in which case crossing by the bore or open-cut method would have minimal impact on the waterbody. If flow were present in these waterbodies, Calhoun Point Comfort 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.

Stormwater from areas disturbed during construction would be discharged under a General Construction Permit, which Calhoun Point Comfort would obtain from the EPA under the NPDES program. In addition, Calhoun Point Comfort 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 guidelines for an acceptable level of protection for wetlands and 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. Calhoun Point Comfort proposes to cross all waterbodies in accordance with our Procedures. We believe that using the measures detailed in our Procedures would minimize both short- and long-term impacts on 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. Calhoun Point Comfort would follow the measures outlined in its draft *Water Quality Management Plan* and SPCC Plan to minimize the potential impacts of spills of hazardous materials during construction in waterbodies.

4.3.2.3 Hydrostatic Testing

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

LNG Storage Tanks

Once construction is completed, the LNG storage tanks would be hydrostatically tested, in accordance with API Standard 620, Appendix Q.8 (see section 2.4.1.4). Hydrostatic testing of each tank would involve filling the inner tank with approximately 28 million gallons of fresh water. Test water would be obtained from the CCND or purchased from Formosa Plastic Corporation or the City of Point Comfort. At the maximum level calculated, the water would be maintained for at least 48 hours for inspection. To minimize water usage, the two tanks would undergo hydrostatic testing using the same water by transferring the water at the conclusion of the test of the first tank to the second tank to be tested. After testing, the tanks would be cleaned with fresh water and dried. Pumps in each tank would control the discharge rate of the test water. Fresh water would be discharged into Lavaca Bay at a rate of approximately 10,000 gpm and be in compliance with hydrostatic test water permits issued by the TRRC. No chemicals would be added to the hydrostatic test water before or after testing. Prior to discharge, all test water would be analyzed for chemical composition and dissolved oxygen would be restored. Calhoun Point Comfort stated that, if the construction sequence allows, it would use the test water from the LNG tanks to hydrostatically test the Point Comfort Pipeline.

Pipeline

Prior to being placed into service, the pipeline and laterals would also be hydrostatically tested to DOT standards, as listed in 49 CFR 192. In addition, Calhoun Point Comfort has prepared a Draft Hydrostatic Testing Plan to address the methods of water withdrawal and discharge. The pipeline would be tested in one segment, using approximately 8.1 million gallons of water for the entire pipeline. Of this amount, about 3,681 gallons and 13,165 gallons would be used to test the Formosa and Transco Laterals, respectively. The sections of pipe that would be installed using the HDD method would be tested separately to ensure the integrity of the HDD segment. Of the 8.1 million gallons, about 346,500 gallons would be used to test each HDD segment.

Temporary manifolds and pumping systems would be used to withdraw water. Calhoun Point Comfort estimates that about 4.5 million gallons of water would be withdrawn from the Navidad River and the remaining 3.6 million gallons would be obtained from Formosa Plastic Corporation. Formosa Plastic Corporation has informed Calhoun Point Comfort that it could supply all of the water needed for hydrostatic testing from its industrial waste water system. As a result, Calhoun Point Comfort and Formosa Plastic Corporation are currently in negotiations and expect to have an agreement fully executed prior to the start of construction. **We recommend that:**

- **Calhoun Point Comfort file with the Secretary any agreements reached with Formosa Plastic Corporation regarding the use of its industrial waste water to hydrostatically test the Point Comfort Pipeline and Formosa and Transco Laterals. Calhoun Point Comfort should provide the volume of water to be obtained from Formosa Plastic Corporation and confirm that water from the Navidad River would not be used prior to hydrostatic testing.**

Water intake hoses would be screened to prevent the entrainment of aquatic species. Calhoun Point Comfort indicated that water may also be obtained from a retention basin at the LNG terminal site or, if the construction sequence allows, test water from the LNG tanks could be used to hydrostatically test the pipeline. Water would be pushed from one segment to another by

connecting piping at the manifold sites as each test segment is filled sequentially. The pipeline segments would be pressurized to the design test pressure and the pressure would be maintained for a minimum of eight hours. 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 is completed, the water would be discharged into a retention basin at the LNG terminal site via a temporary water line. Discharge of hydrostatic test water would be in accordance with our Procedures and NPDES permit requirements.

Discharge of hydrostatic test water used to test the integrity of oil and gas facilities requires permitting from the TRRC, as regulated by the Texas Administrative Code (TAC) Title 16, Part 1, Chapter 3, Rule 3.30 Memorandum of Understanding Between the TRRC and the TCEQ under Section (e)(6)(A). In addition, hydrostatic test waters that fall under the jurisdiction of the TRRC 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.

4.3.2.4 Operational Impacts

LNG Terminal

Operational impacts of the LNG terminal on marine waters would include periodic maintenance dredging of the CCND's turning basin and Calhoun Point Comfort's ship berth, as well as incidental propeller wash from the LNG ship traffic in Point Comfort Channel. Based on the operating history of the Port, the CCND and Calhoun Point Comfort expect maintenance dredging to be required about every two years. Both maintenance dredging and incidental propeller wash could result in temporary increases in turbidity in Lavaca Bay from the resuspension of bottom sediments.

The ship berth would include erosion protection (*i.e.,* articulated concrete blocks) placed on slopes to stabilize the shoreline and prevent erosion from wave action and wheel wash and bow thrusters from the LNG ship wash. We believe that turbidity caused by maintenance dredging using a hydraulic cutterhead dredge would be short-term, localized, and not significant. Maintenance dredging should not add appreciably to ongoing maintenance dredging activities in Point Comfort Channel. The CCND and Calhoun Point Comfort anticipates that materials generated during maintenance dredging would be pumped to the DMPAs within Lavaca Bay and Cox Bay, if they are still available, or another permitted disposal area. Maintenance dredging and dredge disposal would require an additional approval from the COE.

In the event of an accidental spill of oil, gas, lubricants, or other hazardous materials during construction or operation, Calhoun Point Comfort would follow the measures outlined in its draft *Water Quality Management Plan* and SPCC Plan. In addition, LNG vessels calling at the LNG terminal would be required to have a vessel response plan that satisfies Coast Guard requirements and applicable international standards. A Storm Water Management Plan would also be prepared to comply with TCEQ and EPA requirements concerning storm water runoff

due to the impervious surfaces at the LNG facility. Storm water discharges would be directed to NPDES-permitted discharge points.

Calhoun Point Comfort has designed its LNG terminal to account for an accidental spill of LNG during operation of the facility, and prevent the LNG from entering Lavaca Bay. The LNG facilities would include safety and hazard detection systems, three LNG containment sumps, and two LNG process sumps and associated LNG spill collection system. In the unlikely event that LNG is spilled into the water, the cryogenic liquid would vaporize rapidly upon contact with the warm air and water. Being less dense than water, LNG would float on the surface prior to vaporizing. Because LNG is not soluble in water and the LNG would completely vaporize shortly after being spilled, there would be no liquid left that could mix with and/or contaminate the water.

The SCV technology that would be used to process the LNG produces excess water at a rate of 200 gpm. During the vaporization process, this excess water would become acidic. Calhoun Point Comfort would neutralize the excess water with a caustic solution before it is discharged into the terminal drainage system and into Cox Bay. The temperature of the produced water would range from 60 to 70°F and would raise to ambient temperature before it is discharged into the bay. Discharges of excess water from the SCV process area would comply with the Texas Pollutant Discharge Elimination System.

As with other large cargo ships, LNG carriers would take on some ballast water to maintain stability and trim as they offload their cargo, but they would not be fully loaded when departing the Calhoun LNG Terminal. The amount of ballast water required by each LNG carrier would vary according to its size and the weather conditions. A typical 138,000 m^3 LNG carrier would require about 13.7 millions gallons of water, which would be obtained in Lavaca Bay and transported out of the waterway. The larger 200,000 m^3 ships would withdraw about 19.8 million gallons of water. This would constitute a minor but long-term impact to water resources of Lavaca Bay.

Although ballast water intake by the LNG carrier would occur during offloading of the LNG, no release of ballast water would occur within Lavaca Bay. Any limited discharge of ballast water that should occur would be conducted in accordance with the Coast Guard's mandatory ballast water management program (33 CFR 151).

Pipeline

Operation of aboveground facilities associated with the proposed pipeline, such as pig launchers and receivers, are not expected to affect water resources. Impacts to surface waters are not expected during operation of the proposed pipeline because no further in-stream activities would be expected. Since the pipeline would be installed at a sufficient depth below the beds of waterbodies, exposure of the pipeline is not expected. In the event that a pipeline anomaly (*i.e.*, corrosion, dent, or rupture) is detected during routine inspections that could require pipeline excavation or replacement within a waterbody, impacts would be expected to be similar to those described for construction. Therefore, operation of the project should not have a significant impact on water resources.

4.4 VEGETATION

4.4.1 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. Coastal estuarine emergent wetlands and freshwater palustrine emergent, scrub-shrub, and forested wetlands occur within the Lavaca Bay watershed. Estuarine emergent wetlands are transitional vegetated areas along the shoreline bay shoreline margins. Estuarine emergent wetlands include both intertidal wetlands that are regularly flooded by the tide and supratidal wetlands (mid and high marsh) that are less frequently flooded by the tide. Palustrine wetlands are nontidally influenced freshwater wetlands that are generally dominated by persistent emergents, emergent mosses, or lichens, scrub-shrubs, or trees. They are found in all water regimes, except subtidal and irregularly exposed systems. Emergent wetlands consist of erect, rooted, herbaceous wetland plants that generally persist for most of the growing season. Scrub-shrub wetlands include areas dominated by woody vegetation less than 20 feet tall and are vegetated with true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. Forested wetlands contain woody vegetation that is 20 feet or taller. Calhoun Point Comfort identified wetlands within the project area by field delineation conducted in December 2004 and April 2005. Delineation followed the 1987 COE Wetland Delineation Manual (COE, 1987). Wetland types were classified using the FWS classification system (Cowardin *et al.*, 1979).

Perimeter salt marshes and freshwater marshes are found in upper Lavaca and Cox Bays as well as Chocolate Bay, located south of the Project. Smooth cordgrass (*Spartina alterniflora*) is common in mixed marsh grass stands in upper Lavaca Bay near the mouth of the Lavaca River and portions of Cox Bay. Marsh plants including shoregrass (*Monanthochloe littoralis*), saltgrass (*Distichlis spicata*), black rush (*Juncus roemerianus*), saltwort (*Batis maritima*), and glassworts (*Salicornia* spp.) are found along the shores and inland reaches of upper Lavaca Bay (TGLO, 2001).

No tidal wetlands or vegetated tidal flats would be impacted by the LNG terminal. An estuarine marsh and tidal flat occurs along the southern boundary of the terminal site and outside of the construction area.

As part of its DMMP, Calhoun Point Comfort proposes to use five DMPA within Lavaca Bay and Cox Bay. These DMPAs would be between 0.6 and 1.9 miles from the LNG terminal site. Placement of dredge material at these DMPAs would create both upland and estuarine habitat and/or stabilize existing shoreline. For example, placement of dredged material at the Dredge Island Expansion North and South DMPAs would fill about 55 acres of previously disturbed and unvegetated open bay habitat and about 90 acres of uplands resulting in the creation of about 145 acres of upland confined placement area.

Placement of dredged material at the Dredge Island Marsh DMPA would fill 280 acres of shallow unvegetated bay bottom habitat, resulting in the creation of 260 acres of coastal marsh and 20 acres of uplands. The Enhanced Recovery Projects DMPA would raise the area elevation using the dredged material to about minus 3 feet MLLW but retain the shallow unvegetated bay

bottom habitat that currently exists. Placement of dredged material at the Central Cox Bay Marsh and Shoreline Protection DMPA would fill 435 acres of shallow open bay habitat to create 341 acres of coastal marsh and 94 acres of uplands which would restore the Central Cox Bay shoreline and protect it from erosion.

Dredged material placement could result in a large conversion of habitats, particularly converting about 770 acres open bay to 601 acres of marsh and 169 acres of uplands. These conversions are proposed to beneficially cap existing mercury contaminated sediments, create intertidal wetlands, or restore eroded shorelines.

The pipeline would affect palustrine (freshwater) emergent marsh, scrub-shrub, and forested wetlands. Representative palustrine emergent and scrub-shrub wetland plant species found along the pipeline right-of-way include Eastern baccharis (*Baccharis halimifolia*), longs sedge (*Carex longii*), green flatsedge (*Cyperus virens*), spikerush (*Eleochari*s spp.), spider lily (*Hymenocallis carolinia*), whiteroot rush (*Juncus brachyocarpus*), soft-stem rush (*Juncus effuses*), water primrose (*Ludwigia peploides*), pepperwort (*Marsilea vestita*), pink smartweed (*Polygonum pensylvanicum*), water pepper (*Polygonum hydropiperoides*), foxglove (*Physostegia intermedia*), white-topped sedge (*Rhynochospora colorata*), horned beakrush (*Rhynchospora corniculata*), curly leaf dock (*Rumex crispus*), grassy arrowhead (*Sagittaria graminea*), dwarf palmetto (*Sabal minor*), soft-stem bulrush (*Scirpus validus*), rattlebox (*Sesbania drummondii*), wiregrass (*Spartina patens*), gulf cordgrass (*Spartina spartinae*), duckweed (*Spirodela polyrhiza*), and cattail (*Typha* spp.).

Representative forested wetland plant species found along the pipeline right-of-way include American elm (*Ulmus americana*), water oak (*Quercus nigra*), green ash (*Fraxinus carolinia*), Chinese tallow (*Triadica sebifera formerly Sapium sebiferum*), live oak (*Quercus virginiana*), and cedar elm (*Ulmus crassifolia*) with a herbaceous and scrub-shrub understory that contains many of the species described above.

Calhoun Point Comfort submitted its Section 404 permit application to the COE during June and July 2005 and has not yet received verification of their wetland determinations/delineations. Once the COE has reviewed the application and verified the wetland impacts, a jurisdictional determination for wetland impacts for the Project would be issued.

Approximately 2.9 miles of palustrine wetlands would be crossed by the Point Comfort Pipeline. No wetlands would be crossed by the Formosa or Transco Laterals and no wetlands would be affected by aboveground facilities. Construction of the Point Comfort Pipeline would affect about 23.8 acres of wetlands, while operation of the Project would result in the permanent conversion of 0.2 acre of forested wetlands to emergent wetlands for the life of the Project. Of the total amount, about 20.1 acres would be emergent, 0.8 acre would be scrub-shrub, 0.7 acres would be forested, and 2.2 acres would be and emergent/forested mix (see table 4.4.1-1).

TABLE 4.4.1-1

Wetlands Crossed by the Point Comfort Pipeline

County / Milepost	NWI Classification a/	Length of Wetland Crossed Within Construction Right-of-Way	Wetlands Affected During Construction b/	Wetlands Affected During Operation c/	Area Avoided by HDD d/
		Miles	Acres	Acres	Acres
Calhoun					
0.3	PSS	0.01	0.50	0.01	
1.2	PEM/PFO	0.27	2.17 e/, f/	0.57 f/	
1.7	PEM	0.02	0.80	0.00	
1.9	PEM	0.41	5.39 e/	0.00	0.62
Subtotal		**0.71**	**8.86**	**0.58**	**0.62**
Jackson					
9.2	PEM	0.06	0.52	0.00	
9.3	PEM	0.03	0.07	0.00	
9.4	PEM	0.06	0.53	0.00	
12.3	PSS	0.05	0.30	0.08	
12.4	PEM	0.02	0.03	0.00	
12.5	PEM	0.24	1.47	0.00	
12.8	PEM	0.08	0.56	0.00	
16.4	PEM/PFO	0.16	0.00	0.00	1.04
17.1	PEM	0.18	2.12	0.00	
17.8	PEM	0.04	0.28	0.00	
18.0	PFO	0.04	0.25	0.02	
18.2	PEM	0.10	0.77	0.00	
18.4	PEM	0.18	1.33	0.00	
19.5	PEM	0.04	0.35	0.00	
19.9	PEM	0.08	0.55	0.00	
20.1	PEM	0.09	0.95	0.00	
21.9	PEM	0.01	0.04	0.00	
22.5	PEM	0.11	1.39	0.00	
22.7	PEM	0.07	0.68	0.00	
22.7	PFO	0.02 e/	0.01	0.03	
22.8	PFO	0.06	0.00	0.00	0.29
23.6	PFO	0.07	0.49	0.03	
23.7	PEM	0.02	0.05	0.00	
23.8	PEM	0.05	0.47	0.00	
24.9	PEM	0.17	1.75	0.00	
25.1	PEM	0.01	0.00	0.00	0.02
25.3	PEM	0.05	0.00	0.00	0.44
25.4	PFO	0.05	0.00	0.00	0.39
25.5	PEM	0.02	0.00	0.00	0.07
25.5	PEM	0.01	0.00	0.00	0.10
25.5	PEM	0.03	0.00	0.00	0.12
25.5	PFO	0.02	0.00	0.00	0.08
Subtotal		**2.22**	**14.96**	**0.16**	**2.55**
Total g/		**2.93**	**23.82**	**0.74**	**3.17**

a/ Compiled using National Wetlands Inventory Maps. Palustrine Emergent (PEM), Palustrine Forested (PFO), Palustrine Scrub/Shrub (PSS)
b/ Construction acreage is based on a 75-foot-wide construction right-of-way where the wetland crossing distance is 100 feet or less. Where the wetland crossing distance is greater than 100 feet, the temporary construction right-of-way will be 100 feet.
c/ Permanent acreage is based on a width of 30 feet that would be cleared of trees and shrubs.
d/ Pipeline segment crossed by Horizontal Directional Drill. Acre mitigated is the wetland amount avoided.
e/ Wetland within additional temporary workspace.
f/ Of the 2.17 acres affected during construction, 1.79 would be forested and 0.38 would be emergent. Of the 0.57 acres affected during operation, 0.42 would be forested and 0.15 would be emergent.
g/ Due the effects of rounding the totals may not sum correctly.

Calhoun Point Comfort identified three locations where additional temporary workspaces would be located partially or completely within wetlands. Between MP 1.2 and 1.4 about 1.8 acres of forested wetland would be affected by the temporary workspace needed for pull back stringing and pipe bending near the bore site for a railroad spur crossing. At MP 1.9, about 1.4 acres of emergent wetland would be affected by the temporary workspace needed for a truck turnaround and an HDD entry hole for the crossing of State Route 35. At MP 22.7, about 0.1 acre of forested wetland would be affected by the temporary workspace needed for an HDD entry hole for the Lavaca River crossing.

We have reviewed these temporary workspace locations and believe that there is no other reasonable or practical location for them except in the wetlands and that these workspaces are necessary for the installation of the pipeline. Calhoun Point Comfort has made efforts to locate additional temporary workspaces, to the extent practical, to minimize wetland impacts and would continue this effort during its design of the Project. Although forested wetlands would take longer to revegetate, all 3.8 acres (2.4 acres, forested; 1.4 acres, non-forested) of temporary workspace located in wetlands along the pipeline routes would be allowed to return to pre-existing conditions following restoration. However, NOAA Fisheries considers this type of impact to forested wetlands to be permanent due to the length of time required for the forest canopy regeneration. Using the NOAA Fisheries' definition, a total of about 2.54 acres of forested wetlands would be permanently impacted along the pipeline right-of-way and temporary workspaces and would be included in calculations for determining mitigation.

For those terrestrial wetlands that would be temporarily affected during construction of the pipeline, 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 facilitate surface water flow, buffer flood flows and/or control erosion. Failure to properly segregate topsoil over the pipeline trench line 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. Altering 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.

A majority of the impacts to wetland resulting from construction and operation of the proposed pipelines would be temporary. Calhoun Point Comfort would re-establish all pre-existing wetland elevations in temporarily impacted wetland areas immediately after pipeline installation is complete and would monitor restored wetland areas in accordance with an approved restoration and monitoring plan.

To minimize construction-related impacts on wetlands, Calhoun Point Comfort would implement our Procedures. The Procedures would include the following measures, among others, to minimize impact on wetlands:

- Hazardous materials, chemicals, fuels, and lubricating oils would not be stored within a wetland or within 100 feet of a wetland boundary.

- 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.
- Vegetation would be cut at ground level, leaving existing root systems in place to promote regrowth. Stumps would be removed from the trench line; stumps may be removed from the working side of the right-of-way if removal is required for safety concerns.
- 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.
- Vegetation maintenance would not be conducted over the full width of the permanent right-of-way in wetlands. Shrubs and trees may be selectively removed within 15 feet of the pipeline that are greater than 15 feet in height.
- Monitoring the success of wetland revegetation annually for the first three years after construction or until wetland vegetation is successful.

Our Procedures require that an applicant identify those provisions of the Procedures that it considers unnecessary or technically infeasible, or unsuitable, due to local conditions. The applicant must provide site-specific justification why those provisions are not applicable and/or provide alternative measures that would ensure an equal or greater level of protection. Calhoun Point Comfort requested use of a 100-foot-wide construction right-of-way in wetland areas. As indicated in Section VI.A.3. of our Procedures, in wetlands, the width of the construction right-of-way to must be limited to 75 feet or less. In section 2.4 of this EIS, we recommended that Calhoun Point Comfort use a 75-foot-wide construction right-of-way in all wetlands crossed by the Point Comfort Pipeline. Based on our recent experience with similar types of projects in the Gulf Coast that have proposed 36-inch-diameter pipelines, we believe that a 75-foot-wide construction right-of-way in wetlands would be adequate to construct the pipeline.

In addition to the measures required by our Procedures, Calhoun Point Comfort 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. Calhoun Point Comfort 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.

All permanently impacted wetlands would require compensatory mitigation according to an approved wetland mitigation plan. In general, the loss of wetlands 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. Calhoun Point Comfort has initiated consultation with the COE, FWS, and TPWD regarding the development of a mitigation plan that would compensate for impacts to wetlands.

On September 7, 2005, Calhoun Point Comfort met with the FWS, COE, NOAA Fisheries, and TGLO and discussed wetland mitigation options associated with the Point Comfort Pipeline. Based on feedback received at this meeting, Calhoun Point Comfort developed a *draft Wetland and Waters of the U.S. Mitigation Plan* that was filed with the Commission on November 1, 2005 (see appendix E). Where feasible, Calhoun Point Comfort selected a pipeline route or proposes to utilize construction methods (*i.e.,* HDD) to avoid or minimize impacts on wetlands and waterways. In its draft plan, Calhoun Point Comfort considered three wetland mitigation options to compensate for unavoidable wetland losses: (1) on-site mitigation/ restoration; (2) off-site restoration; and (3) mitigation banking.

On-Site Mitigation/Restoration

Initially, Calhoun Point Comfort considered in-kind, on-site mitigation/restoration. Since surface elevations would be restored to pre-construction conditions, wetland vegetation would be allowed to revegetate along the construction right-of-way. As a result, herbaceous wetlands would not be permanently impacted by construction or operation of the pipeline. About 2.54 acres of forested wetlands would be permanently impacted along the pipeline right-of-way. On-site mitigation/restoration for forested wetland impacts would involve the purchase, enhancement and/or restoration, and stewardship of land immediately adjacent to the right-of-way and on-site restoration or construction of wetlands. Calhoun Point Comfort determined that this option would be impractical and unfeasible since a suitable location for such a purchase along the pipeline route is not available.

Off-site Restoration

Calhoun Point Comfort consulted with the FWS and TPWD to determine if any ongoing or planned wetland restoration projects occur in the project area. If an off-site restoration project were identified, Calhoun Point Comfort could fulfill its mitigation requirements by providing funding for all or part of the off-site restoration project. Calhoun Point Comfort, in consultation with the FWS, identified a potential off-site mitigation project that would involve the purchase and preservation of forested wetlands in Victoria County, located adjacent to Calhoun and Jackson Counties. Calhoun Point Comfort is currently investigating the specifics and feasibility of this mitigation option.

Mitigation Banking

Based Calhoun Point Comfort's September 7, 2005 meeting with the FWS, COE, NOAA Fisheries, and TGLO a consensus was reached that the purchase of wetland credits from a COE approved wetland mitigation bank would be the preferred mitigation option to compensate for

forested wetlands impacts. Although the forested wetland impacts along the pipeline route would occur in Calhoun and Jackson Counties, there is no approved COE wetland mitigation bank that services these counties.

Currently there are two wetland mitigation banks that could provide wetland credits to mitigate the forested wetland impacts along the Point Comfort Pipeline: (1) the Katy-Cypress Wetlands Mitigation Bank; and (2) the Palacios Wetland Mitigation Bank. The Katy-Cypress Wetlands Mitigation Bank is located about 80 miles for the project area and is in a different watershed. It is permitted to service Calhoun County, but not Jackson County.

The Palacios Wetland Mitigation Bank is currently pending COE approval due to reconstruction of the bank. It would service Calhoun and Jackson Counties. Currently, this wetland bank cannot sell wetland credits; however, Calhoun Point Comfort's consultations with the mitigation bank operator indicate that it would gain COE approval in the near future. Since credits have not yet been sold by the bank the conservation easement has not been activated. Once activated, the land at the bank could only be used for wetland mitigation banking. The Palacios Wetland Mitigation Bank includes about 150 acres of herbaceous freshwater wetlands, no forested wetlands exist. As a result, the use of this wetland mitigation bank would be considered out-of-kind to mitigate for the forested wetland impacts along the pipeline route.

Should the FWS, COE, and TPWD agree to out-of-kind mitigation (*i.e.,* purchasing herbaceous wetland credits to mitigate for forested wetland impacts) then the Palacios Wetland Mitigation Bank would be a viable mitigation option. Calhoun Point Comfort stated that the COE could request a higher mitigation ratio (*e.g.*, 3:1 or 4:1 ratio of herbaceous to forested wetland). Because consultation with the appropriate agencies has not yet been completed to establish a mitigation ratio, **we recommend that:**

- **Calhoun Point Comfort continue its consultation with the COE, FWS, EPA, TPWD, and TGLO to further develop its Wetlands and Waters of the U.S. Mitigation Plan. Prior to construction, Calhoun Point Comfort should file its final plan with the Secretary for review and written approval by the Director of OEP.**

4.4.2 Seagrasses

Seagrasses or submerged aquatic vegetation found in subtidal areas are not always considered wetlands as defined above. Typically, seagrasses are considered near-shore habitats that occur in some estuarine systems. Submerged aquatic vegetation is generally absent from Lavaca Bay; however, shoalgrass (*Halodule wrightii*) and wigeongrass (*Ruppia maritima*) have been found along the southern shoreline of Keller Bay, located southeast of the Project. No near-shore marine habitat such as estuarine submerged aquatic bed (seagrass) would be affected by the LNG terminal. No near-shore marine habitat such as estuarine submerged aquatic bed (seagrass) would be affected by the LNG terminal.

4.4.3 Upland Vegetation

The upland vegetation communities that would be affected by construction and operation of the proposed Project include coastal grasslands, scrub-shrub, woodlands, and agricultural lands. The proposed 73-acre LNG terminal site consists of disturbed, undeveloped, manmade industrial land that is sparsely vegetated with Bermuda grass (*Cynodon dactylon*), southern carpet grass (*Axonopus affinis*), white clover (*Trifolium repens*), and crow poison (*Nothoscordum bivalve*). This area would be cleared during construction of the LNG terminal and all vegetation would be replaced with industrial facilities and landscaped vegetation.

Construction of the proposed pipeline would require about 416.6 acres of land, of which 338.6 acres would be open land (agricultural/range land), 27.4 acres would be woodland, and 50.6 acres would be developed land. The open land is covered by grasslands and scrub-shrub vegetation. Shrub species include huisache (*Acacia farnesiana*), Eastern baccharis, hackberry (*Celtis laevigata*), yaupon (*Ilex vomitoria*), honey mesquite (*Prosopis glandulosa*), dewberry (*Rubus* spp.), McCartney rose (*Rosa bracteata*), greenbrier (*Smilax bona-nox*), and cedar elm, while herbaceous species include grasses such as southern carpet grass (*Axonopus affinis*), Bermuda grass (*Cynodon dactylon*), longtom (*Paspalum lividum*), knotroot bristlegrass (*Setaria geniculata*), vasey grass (*Paspalum urvillei*), Johnson grass (*Sorghum halepense*), and smutgrass (*Sporobolus indicus*). Hackberry, honey mesquite, cedar elm, and live oak are common species found in woodlands crossed by the pipeline. Typical crops grown on the agricultural land include corn, sorghum, and cotton. 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.

The aboveground facilities would be on industrial land and herbaceous, shrub, and brush range lands.

Calhoun Point Comfort would follow our Plan and apply our mitigation measures for minimizing erosion and enhancing revegetation before, during and after the construction of the Project. Impacts on vegetation within the LNG terminal site would be minimal since this area is currently in industrial use. To minimize impacts on vegetation along the pipeline right-of-way, about 93.0 percent (25.2 miles) of the route for the 36-inch-diameter pipeline would be immediately adjacent to existing rights-of-way.

Upon completion of construction activities, all temporarily disturbed areas would be restored to pre-construction contours. The effects of clearing (*e.g.*, removal of protective vegetative cover, increase in sun, wind, and precipitation exposure, and alteration of the vegetation structure) would be of longer duration in forested areas than in other areas (*e.g.*, agricultural and open lands) and, in the case of permanent right-of-way, would be for the life of the Project. In accordance with our Plan, Calhoun Point Comfort would not seed actively cultivated farm land, unless requested to do so by the landowner. Calhoun Point Comfort would plant and maintain Bermuda grass at the LNG terminal site and allow the pipeline right-of-way to revegetate per our Plan. Calhoun Point Comfort would also consult with the appropriate state and federal agencies to develop a revegetation and restoration plan that includes seed mixes.

Routine vegetation maintenance clearing could occur within the existing permanent right-of-way no more than once every 3 years. However, to facilitate leak and corrosions surveys, a corridor no more than 10 feet wide centered on the pipeline could be maintained by mowing or a similar means on an annual basis, in accordance with our Plan and Procedures. We believe that with the implementation of our Plan and Procedures, the Project would not significantly impact upland vegetation.

4.4.4 Noxious Weeds and Invasive Species

Calhoun Point Comfort indicated that a noxious weed, the Chinese tallow tree (*Triadica sebifera* formerly *Sapium sebifera*), was found in wetlands along the pipeline right-of-way. Our review of Calhoun Point Comfort's wetland delineation report reveals that the tallow tree was observed in a scrub-shrub wetland at MP 12.3, an emergent wetland at MP 12.4, and a forested wetland at MP 25.5 (Hill Country, 2005). Tallow trees were introduced into the U.S. in the late 1700s. It was originally cultivated as an ornamental shrub and possibly touted as a food source for poultry. Tallow tree is capable of invading areas and rapidly replacing the natural communities with nearly monospecific stands. Characteristic of woody invaders, it grows rapidly, begins reproduction when young (only 3 years old), produces abundant viable seed, and can reproduce from cuttings. Seeds are spread by birds and also may float for great distances. Although popular with landscaping, tallow tree degrades the surrounding ecosystem by producing tannins and increasing the rate of eutrophication (the aging process and conversion of water habitats to marsh and dry land). It persists in all environments except in permanently saturated areas. Because of its occurrence in the project area and in the absence of any known management program for this species, it is likely that the Chinese tallow tree could be reestablished in the construction areas within 1 to 2 years. To control the spread of this species within maintained areas, Calhoun Point Comfort consulted with the Jackson County Texas Cooperative Extension Center about a management approach to control the spread of Chinese tallow tree along the permanent pipeline right-of-way, especially near MP 12.3, MP 12.4, and MP 25.5. Two herbicidal (Brush Buster) methods could be employed to control Chinese tallowtree: (1) the leaf spray method which works best on tallowtrees that have multiple stems at the ground level and are less than 8 feet tall and (2) the stem spray method which works best for young trees or older trees with few basal stems in sparse stands. Application of herbicides to control Chinese tallowtree would be conducted in accordance with herbicide label directions and additional suggestions provided by the Texas Cooperative Extension's *Brush Busters How to Take Out Tallowtree* guidelines.

Our Plan addresses vegetation maintenance for uplands including guidelines for follow up inspections and guidelines for determining successful revegetation. We believe that by following our Plan, consulting with the appropriate state and federal agencies about recommended seed mixes, and the Texas Cooperative Extension about the management of Chinese tallow tree, construction and operation of the Calhoun LNG Project would not significantly impact upland vegetation.

4.5 WILDLIFE AND AQUATIC RESOURCES

This section provides a description of the wildlife and aquatic resources in the project area. Potential impacts to those resources from construction and operation of the Project are discussed, and proposed or additional mitigation measures needed to eliminate or minimize adverse impacts to these resources are identified. Threatened, endangered, and special status species are discussed in section 4.6.

4.5.1 Wildlife

Several habitat types would be affected by the proposed Project including manmade and industrial, open water and shoreline, coastal grasslands, scrub-shrub, woodlands, agricultural, pasture and palustrine wetland habitats. The following subsections provide a brief description of each of the wildlife habitat types present, the wildlife commonly associated with each habitat type, and the potential effects of the Project on these terrestrial wildlife species.

Manmade and Industrial Habitat

The manmade and industrial habitat type consists of deposited dredge material, disturbed, undeveloped, and industrial lands that are sparsely vegetated with grasses. The proposed 73-acre LNG terminal site consists of unmanaged dredge material that is primarily utilized by common birds including sparrows and pipits, which may occur on the higher and drier portions of the terminal site, and terns, black skimmers (*Rynchops niger*), killdeer (*Charadrius vociferus*), and common night hawk (*Chordeiles minor*), which may nest on the bare, sand and gravel patches found at the terminal site. Previously disturbed, industrialized and developed lands that occur along the pipeline route include lands managed by Formosa Hydrocarbons Company and Formosa Plastics Corporation, road shoulders, roadside ditches, and existing rights-of-way. These areas are utilized for forage grounds by wading birds and support a variety of small mammals, invertebrate and amphibian species, but are not considered valuable wildlife habitat.

There are two colonial waterbird nesting areas in the vicinity of the proposed LNG terminal site. Texas Waterbird Colony No. 609-120 is located on Dredge Island between 0.4 mile and 1.4 miles west and northwest of the terminal site and the Texas Waterbird Colony No. 609-121 is located on a dredged material disposal area known as Snake Island about 1.5 miles south of the terminal site. Nesting activities at both of these sites are monitored by the TPWD. The least tern (*Sterna antillarum*), little blue heron (*Egretta caerulea*), roseate spoonbill (*Ajaia ajaja*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), white ibis (*Eudocimus albus*), white-faced ibis (*Plegadis chihi*), glossy ibis (*Plegadis falcinellus*), laughing gull (*Larus atricilla*), gull-billed tern (*Sterna nilotica*), great egret (*Ardea alba*), great blue heron (*Ardea herodias*), Forster's tern (*Sterna forsteri*), cattle egret (*Bubulcus ibis*), Caspian tern (*Sterna caspia*), black skimmer (*Rhynchops niger*), and black-crowned night-heron (*Nycticorax nycticorax*) have all been recorded at both Colonies No. 609-120 and No. 609-121. The reddish egret (*Egretta rufescens*), royal tern (*Sterna maxima*), sandwich tern (*Sterna sandvicensis*), brown pelican (*Pelecanus occidentalis*), and American oystercatcher (*Haematopus palliatus*) have only been recorded at Colony No. 609-121 (QuickBase, 2005). Calhoun Point Comfort consulted with the FWS about these waterbird colonies and reported that Colony 609-120 has been inactive for about 10 years and Colony 609-121 remains active.

Open Water and Shoreline Habitat

Deep estuarine open water habitat type is generally considered to be any aquatic habitat that lacks emergent, hydrophytic vegetation and is at least 6 feet deep. This habitat type is maintained by rainfall, river and runoff inflow, and Gulf of Mexico tidal influences. The American alligator (*Alligator mississippiensis*) could be present in the Lavaca and Cox Bays as it forages for fish, snakes, turtles, frogs, muskrats, nutria, and other small animals that may be present near the terminal site.

Estuarine shoreline habitats include shallow estuarine open water (less than 6 feet deep), intertidal and supratidal unvegetated mud and sandflats, and emergent wetlands. Open water and shorelines provide habitat for a variety of birds including pelicans, cormorants, ducks, grebes, shorebirds, sparrows, wintering Common Loon (*Gavia immer*), and Osprey (*Pandion haliaetus*). Along the southern boundary of the terminal site, outside of the construction area, these birds tend to concentrate in the estuarine marsh and tidal flat area.

Coastal Grassland, Scrub-Shrub, and Woodland Habitats

The coastal grassland habitat type consists of pockets of short- to mid-grasslands that are interspersed with herbaceous and woody plants. The majority of the coastal grassland habitat has been heavily grazed or is currently maintained. The scrub-shrub habitat consists of large shrubs, small trees, and a sparse understory. The woodland habitat includes large forested areas interspersed with grassy clearings. Wildlife using these habitat types include mammals such as white-tailed deer (*Odocoileus virginianus*), bobcat (*Felis rufus*), collared peccary-javelina (*Tayassu tajacu*), common raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), Eastern cottontail (*Sylvilagus floridanus*), black-tailed jackrabbit (*Lepus californicus*), striped skunk (*Mephitis mephitis*), and nine-banded armadillo (*Dasypus novemcinctus*). Birds such as vermilion flycatcher (*Pyrocephalus rubinus*), Couch's kingbird (*Tyrannus couchi*), northern bobwhite (*Colinus virginianus*), mourning dove (*Zenaidura macroura*), sandhill crane (*Grus canadensis*), cattle egret, and numerous other bird species including hawks, owls, woodpeckers, swallows, thrashers, wrens, blackbirds, and sparrows also utilize these habitat types.

Agricultural Land and Pasture/Range Land Habitats

The majority of the pipeline would cross agricultural land and pasture/range land. These habitats have generally been altered from their original vegetation community structure and diversity as a result of crop production and livestock grazing. Agricultural and pasture lands provide cover and serve as an important food source for a variety of small mammals, songbirds, waterfowl, and game birds. This habitat type also provides foraging grounds for larger predatory mammals and birds. Wintering species such as sandhill crane, geese, sparrows, and raptors utilize this habitat to forage.

Palustrine Wetland Habitat

The palustrine wetland habitat type includes emergent wetlands that are associated with perennial and intermittent streams and isolated, depressional wetlands. Wetlands are described and discussed in detail in section 4.4.1 of this EIS. Common mammals associated with the palustrine wetland habitat type include the swamp rabbit (*Sylvilagus aquaticus*) and rice rat (*Oryzomys palustris*). Some of the bird species commonly found in this habitat type include

kites, crows, gulls, vultures, wrens, starlings, orioles, warblers, sparrows, owls, cuckoos, hawks, plovers, terns, swallows, sandpipers, osprey, ibis, and numerous species of ducks. Reptiles and amphibians commonly associated with this habitat type include American alligator, bullfrog (*Rana catesbiana*), western cottonmouth (*Agkistrodon piscivorus*), eastern mud turtle (*Kinosternon subrubrum*), yellow mud turtle (*Kinosternon flavescens*), cricket frog (*Acris* spp.), plainbelly water snake (*Nerodia erythrogaster*), snapping turtle (*Chelydra serpentina*), and green frog (*Rana clamitans*).

4.5.1.1 Potential Project Impacts on Wildlife and Avian Resources

Wildlife Resources

The impact of construction resulting from the proposed Project on wildlife and wildlife habitats would vary depending upon the location, timing, and type of construction. The specific requirements of each species present within the project area would also contribute to expected project impacts. In general, impacts to terrestrial wildlife resulting from the Project would be short-term and minimal because most terrestrial species are reasonably mobile and would be expected to temporarily relocate to similar adjacent habitats during construction activities. Some smaller, less mobile wildlife, such as small mammals, amphibians and reptiles, would likely experience direct mortality during clearing and grading activities. Impacts to wildlife resources would also be minimized through required restoration of the pipeline construction right-of-way. Much of the area affected by construction would be allowed to revert to pre-construction conditions following construction.

Operation of the Project would result in the permanent conversion of about 76.5 acres of upland habitat to industrial use, of which 73 acres would be within the LNG terminal site and the remaining 3.5 acres would be within the aboveground facilities associated with the pipeline. This conversion to industrial use would represent a loss of wildlife habitat; however, impacts resulting from this loss would be minimal since the majority of the loss would be from the LNG terminal site where the existing habitat consists of unmanaged dredge material.

Avian Resources

Calhoun Point Comfort would survey the LNG terminal site during the spring of 2006 to determine if the site is being used for nesting by terns, black skimmers, killdeer, or common night hawk. Results of the survey would be filed with the Secretary, FWS, and TPWD. Should nesting areas be discovered on the LNG terminal site during this survey, Calhoun Point Comfort would consult with the FWS and TPWD to determine appropriate mitigation. Given the distances of active Texas Waterbird Colony 609-121 to the proposed project, we believe that construction and operation of the project would not disrupt birds nesting at this colony. Should nesting birds be found at this location, Calhoun Point Comfort would restrict construction activities within 1,000 feet of the rookery island during the nesting season (February through September).

Construction of the LNG terminal could cause potential injury or mortality of migrating birds that may strike the LNG terminal facilities. Communication towers that can exceed 300 feet in height are known to be the source of large numbers of bird strikes and an estimated 4 to 5 million birds collide with them each year (Manville 1999). By comparison, building window collisions

are estimated to take from 97 to 970 million birds per year, or from 1 to 10 birds per building annually in North America (Klem, 1989, 1990; O'Connell; 1998). In addition to radio towers and large structures, electric utility power lines also have been documented as a cause of avian mortality due to wire strikes.

Studies on building strikes by birds generally focus not so much on the structures themselves, but the veneer of reflective or clear glass construction materials, the use of guy wires to support tall structures, or substantial lighting from either inside or outside sources (Klem, 1990). Lighting is a particular concern, since it appears that migrating birds, which often fly at night, are drawn to artificial lights. Absent from the extensive literature available on bird strikes is any mention of storage tanks or other solid non-reflective/transparent man-made structures or natural solid objects (trees, hills, etc.).

The historical lack of favorable habitat would likely cause migratory species to be unattracted to the LNG terminal site, further reducing the likelihood of interaction with the LNG storage tanks (the tallest structures at the terminal). The LNG storage tanks would not be illuminated with high intensity lighting. The intensity and number of lights would be limited to what is required for security and operations. Due to the limited amount of suitable habitat historically present on the LNG terminal site, the lack of scientific literature reporting on bird striking storage tanks, and the low intensity lighting to be used, we believe the likelihood of adverse effects on migratory birds from collisions with the LNG storage tanks is minimal.

The proposed facility would obtain electrical power from an outside power source and would need 0.7-mile-long power line that would be within an existing utility right-of-way and along an existing access road (see section 2.10.2 of this EIS). The LNG tanks would be left in their light concrete non-reflective state. This design further reduces the likelihood of bird strikes since no reflective materials would be used and there would be no extensive lighting of the tanks, thus avoiding the two major sources of bird strikes on man-made structures. It is unlikely that the construction, placement, and/or operation of the 27.1-mile-long pipeline would have long-term impacts on migratory birds.

Project construction, specifically the clearing of vegetation, could potentially impact about 338.6 acres of habitat suitable for use by migratory birds protected under the Migratory Bird Treaty Act of 1918. The Migratory Bird Treaty Act implements various treaties and conventions for the protection of migratory birds. Under this act, taking, killing, or possessing migratory birds is unlawful. During operation of the pipeline, relatively little vegetation maintenance would be required due to the large percentage of agricultural land crossed. Calhoun Point Comfort would avoid vegetation maintenance during the peak nesting period between April 15 and August 1 of any year. If vegetation clearing must be conducted during this time, Calhoun Point Comfort would survey for all migratory bird nests prior to commencing work. To further protect nesting migratory birds, Calhoun Point Comfort would conduct surveys of areas that could be used by migratory birds before construction. If an active migratory bird nest is found along the construction right-of-way, Calhoun Point Comfort would establish a 25-foot buffer around the nest until young have fledged or the nest is abandoned or consult with the FWS and TPWD to identify the most appropriate measure that should be taken to avoid or minimize impacts.

4.5.2 Aquatic Resources - Estuarine

The Matagorda Bay system, which includes the open waters of Lavaca and Cox Bays, form an extensive estuarine system comprised of perimeter salt marshes, oyster beds, and freshwater marshes. These aquatic habitats are highly productive systems that provide an abundant food base for those species that can tolerate the dynamic and stressful estuarine environment.

Estuarine habitats serve as active nursery grounds and adult feeding areas for numerous fish and invertebrate species. The Matagorda Bay estuary, which includes Lavaca and Cox Bays, is comprised of open shallow and deepwater habitats, saline, brackish, and fresh water marshes, oyster reefs, and seagrasses. Reef systems throughout Matagorda Bay support a significant oyster fishery. Marine mammals are also known to inhabit the area. Representative fish, invertebrate, and marine mammal species of the greater Matagorda Bay system are listed in Table 4.5.2-1.

TABLE 4.5.2-1

Representative Fish, Invertebrate, and Marine Species of the Greater Matagorda Bay System

Common Name	Scientific Name
Atlantic bottlenose dolphin	*Scomberomorus maculates*
Atlantic croaker	*Micropogonias undulates*
Bay anchovy	*Anchoa mitchilli*
Black drum	*Pogonias cromis*
Blue crab	*Callinectes sapidus*
Brown shrimp	*Farfantepenaeus aztecus*
Eastern oyster	*Crassostrea virginica*
Florida pompano	*Trachinotus carolinus*
Gulf kingfish	*Menticirrhus littoralis*
Gulf menhaden	*Brevoortia patronus*
Gafftopsail catfish	*Bagre marinus*
Pinfish	*Lagodon rhomboids*
Pigfish	*Orthopristis chrysoptera*
Red drum	*Sciaenops occellatus*
Sand seatrout	*Cynocion arenarius*
Sheepshead	*Archosargus probatocephalus*
Silver perch	*Bairdiella chrysura*
Southern flounder	*Paralichthys lethostigma*
Southern kingfish	*Menticirrhus americanus*
Spot	*Leiostomus xanthurus*
Spotted seatrout	*Cynoscion nebulosus*
Sea catfish	*Arius felis*
Striped mullet	*Mugil cephalus*
White shrimp	*Litopenaeus setiferus*

4.5.2.1 Fish Species

Fish communities within the vicinity of the project area consist of species found in both estuarine and offshore marine habitats, and are classified as marine warmwater species. Distribution and abundance of these species vary depending on factors such as temperature, salinity, and reproduction cycles. 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. The species most common to Lavaca and Cox Bays include Atlantic croaker, spot, bay anchovy, sand seatrout, spotted seatrout, red drum, black drum, southern flounder, gafftopsail catfish, and sheepshead.

4.5.2.2 Invertebrates

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 protozoa 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 bivalve mollusks (e.g., clams and oysters), polychaete worms, snails, and crabs. The macrobenthic assemblage known to occur in the vicinity of the project area in upper Lavaca Bay and Cox Bay is the Eastern oyster.

Whereas benthic infaunal 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 open bay communities. Shrimp (*e.g.*, brown, pink, and white) and blue crabs are the most abundant epifauna in the vicinity of the project area.

4.5.2.3 Commercial and Recreational Fisheries

Commercial and recreational fisheries are important industries in the greater Matagorda Bay system. Table 4.5.2.3-1 provides a list of representative saltwater commercial and recreational fish and shellfish species known to occur in the vicinity of the project area in Lavaca and Cox Bays.

Calhoun Point Comfort reported that the dominant commercial fisheries in Matagorda Bay are brown, pink, and white shrimp; blue crab; and Eastern oyster. TPWD estimates indicate that the top three recreational fish species for Matagorda Bay are the spotted seatrout, red drum, and southern flounder.

TABLE 4.5.2.3-1

Representative Recreational and Commercial Fish and Shellfish Species Known to Occur in Lavaca Bay and Cox Bay

Common Name	Scientific Name	Fishery Classification
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
Red drum	*Sciaenops ocellatus*	Warmwater marine/estuarine
Spanish mackerel	*Scomberomorus maculatus*	Warmwater estuarine
Pink shrimp	*Farfantepenaeus duorarum*	Warmwater estuarine
White shrimp	*Litopenaeus setiferus*	Warmwater estuarine
Brown shrimp	*Farfantepenaeus aztecus*	Warmwater estuarine
Blue crab	*Callinectes sapidus*	Warmwater estuarine
Eastern oyster	*Crassostrea virginica*	Warmwater estuarine

As discussed in section 4.2.4 of this EIS, on April 20, 1998, the TDH issued a fish closure of a 1 square mile area of Lavaca Bay along the Point Comfort and Alcoa Industrial Channels and around Dredge Island to the taking of finfish and crabs. However, on January 13, 2000, the TDH reopened a portion of the closure area, Cox Bay, located due south of the LNG terminal site. The closure for Cox Bay was reopened based on the reduced contaminants in surface sediments and reduced burden of mercury in fish tissues (EPA ROD, 2001).

Activities proposed at the Enhanced Recovery Project DMPA may affect the local shrimping industry by restricting boat access through specific areas under certain low low water level conditions.

4.5.2.4 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, federally-managed species in the Lavaca and Cox Bay estuaries, and those of commercial and recreational value. Commercial and recreational fish species are discussed above in section 4.5.2.3. Threatened and endangered fish species are discussed in section 4.6 of this EIS. Species with EFH designations in Lavaca Bay and Cox Bay include red drum, Spanish mackerel, and pink, white and brown shrimp. EFH is further discussed in appendix B of this EIS.

4.5.2.5 Project Impacts on Estuarine Species

LNG Facilities and Proposed Dredging Impacts

All marine habitats associated with the Project would occur in the vicinity of the CCND's new turning basin, Calhoun Point Comfort's ship berth, and the five proposed DMPAs within Lavaca

Bay and Cox Bay. 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; loss of organisms by direct removal, entrainment, or burial; and loss related to turbidity or noise impacts.

Construction activities along the boundaries of the LNG terminal site would include grading and leveling to create the footprint of the LNG terminal. This activity could result in siltation at the water's edge and temporary increases in turbidity and/or the suspension of solids within the water column. Bulkhead activities (driving of sheet piles) would occur on the north side of the terminal site and at the ship berth location. Impacts associated with these activities are described below and would be short-term and localized. Fish and larger motile invertebrates such as shrimp and crabs are expected to avoid the affected areas. In general, impacts would be minimized through the implementation of Calhoun Point Comfort's BMPs to be identified in Calhoun Point Comfort's SWPP Plan.

The creation of the CCND's new turning basin and Calhoun Point Comfort's ship berth would permanently remove the benthic organisms that occupy the sediments that would be dredged. However, benthic organisms may recolonize the bottom sediments after each dredge 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 turning basin and ship berth would not cause detectable adverse effects on aquatic species. All permanent impacts to existing shallow water habitats (less than 6 feet deep) that would be converted to deep water habitats would require compensatory mitigation according to a resource agency approved mitigation plan (see appendix E).

In addition to the loss or alteration of aquatic habitats, the primary impacts to fish 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 Lavaca Bay. To determine potential impacts on Eastern oyster habitat in Lavaca Bay and Cox Bay, Calhoun Point Comfort conducted an oyster survey during December, 2005 in the proposed dredge area for the CCND's turning basin and Calhoun Point Comfort's ship berth and at each of the five DMPAs. Thirty-seven oyster reefs were delineated in these areas resulting in about 24.5 acres of potential impact (see table 4.5.2.5-1).

Potential impacts on oyster reef habitat would result from dredging activities associated with the turning basin and ship berth and disposal and permanent storage of dredged material at the five DMPAs. Calhoun Point Comfort reported that 3,743 acres of oyster reef habitat occur in the Lavaca Bay system. The amount of oyster reef habitat that would be affected by the project represents 0.6 percent of available habitat within this system. To mitigate impacts on the 24.5 acres of oyster reef habitat that would be affected within the project area, Calhoun Point Comfort would coordinate with appropriate state and federal agencies to develop a mitigation plan to compensate for these impacts. We believe there would be no significant impacts on oysters or oyster reef habitats within Lavaca Bay and Cox Bay as a result of dredging activities and disposal and permanent storage of dredged material.

TABLE 4.5.2.5-1

Oyster Reefs Delineated in the Project Area and Potential Project Impacts

Project Area	Number of Delineated Oyster Reefs	Acres of Potential Impact
Dredge Area		
CCND's Turning Basin and Calhoun Point Comfort's Ship Berth	6	17.8
DMPAs		
Dredge Island Expansion North	6	0.6
Dredge Island Expansion South	2	0.5
Dredge Island Marsh	15	3.8
Enhanced Recovery Project Area	2	1.0
Central Cox Bay Marsh and Shoreline Protection Area	6	0.8
Total	**37**	**24.5**

Source: Calhoun Point Comfort's Oyster Reef Delineation Study Lavaca Bay System (December 2005) and March 3, 2006 Supplemental Response to FERC's Data Request Number 3.

Demersal and pelagic fish of various life stages would also be at some risk of being entrained. However, much of the available evidence suggests that entrainment is not a significant problem for many species of fish and shellfish in bodies of water that require periodic dredging. In most instances, dredging related impacts appear to be most serious in narrow constricted river channels (Reine and Clarke, 1998).

Increases in turbidity can affect fish physiology and/or behavior. Potential physiological effects include mechanical abrasion of surface membranes, delayed larval and embryonic development, reduced bivalve pumping rates, and interference with respiratory functions. Possible behavioral effects from increased turbidity include interference with feeding for sight-foraging fish and area avoidance. Alternately, the reduced visibility of predatory fish could lower vulnerability to predation for prey species. Turbidity tends to interfere with light penetration and thus reduces photosynthetic activity by phytoplankton. Such reductions in primary production would be localized around the immediate area of dredge operations in Lavaca Bay and would be limited to the duration of the sedimentation plume at the turning basin and ship berth.

Excessive nutrient loading from sediment resuspension can also have an adverse impact upon the harbor because it can cause dramatic increase in the productivity of planktonic algal populations. The particles that would be resuspended as a result of dredging are fine silt and clays that would wash out of the channel before settling. If particles are suspended higher in the water column, or in deeper water, the settling time and distance would be greater. Calhoun Point Comfort would comply with any project-specific recommendations or requirements to minimize suspension of sediments that are attached to dredging permits. In general, 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 shallow shoreline areas in the vicinity of the Project. Submerged aquatic vegetation is generally absent from Lavaca Bay; however, shoalgrass and wigeongrass have been found along the southern shoreline of Keller Bay, located southeast of the Project. Perimeter salt marshes, oyster beds,

and freshwater marshes are found in upper Lavaca Bay and Cox Bay as well as Chocolate Bay, located south of the Project. It is expected that any turbidity or sedimentation impacts would be limited to within several hundred feet of dredging operations. Since turbidity and sedimentation impacts are expected to be minor and limited to within several hundred feet of dredging operations, no wetlands, seagrasses, or oyster reefs are expected to be impacted by the proposed dredging operations. If any of these sensitive habitats are determined to be located in close proximity to the proposed dredging operations and at risk of being impacted, appropriate measures (*i.e.,* use of silt curtains and absorbent boom, shallower dredge cuts, containment structures, or stop dredging activates until turbidity levels have declined) would be implemented to protect these habitats. Therefore, no siltation or turbidity impacts to wetlands, seagrasses, or oyster reefs are anticipated, because theses habitats do not occur within or immediately adjacent to the proposed dredge areas.

Pile driving activities, in some cases, can generate intense underwater sound pressure waves that can adversely affect nearby marine organisms including marine mammals, sea turtles, and fish. The Atlantic bottlenose dolphin is common in Matagorda and Lavaca Bays. 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 elicit 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 that 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).

Calhoun Point Comfort has not yet identified the type of hammer that would be used to drive piles during construction of the ship berth. Driving steel pipe 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 could generate underwater sound levels great enough to affect some fish as far as 190 feet (*i.e*., 190 decibels (re: 1 μPa)) and 1,860 feet (*i.e*., 155 decibels (re: 1 μPa)) from a steel pile. 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 Lavaca Bay while piles are being driven. Because the piles would be located in an active Port area, it seems likely that construction noise and activities would cause many marine species to avoid the area where the most intense sound levels would be generated.

Ship and boat traffic associated with construction and operation of the Project would also generate underwater sounds. Although vessel noise would not generally be of the intensity produced from driving steel piles, project-related vessels (LNG carrier ships, tugs, and construction barges) operating in the Point Comfort Channel could generate sounds that elicit 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).

Hydrostatic test water discharges into Lavaca Bay would be in accordance with permit requirements issued by the TRRC. Hydrostatic testing is further discussed in section 4.3.2.3. Prior to discharge, all test water would be analyzed for chemical composition and treated if necessary. Therefore, we believe there would be no significant impacts on aquatic species or habitats as a result of discharging hydrostatic test water.

Operation of the LNG terminal should not have a significant effect on area fisheries. Operation would involve additional vessel traffic of up to 120 LNG carriers per year. This would include berthing of an average of two to three LNG ships per week, or two to three additional vessel movements both inward and outward through the Point Comfort and Matagorda Ship Channels per week. Increased vessel traffic is not expected to result in increased impacts to marine mammals or sea turtles. To help minimize impacts to marine mammals and turtles, Calhoun Point Comfort would include NOAA Fisheries' *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* policy as part of its Terminal Use Agreement with LNG Ship operators (see section 4.6 of this EIS).

LNG ships calling from international ports could potentially introduce aquatic invasive species into U.S. waters. However, no release of ballast water would occur within Lavaca Bay. Therefore, there would be no impact on aquatic species or habitats as a result of discharge of LNG ship ballast water. It is expected that any LNG carriers calling at the Calhoun Point Comfort 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) and international standards that were adopted on February 13, 2004. In addition, the Coast Guard has developed responses to exotic/invasive species associated with foreign vessels and its Office of

Operating and Environmental Standards developed *Mandatory Practices for All Vessels with Ballast Tanks on All Waters of the United States*. The mandatory practices include requirements to rinse anchors and anchor chains during retrieval to remove organisms and sediments at their place of origin and to remove fouling organisms that may be affixed to ship hulls, piping, and tanks. The removal of organisms would be conducted on a regular basis and the disposal of any removed substances would be in accordance with local, state, and federal regulations. Therefore, we conclude that the introduction of non-indigenous attached species via ship hulls is not likely to significantly alter the local biotic community.

There are potential impacts on marine organisms resulting from the intake of ballast water while in port. While the vessel is discharging its LNG, it would be taking on seawater ballast to maintain a constant draft at the berth. The LNG ships would require approximately 26.2 million gallons of seawater ballast. Ballast water would be drawn in through intake openings on the side of the LNG ship. These openings would be covered with a strainer plate with slots about 1-inch-wide by 8- to 12-inches long. Aquatic species in the immediate vicinity of the LNG ship berth 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 (24-30 feet below the surface) near the bottom of the LNG ship berth. Ballast water intake at Calhoun Point Comfort's proposed LNG terminal would be similar to ongoing ballast water intake by numerous ships currently calling on the Port of Port Lavaca-Point Comfort, and impacts from entrainment during ballast water intake by LNG ships at the proposed terminal would not add appreciably to current impacts.

In addition to ballast water intake, the SCV technology that would be used to process the LNG produces excess water at a rate of 200 gpm. During the vaporization process, the excess water would become acidic. Calhoun Point Comfort would neutralize the excess water with a caustic solution before it is discharged into the terminal drainage system and into Cox Bay. The temperature of the produced water would range from 60 to 70°F and would rise to ambient temperature before it is discharged into the bay. Discharges of excess water from the SCV process area would comply with the Texas Pollutant Discharge Elimination System and would be of ambient temperature. Discharges of freshwater would create a dilution zone outside of the outfall area and would result in an area of slightly lower salinity than the adjacent waters of Cox Bay. Calhoun Point Comfort would conduct an evaluation using site specific ambient condition data and the CORMIX Mixing Zone Expert System water model to confirm that fresh water discharges at design temperature and salinity conditions would maintain water quality standards within the mixing zone. The results of this evaluation would be submitted with Calhoun Point Comfort's permit applications to the TCEQ.

Dredged Material Management

As part of its DMMP, Calhoun Point Comfort proposes to use five DMPA within Lavaca Bay and Cox Bay. These DMPAs would be between 0.6 and 1.9 miles from the LNG terminal site. Placement of dredge material at these DMPAs would create both upland and estuarine habitat and/or stabilize existing shoreline. For example, placement of dredged material at the Dredge Island Expansion North and South DMPAs would fill about 55 acres of previously disturbed and unvegetated open bay habitat and about 90 acres of uplands resulting in the creation of about 145 acres of upland confined placement area.

Placement of dredged material at the Dredge Island Marsh DMPA would fill 280 acres of shallow unvegetated bay bottom habitat, resulting in the creation of 260 acres of coastal marsh and 20 acres of uplands. The Enhanced Recovery Projects DMPA would raise the area elevation using the dredged material to about minus 3 feet MLLW but retain the shallow unvegetated bay bottom habitat that currently exists. Placement of dredged material at the Central Cox Bay Marsh and Shoreline Protection DMPA would fill 435 acres of shallow open bay habitat to create 341 acres of coastal marsh and 94 acres of uplands which would restore the Central Cox Bay shoreline and protect it from erosion.

Dredged material placement could result in a large conversion of habitats, particularly converting about 770 acres open bay to 601 acres of marsh and 169 acres of uplands. These conversions are proposed to beneficially cap existing mercury contaminated sediments, create intertidal wetlands, or restore eroded shorelines. The loss of open water habitat could adversely impact estuarine species that utilize shallow muddy bottoms. However, when compared to the entire Matagorda Bay estuary, the conversion would be a minor percentage. In addition, the beneficial utilization of dredge material to create wetlands may convert existing unvegetated shallow water habitat to intertidal wetlands. Creation of shallow marsh habitat could provide vital nursery habitat to juvenile estuarine fisheries in the area. Additional discussions on the proposed DMMP (appendix D) are in section 2.1.4.2 and impacts and mitigation to federally-managed species are further presented in the EFH Assessment (appendix B).

4.5.3 Aquatic Resources - Freshwater

No natural freshwater ponds, lakes, or streams occur on or adjacent to the LNG terminal site. The proposed Point Comfort Pipeline would cross 65 surface waterbodies as listed in table 4.3.2.2-1 of this EIS. Only four of these waterbodies (a slough [MP 4.5], Navidad River [MP 16.5], Lavaca River [MP 23.4], and tributary to Lavaca River [MP 23.5]) are natural, perennial waterbodies. The remaining waterbodies are intermittent-flowing drainages or ditches. The waterbodies capable of supporting fish populations have been classified as warmwater and sport fisheries and include gamefish such as largemouth bass (*Micropterus salmoides salmoides*), sunfish (*Lepomis* spp.), crappies (*Pomoxis* spp.), and catfish (*Pylodictis* spp.).

Impacts on fisheries resources resulting from pipeline construction activities at waterbody crossings can include sedimentation and turbidity, alteration or removal of instream and stream bank fish cover, introduction of water pollutants, or entrainment of small organisms during hydrostatic testing. Studies generally have indicated that pipeline construction through waterbodies results in temporary impacts on streams and rivers, and that there are no long-term effects on water temperature, pH, dissolved oxygen, benthic invertebrate populations, or fish populations (Vinkour and Shubert, 1987; Blais and Simpson, 1997).

In order to minimize impacts, Calhoun Point Comfort would cross 11 of the 65 waterbodies using the HDD crossing method. Fourteen waterbodies are channelized intermittent roadside ditches that would be crossed by the bore method. Crossing by HDD or bore would avoid direct impact on the waterbodies and associated fisheries. The remaining 40 waterbodies crossed by the pipeline are both channelized and natural intermittent drainages that would be crossed by the open-cut method.

An open-cut crossing would result in short-term increases in turbidity and siltation downstream of the pipeline crossing sites. The concentration of suspended solids would decrease rapidly following the completion of in-stream work. The increased siltation may cause decreased flow of oxygenated water to benthic organisms and fish eggs, resulting in degradation of benthic and spawning habitat. Direct loss of spawning habitat, benthic invertebrates, and protective cover may occur at the pipeline crossing location due to trenching and backfilling. However, any sedimentation and turbidity resulting from construction would be short-term. Where feasible, waterbody crossings would occur during periods of low or no-flow. Calhoun Point Comfort 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.

Use of our Procedures would reduce impacts on fisheries from construction-induced sedimentation and turbidity. Trench spoil 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 from the open-cut crossing would be short-term and suspended sediment concentrations would be expected to return to pre-construction levels soon after construction across the waterbody is completed. Because of Calhoun Point Comfort's proposed use of our Procedures, and the use of the HDD and bore method for many waterbody crossings, impact on fish and other freshwater aquatic organisms is expected to be very localized and short-term.

Hydrostatic testing of the integrity of the completed pipelines would occur following construction, which would require water to be withdrawn from either the Navidad River or Formosa Plastic Corporation. Water withdrawal could potentially entrain fish eggs and juvenile fish. To minimize the potential for this impact, Calhoun Point Comfort would implement FERC's Procedures, which include covering the intake hose with an adequately sized mesh screen to reduce the potential for fish and fish egg entrainment, and adding no chemicals to the water for the hydrostatic testing of the pipelines. Thus, impacts to the fisheries resources from hydrostatic testing would be minimal with the use of these preventative measures.

4.6 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

In order to comply with Section 7 of the ESA, Calhoun Point Comfort, acting as the FERC's non-federal representative for purposes of complying with the ESA, consulted with the FWS and NOAA Fisheries regarding the presence of federally-listed and proposed threatened and endangered species and their critical or proposed critical habitats within the project area. Calhoun Point Comfort also consulted with the TPWD regarding the presence of state-listed threatened and endangered species within the project area.

We have requested that the FWS and NOAA Fisheries consider this EIS as our BA for the Project. This draft EIS has been provided to the appropriate FWS and NOAA Fisheries field offices for their review. Below is our assessment of potential effects of the Calhoun LNG Project on federally-listed endangered or threatened species.

4.6.1 Federally-Listed or Proposed Threatened and Endangered Species

The FWS and NOAA Fisheries identified 22 federally-listed endangered species and four federally-listed threatened species that could potentially occur within the project area. These species include six birds (brown pelican, bald eagle, whooping crane, piping plover, Eskimo curlew, and Interior Least Tern), eleven mammals (six whales, jaguarundi, Louisiana black bear, ocelot, red wolf, and West Indian manatee), and five marine reptile species (loggerhead sea turtle, green sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, and hawksbill sea turtle).

Based on review of available literature and the results of field surveys conducted by Calhoun Point Comfort, we believe that the Project would have no effect on six of these species because the Project would not be within the known range of the species or because the Project would not impact habitat for the species (table 4.6.1-1). These six species are not addressed further in this EIS. The remaining 16 species are listed in table 4.6.1-2 and discussed below.

TABLE 4.6.1-1

Federally-Listed Endangered and Threatened Species Eliminated From Further Consideration for the Calhoun LNG Project

Species	Status a/	Reason for Elimination from Further Consideration b/	Determination
Birds			
Eskimo Curlew *(Numenius borealis)*	F- E TX – E	Thought to be extinct.	No effect
Interior 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
Mammals			
Louisiana Black Bear (*Ursus americanu luteolus*)	F - T TX - T	Suitable habitat not present in project area.	No effect
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
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
Red Wolf (*Canis rufus*)	F- E TX - E	Thought to be extirpated from Texas.	No effect

a/ Status: F = Federal, TX = Texas, E = Endangered, T = Threatened.
b/ Calhoun Point Comfort conducted habitat surveys during December 2004 and February, March, and April 2005.

TABLE 4.6.1-2

Federally-Listed Endangered and Threatened Species Potentially Occurring in the Calhoun LNG Project Area

Species	Status a/	Preferred Habitat	Determination
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.	Not likely to adversely affect
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 mottles, grassland swales, and ponds.	Not likely to adversely affect
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
Mammals			
Sperm Whale (*Physeter macrocephalus*)	F- E TX – 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
Fin Whale (*Balaenoptera physalus*)	F- E TX – E	Deep waters off the continental shelf.	Not likely to adversely affect
Blue Whale (*Balaenoptera musculus*)	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
North Atlantic right Whale (*Eubalaena glacialis*)	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 nine to 15 feet deep.	Not likely to adversely affect
Reptiles			
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
Hawksbill Sea Turtle (*Eretmochelys imbricate*)	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 Birds

Brown Pelican *(Pelecanus occidentalis)*

The brown pelican is federally- and state-listed as endangered. 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. 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.

Brown pelicans are a common resident along the Texas Gulf Coast and have been sparsely recorded at Texas Waterbird Colony No. 609-121, a dredged material disposal area about 0.3 mile south of the terminal site, during 1996, 2000, and 2001 (QuickBase, 2005). Brown pelicans were observed feeding and loafing in Cox Bay south of the project area during habitat surveys, and they would be expected to also utilize areas in the immediate vicinity of the proposed LNG terminal for feeding and loafing. The nearest known brown pelican nesting site to the Project is Sundown Island, approximately 20 miles south of the LNG terminal site. Since brown pelicans are considered a highly mobile species and there is an abundance of foraging and nesting habitats within the project area, we believe that construction and operation of the Calhoun LNG Project is not likely to adversely affect brown pelicans.

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. The bald eagle ranges over the U.S. and Canada. In Texas, bald eagles are present year-round as spring and fall migrants, breeders, or winter residents. Preferred nesting habitat is in undisturbed coastal regions, or along river systems or lake shores with large, tall trees for nesting and roosting. Nesting typically occurs from October to June or July. Bald eagles are vulnerable to disturbance throughout the nesting period.

The area adjacent to the Navidad River crossing at the northern end of the Project meets habitat requirements for bald eagle nesting and foraging. During an April 15, 2005 field survey of the proposed Point Comfort Pipeline route, Calhoun Point Comfort observed an adult bald eagle near MP 17.5. Based on information obtained by Calhoun Point Comfort during its consultation with the TPWD, it was discovered that two bald eagle nests are known to be located within about 1.0 mile of the proposed pipeline right-of-way, in the vicinity of the proposed crossing of the Navidad River (MP 16.5). The pipeline would be adjacent to existing right-of-way at this location. At this location, one bald eagle nest site is located about 0.9 mile south of the pipeline right-of-way, within full-canopied woodlands. The pipeline right-of-way and construction activities would not likely be visible from the nest site and Calhoun Point Comfort indicated that it would not locate any temporary access roads between this nest site and the right-of-way. The second bald eagle nest site at this location is between 0.8 and 1.0 mile north of the pipeline right-of-way. Visibility of the proposed right-of-way and pipeline construction activities from this nest site would be limited because of area woodlands.

The proposed Project would not directly affect the known bald eagle nest sites. Construction activities may affect foraging habits and could potentially affect nesting bald eagles if construction occurred during the nesting season, between October and July. However, the potential for construction to affect these nesting bald eagles is believed to be minimal because (1) of the distance between the nests and proposed construction right-of-way, (2) only a short section of the right-of-way, about 0.5 mile, would be within 1.0 mile of the nests, and (3) direct visibility and noise from construction activities would be limited by woodland vegetation between the nests and proposed right-of-way.

The FWS indicated that, for all projects occurring from October 1 to July 1 that are within 3 miles of a river or other large body of water, such as lakes or reservoirs, an eagle nest survey should be conducted within a 1-mile radius of the entire project. If nests are located, the project should be conducted during the summer months between July 1 and October 1 (FWS, 2005b). Calhoun Point Comfort has agreed to conduct bald eagle nest surveys before construction and would coordinate with the FWS and TPWD to determine the optimum survey dates, methodology, and area to be surveyed. In addition, Calhoun Point Comfort indicated that it would construct the pipeline through sensitive bald eagle habitat during the non-nesting period from July 1 to October 1, and it would coordinate with the FWS and TPWD to determine the exact area where such a timing restriction would apply (Amec-Paragon, 2005c).

With Calhoun Point Comfort's indication that it would consult with the FWS and TWPD concerning this species and that it would construct nearby pipeline during the non-nesting period, we believe that construction and operation of the Calhoun LNG Project is not likely to adversely affect bald eagles. To ensure that bald eagles are protected during construction of the pipeline, Calhoun Point Comfort prepared a bald eagle management plan that provides guidance on the protection of bald eagles, and their habitat, during construction. The bald eagle management plan was prepared in accordance with the FWS and TPWD's *Habitat Management Guidelines for Bald Eagles in Texas* and identifies measures to minimize impacts and protect bald eagle nest sites near construction activities. As indicated in its bald eagle management plan, if a bald eagle nest is identified along the pipeline construction right-of-way, Calhoun Point Comfort would maintain a 25 foot buffer around the nest until young have fledged or the nest has been abandoned. This distance does not correspond with the primary and secondary management zones for nest sites identified in the bald eagle management plan, as developed by the FWS and TPWD. Therefore, **we recommend that:**

- **Calhoun Point Comfort consult with the FWS and TPWD regarding distances of primary and secondary management zones should a bald eagle nest site be identified along the Point Comfort Pipeline construction right-of-way and finalize its bald eagle management plan prior to construction**.

Whooping Crane (*Grus americana*)

The whooping crane is federally- and state-listed as endangered. The whooping crane winters in coastal Texas. Designated critical habitat for this species is located within the Aransas National Wildlife Refuge (NWR) in Aransas, Calhoun, and Refugio Counties, approximately 30 miles southwest of the project area. Some whooping cranes also winter on Matagorda Island, which at its closest point is about 20 miles south of the project area. Winter habitat 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 also occasionally use upland areas with oak mottles, grassland swales, and ponds that provide foods such as snails, crayfish, and insects. The central and eastern Panhandle also provides a major stopover area for birds migrating between summer and winter habitats. Because the proposed Project is over 20 miles from the nearest known wintering habitat of the whooping crane and any sightings of the whooping crane would result from transient stopovers, we believe that construction and operation of the Calhoun LNG Project is not likely to adversely affect whooping cranes.

Piping Plover *(Charadrius melodus)*

The piping plover is federally- and state-listed as threatened. 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 beaches during high tide.

The piping plover would not be expected to occur along the Point Comfort Pipeline, but could potentially occur on tidal flats near the proposed LNG site. No tidal wetlands or vegetated tidal flats would be impacted by the LNG terminal. An estuarine marsh and tidal flat occurs along the southern boundary of the terminal site and outside of the construction area. The closest potential habitat to the LNG terminal site is a wide tidal mudflat along the shoreline of Cox Bay to the east of the site. Calhoun Point Comfort surveyed the proposed LNG terminal site and the adjacent mudflat during a two-day period in early 2005, visiting the site four times at various times of the day and various tide stages. No piping plovers were observed during the surveys of the LNG terminal site and the adjacent tidal mudflat. If piping plovers were to use the habitat adjacent to the site, potential impact would be limited to occasional and temporary displacement from the habitat as a result of construction activity and noise. Habitat would not be permanently affected. We believe that construction and operation of the Calhoun LNG Project is not likely to adversely affect the piping plover.

4.6.1.2 Marine Mammals

Whales

Six 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).

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 to occur 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, 2005a). Sperm whales generally occur in waters greater than 590 feet and prefer continental margins, sea mounts, and areas of upwelling where food is abundant.

Sei whales (*Balaenoptera borealis*) and blue whales (*Balaenoptera musculus)* are uncommon in the Gulf of Mexico. The blue whale's range typically extends from the Arctic Ocean to mid-latitude waters and is often sighted off of eastern Canada. The sei whale is also typically found in northern waters, however the southern limits of its spring and summer ranges include the Gulf of Maine and Georges Bank. It is often found in the deeper waters of the continental shelf edge (NOAA, 2005a).

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, 2005a).

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, 2005a). 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, 2005a).

North Atlantic right whale (*Eubalaena glacialis*) is the rarest of all large whale species and among the rarest of all marine mammal species (NOAA, 2005a). They are found in the North Atlantic, North Pacific, and Southern Hemisphere regions. The majority of individuals in the western North Atlantic population range from wintering and calving areas in coastal waters off the southeastern United States to summer feeding and nursery grounds in New England waters and north to the Bay of Fundy and Scotian Shelf. Three areas were designated by NMFS in June 1994 as critical habitat for the western North Atlantic population: Coastal Florida and Georgia (Sebastian Inlet, Florida to the Altamaha River, Georgia), Great South Channel (east of Cape Cod), and Massachusetts Bay and Cape Cod Bay (NOAA, 2005a). On January 16, 2005, two North Atlantic right whales, a mother and her calf, were observed near the Corpus Christi ship channel and the Ingleside Naval Air Station, about 80 miles southwest from Point Comfort, Texas. Since 1963, this was the third time North Atlantic right whale has been reported in the Gulf of Mexico (Hanna, 2006).

Although the whale species listed usually do not occur in relatively shallow waters such as those found 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. While there are no prescribed routes for ships transiting open waters of the Gulf of Mexico, entrance into the Gulf is through the Straits of Florida, south of the Florida Keys and Florida reefs. From there, a merchant vessel would cross the Gulf by the most direct, safest route to its destination port. A system of shipping safety fairways[7] and fairway anchorages has been established for the Gulf of Mexico and is shown on some, but not all, navigation charts. These fairways are near port entrances and along coastal trade routes, but do not extend across the Gulf of Mexico or into the deep waters of the open Gulf. The probability of these species encountering LNG ships in the open ocean would be

[7] 33 CFR 166.105 defines a shipping safety fairway as "a lane or corridor in which no artificial island or fixed structure, whether temporary or permanent, will be permitted."

inherently low given their ability to avoid on coming vessels coupled with their overall rarity. Mitigation to minimize vessel strikes is discussed below.

West Indian Manatee (*Trichechus manatus*)

The West Indian manatee is federally- and state-listed (in Jackson 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 (NOAA, 2005a).

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 nine 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.

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, Calhoun Point Comfort would include the NOAA Fisheries *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting Policy* (Vessel Strike Avoidance Policy) (see appendix F), to the extent practicable for large LNG ships, 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 recommendations for vessel strike avoidance such as using a Gulf of Mexico reference guide that includes and helps identify the 28 species of whales and dolphins, five species of sea turtles, and the single species of manatee that may be encountered in the Gulf of Mexico Outer Continental shelf; maintaining a vigilant watch for marine mammals and sea turtles and slowing down or stopping vessels to avoid striking protected species; maintaining a distance of 150 feet for sea turtles or small cetaceans and 300 feet for whales; maintaining a parallel direction to the animal's course and avoiding excessive speed or abrupt changes in direction when protected species are in the area; reducing vessel speeds to 10 knots or less when pods or large assemblages of cetaceans are observed near an underway vessel; and reducing speed and shifting engines to neutral when protected species are sighted in the vessel's path or near a moving vessel. In addition, the policy requires that crews report sightings of any injured or dead protected species immediately to the Mammal and Sea Turtle Stranding Hotline or the Marine Mammal Stranding Network.

Due to their rarity in the project area, whales are not likely to be encountered by LNG ships calling on the LNG terminal in the Gulf of Mexico. Although the source of LNG supplies for the proposed LNG terminal have not yet been identified, LNG ships calling on the terminal could be expected to arrive from production countries in North Africa, the Middle East, or the southern Caribbean. In waters of the U.S., the major shipping routes into the Gulf of Mexico would not cross key habitat areas of any of these whale species. In addition, implementation of the measures included in the Vessel Strike Avoidance Policy as discussed above would minimize

potential impacts on these whale species. As such, we have determined that the proposed Calhoun LNG Project is not likely to adversely affect protected marine mammals.

4.6.1.3 Marine Reptiles

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. Along the Atlantic Coast, their range extends from Newfoundland to as far south as Argentina. Their primary nesting sites are along the east coast of Florida with other sites located on the Gulf Coast of Florida, in Georgia, and along the Carolinas.

After hatching, loggerhead hatchlings move to the sea and commonly float on sargassum masses for three to five 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. 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, 2005b).

In Texas, loggerheads are considered to be the most abundant sea turtle, favoring shallow inner continental shelf waters. 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. 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. 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, 2005b).

In Texas, small numbers of green sea turtles can been found in Matagorda Bay, Aransas Bay, and the lower Laguna Madre. Green sea turtle nests in Texas are rare (NOAA, 2005b). Suitable nesting habitat for this species is not available on the proposed project site.

Leatherback Sea Turtle (*Dermochelys coriacea*)

The leatherback sea turtle is federally- and state-listed as endangered. 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, 2005b).

This species is rare along the Texas coast and no nest sites have been recorded in more than 60 years (NOAA, 2005b). Suitable nesting habitat for this species is not available on the proposed project site.

Hawksbill Sea Turtle (*Eretmochelys imbricata*)

The hawksbill sea turtle is federally- and state-listed as endangered. This species inhabits coastal reefs, bays, rocky areas, estuaries, and lagoons at depths of 70 feet or less. Hawksbill sea turtle hatchlings may be found in the open sea floating on masses of marine plants while juveniles, subadults, and adults may be found near their primary foraging area along coral reefs. Hawksbill sea turtles are omnivorous; however, they prefer to feed on invertebrates such as sponges, mollusks, and sea urchins. Nesting occurs on 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, 2005b).

Representatives of at least some life history stages of the hawksbill regularly occur in the northern Gulf of Mexico, especially Texas. Post-hatchlings and juveniles are seen with some regularity in Texas particularly in areas primarily associated with stone jetties (NOAA, 2005b). 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. 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, 2005b).

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-long stretch of coastline near Rancho Nuevo, Tamaulipas, Mexico, about 190 miles south of the Rio Grande and 380 miles south of the project area, and a secondary nesting area occurs at Tuxpan, Vera Cruz about 500 miles south of the project area. 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. It may be transient between crustacean-rich feeding areas in the northern Gulf of Mexico and breeding grounds in Mexico (NOAA, 2005b). Suitable nesting and foraging areas for this species are not found on the proposed project site.

Sea Turtle Impacts

Due to specific nesting habitat requirements, sea turtles would not be likely to be present onshore within the project area. In general, 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 may 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. The Project would include approximately 240 inbound and outbound transits of the Gulf of Mexico per year by LNG tankers, which would result in a miniscule increase in potential boat strike risk for sea turtles. On approach to the Matagorda Ship Channel, vessel speeds are minimal so that boat strike hazards are reduced, even when considering the additional vessel traffic posed by the LNG tankers.

To help reduce the risk associated with vessel strikes or disturbance of protected species, Calhoun Point Comfort has agreed to include the NOAA Fisheries Vessel Strike Avoidance Policy as part of its Terminal Use Agreement with LNG Ship operators (see appendix F).

NOAA Fisheries indicated that with this policy implemented, vessel traffic associated with operation of the Project in not likely to adversely affect listed species.

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, 2004). To address the potential impacts associated with offshore spills of fuel, lubricants, and other hazardous materials, we recommended that Calhoun Point Comfort develop a Marine SPCC Plan to include procedures that would be implemented should such spills occur during construction and operation of the marine terminal (see section 4.3.1 of this EIS). Implementation of a Marine SPCC Plan would protect turtles from this potential impact. The Project would not include water intakes or discharges that could pose an entrainment risk or directly impact sea turtles.

Dredging activities could temporarily disrupt potential foraging grounds. The CCND proposes to dredge the marine basin and berth area using a hydraulic cutterhead dredge. Hydraulic cutterhead dredging is not known to take sea turtles by direct mortality, as with hopper dredging. Dredging activities during construction would be temporary and local in nature because dredging would be confined to CCND's proposed new turning basin and Calhoun Point Comfort's ship berth and maintenance dredging would only occur about once every two years. Dredging actions could potentially result in injury to any sea turtles directly in the area at the time of dredging. However, sea turtle occurrences in the project area would be incidental. Activities at dredge spoil placement areas would similarly not affect sea turtles since suitable nesting areas are not present in the placement areas.

NOAA Fisheries identified pile driving as having the potential to affect sea turtles. Studies have shown that the sound waves from pile driving may result in injury or trauma to fish, sea turtles, or other animals with gas-filled cavities, such as swim bladders, lungs, sinuses, and hearing structures (Abbott and Sawyer, 2002). Although sea turtles would be expected to largely avoid the dredged area during pile driving activities, a potential exists for sea turtles to be injured during the first several strikes of the pile driving hammer. While the CCND has not identified what type of pile driving it would use to install the piles, impact pile driving may be used for some part of pile driving activities. Use of impact pile driving would result in greater acoustic impact on the surrounding aquatic environment than vibratory pile driving. Pile driving activities at the berth area and the dredge disposal area are anticipated to last 180 and 120 days, respectively. To avoid the possibility of harm to sea turtles, as well as marine mammals, CCND on behalf of Calhoun Point Comfort is continuing to consult with NOAA Fisheries, TPWD, and FWS to identify any additional mitigation measures that have been successfully used to minimize the impact on marine organisms from pile driving activities.

With adherence to NOAA Fisheries Vessel Strike Avoidance Policy on vessel strikes and the rare occurrences of sea turtles in the project area, we believe that the Project is not likely to adversely affect sea turtles.

4.6.2 State-Listed Threatened or Endangered Species

The TPWD annotated county lists of rare species for Calhoun and Jackson Counties include 13 state-listed endangered or threatened species, in addition to those species that are also federally-listed and discussed above. We believe that five of these species would not be affected

by the Project because the project area is not within the current known range of the species, or because the species would occur in the project area only as an occasional transient. These species are listed in table 4.6.2-1 and are not discussed further in this EIS.

TABLE 4.6.2-1

State-Listed Endangered and Threatened Species Eliminated From Further Consideration for the Calhoun LNG Project

Species	Status a/	Reason for Elimination from Further Consideration b/
Mammals		
Black Bear (*Ursus americanus*)	F - T/SA TX - T	Suitable habitat not present in project area.
Southern Yellow Bat (*Lasiurus ega*)	TX - E	Project is within historic range of this species, but not within current range.
Birds		
Arctic Peregrin Falcon (*Falco peregrinus tundrius*)	TX - T	Occurs in project area only as occasional transient.
Sooty Tern (*Sternafuscata*)	TX - T	Pelagic species that forages off shore. Breed in colonies on coral clays, atolls, rock stacks, cliffs, or sandbanks.
Fish		
Opossum Pipefish (*Microphis brachyurus*)	TX - T	Project is within possible historic range of species, but outside of known current range.

a/ Status: F = Federal, TX = Texas, E = Endangered, T = Threatened.
b/ Calhoun Point Comfort conducted habitat surveys during December 2004 and February, and April 2005.

The remaining eight state-listed species could potentially occur in the vicinity of the proposed Project. These species are listed in table 4.6.2-2 and discussed in the following sections.

TABLE 4.6.2-2

State-Listed Threatened Species Potentially Affected by the Calhoun LNG Project

Species	State Status a/
Birds	
Reddish Egret (*Egretta rufescens*)	T
White-faced Ibis (*Plegadis chih*i)	T
Wood Stork (*Mycteria americana*)	T
White-tailed Hawk (*Buteo albicaudatus*)	T
Reptiles	
Texas Horned Lizard (*Phrynosoma cornutum*)	T
Texas Scarlet Snake (*Cemophota coccinea lineri*)	T
Timber /Canebreak Rattlesnake (*Croatalus horridus*)	T
Texas Tortoise (*Gopherus berlandieri*)	T

a/ Status: T = Threatened.

Reddish Egret (*Egretta rufescens*)

The reddish egret can be found in brackish marshes, shallow salt ponds, and tidal flats along the Texas Gulf Coast. The reddish egret nests mostly on the ground or on oyster shell beaches (TPWD, 2005a). In the project area, the reddish egret could potentially occur as a visitor in the shallow waters immediately adjacent to the LNG terminal site, but would not be expected to occur along the proposed pipeline. Reddish egret has been recorded at Texas Waterbird Colony No. 609-121, a dredged material disposal area about 0.3 mile south of the LNG terminal site; however, the number of individuals recorded has declined greatly since 1973 (QuickBase, 2005).

White-faced Ibis (*Plegadis chihi*)

The white-faced ibis breeds and winters along the Texas Gulf Coast. It is most commonly found in freshwater marshes, ponds, and rivers. Nesting is colonial on floating mats of dead plants, or in trees. The species could potentially occur within wetland areas on or near the LNG terminal site or the proposed pipeline right-of-way. During 1983, few white-faced ibis were recorded at Texas Waterbird Colony No. 609-120, on Dredge Island between 0.4 and 1.4 miles west and northwest of the LNG terminal site. Larger numbers have been recorded at Texas Waterbird Colony No. 609-121 and with greater consistency since 1973 (QuickBase, 2005).

Wood Stork (*Mycteria americana*)

The wood stork occurs in Texas during the non-breeding season, where it is found in freshwater and brackish marshes, narrow tidal creeks, or flooded tidal pools. The wood stork formerly bred in Texas but breeding in the U.S. is currently restricted to Florida, Georgia, and South Carolina (FWS, 1996). The species could potentially occur within wetland areas on or near the LNG terminal site or the proposed pipeline right-of-way.

White-Tailed Hawk (*Buteo albicaudatus)*

In 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, 2004). 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, 2004b). This species is a possible visitor to the project area. Calhoun Point Comfort would conduct surveys for white-tailed hawk during the breeding and nesting season and consult with TPWD to develop mitigation measures should this species be breeding and nesting within the construction areas of the Project.

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, 2004). Suitable habitat for this species was not identified during Calhoun Point Comfort's habitat surveys of the proposed Project.

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, 2004c). Based on habitat surveys and soil data, suitable habitat for this species would not be crossed by the proposed pipeline. A portion of the LNG terminal site contains potential habitat for this species.

Timber/Canebreak Rattlesnake (*Croatalus horridus*)

The timber/canebreak rattlesnake occurs in the eastern third of Texas. Preferred habitat includes moist lowland forests or upland woods and rocky ridges, near permanent water sources. The snake is active during the day during spring and fall, but becomes nocturnal during the heat of the summer. The timber/canebreak rattlesnake could potentially occur where suitable habitat occurs along the proposed pipeline.

Texas Tortoise *(Gopherus berlandieri)*

The Texas tortoise 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, 2004d). Based on general habitat surveys conducted by Calhoun Point Comfort, portions of the pipeline route and LNG terminal site contain potentially suitable habitat for this species.

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

A variety of measures have been proposed by Calhoun Point Comfort 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 previously disturbed areas, and implementing its draft *Water Quality Management Plan* and 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. In addition, Calhoun Point Comfort would employ a wildlife biologist to monitor the construction work areas for state protected reptiles and consult with the TPWD to develop mitigation measures should such species be discovered in the construction work areas of the Project. Construction crews would undergo environmental awareness training for protected species before construction and field activities are initiated.

Except for areas underlying permanent aboveground facilities, all areas disturbed by construction would be returned to pre-construction conditions, which would restore habitat value of these temporarily disturbed areas. Habitat at sites of permanent aboveground facilities would be converted to industrial use. Implementation of the mitigation measures proposed to protect

wildlife, aquatic resources, and habitat as described in section 4.5 of this EIS would be sufficient to prevent significant adverse effects on threatened and endangered species. 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 FWS and NOAA Fisheries has not yet been completed, **we recommend that:**

- **Calhoun Point Comfort not begin construction of the pipeline or LNG terminal <u>until</u>:**

  a. **the staff completes any necessary consultations with FWS and NOAA Fisheries; and**

  b. **Calhoun Point Comfort has received written notification from the Director of OEP that construction and/or implementation of conservation measures 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, Calhoun Point Comfort should consult with the appropriate offices of 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 Calhoun LNG Project would be located in Calhoun and Jackson Counties, Texas. The proposed LNG terminal would be located on a 73-acre site that is within an 89-acre site owned by the Port of Port Lavaca – Point Comfort in Calhoun County, Texas. The site is bounded by Lavaca Bay to the west, Cox Bay to the south and east, and industrial facilities owned by Alcoa and Formosa Plastics Corporation to the north (see figure 2.2-1 in section 2.0 of this EIS). The LNG terminal would be on the southeastern shoreline of Lavaca Bay about 3.2 miles south of the City of Point Comfort and 4.4 miles northeast of the City of Port Lavaca.

Calhoun Point Comfort proposes to construct a 36-inch-diameter natural gas sendout pipeline to connect the LNG terminal to existing intrastate and interstate natural gas pipelines and an 8- and 16-inch-diameter lateral leading to the Formosa Hydrocarbons Company and Transco meter station, respectively. The pipeline would extend from a pig launcher site within the CCND's Port facilities, adjacent to the LNG terminal site and run in a northwesterly direction to its end point southwest of Edna, Texas. About 25.2 miles of the sendout pipeline route (93 percent) would be immediately adjacent to existing rights-of-way while the Formosa Lateral would be immediately adjacent to existing rights-of-way for 0.2 mile (80 percent) and the Transco Lateral would be immediately adjacent to existing rights-of-way for its entire length (see table 2.3.2.1-2 in section 2.0 of this EIS).

4.7.1 Land Use

Most of the land affected by the construction and operation of the Calhoun LNG Project would be manmade, industrial land at the LNG terminal and open land, including agricultural and range land along the Point Comfort Pipeline and laterals. Other land uses affected along the pipeline

and laterals would include industrial, residential, and forest. Construction would affect a total of 489.6 acres of land: 73 acres of land for the LNG terminal, 344.8 acres for the pipelines, 3.5 acres for the aboveground facilities, 6.4 acres for access roads, 40.1 acres for additional temporary workspace, and 21.8 acres for a contractor pipe yard. Operation of the Project would affect about 178.8 acres of land, of which 73.0 acres would be permanently converted for operation of the LNG terminal and 8.9 acres would be permanently converted for operation of the aboveground facilities (3.5 acres) or from forest to nonforest (5.4 acres). Table 4.7.1-1 summarizes the acres of each land use category that would be affected by construction and operation of the proposed Project.

4.7.1.1 LNG Terminal

Existing land uses at the proposed LNG terminal site include a mixture of open water and industrial land that was created by the placement of dredged material from Lavaca and Cox Bays. In addition to the 73.0 acres of land required for construction and operation of the LNG terminal, construction of the new turning basin and ship berth would require the dredging of a 79.3-acre area owned by the CCND in Lavaca Bay. Of this amount, 66.1 acres would be required for the construction and operation of the turning basin and 13.2 acres would be required for the ship berth. The turning basin and berthing area would be located at the confluence of the Point Comfort Channel and the Alcoa Industrial Channel.

All land within 0.25 mile of the LNG terminal site is used for industrial purposes. Industries in the area include the Alcoa PCO, Formosa Plastics Corporation, Formosa Hydrocarbons Company, and Port facilities for handling general cargo, dry bulk, and bulk liquid cargoes. Land access to the LNG terminal site would be by way of FM 1593 and the existing access road for CCND's Port facilities.

Construction and operation of the LNG terminal would have minimal impacts on land use since the site is open, manmade land which is zoned industrial and is associated with the CCND's Port facilities. The open water in Lavaca Bay would be dredged for the turning basin and berth. About 3.5 million cubic yards would be dredged for the turning basin and 0.7 million cubic yards would be dredged for ship berth. These areas would remain open water after the construction. The construction of the turning basin and ship berth would not affect coastal marsh or aquatic vegetation (see section 4.4.1 of this EIS). The only difference in land use after construction of the terminal would be that the 73.0-acre site would no longer be open and a dock would project into Lavaca Bay, along the southeast side of the Point Comfort Channel.

During construction of its LNG terminal, Calhoun Point Comfort would temporarily use one construction yard located at MP 1.6 of the Point Comfort Pipeline. This tract is located about 0.5 mile west of FM 1593 along the west side of Fannin Road and would be used temporarily during construction of the Project. After construction, all excess construction materials would be removed and the site returned to its previous condition. No significant impacts are expected from the use of this site.

In addition, the CCND identified five DMPAs within Lavaca Bay and Cox Bay (between 0.6 and 1.9 miles of the LNG terminal site) where it intends to dispose of, and permanently store, dredged material.

TABLE 4.7.1-1

Acres of Land Affected by Construction and Operation of the Proposed Project

Facility	Agricultural/Range Land		Forest		Industrial/Residential		Total	
	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation
LNG Terminal a/	-	-	-	-	73.0	73.0	73.0	73.0
Point Comfort Pipeline and Laterals b/	295.7 c/	87.3 c/	23.5	5.4	25.6 d/	6.7	344.8	99.4
Aboveground Facilities								
Pig Launcher and MLV	-	-	-	-	0.3	0.3	0.3	0.3
Formosa Hydrocarbons Interconnect	0.3	0.3	-	-	-	-	0.3	0.3
Formosa Plastics Interconnect	0.3	0.3	-	-	-	-	0.3	0.3
Channel/HPL Interconnect	0.4	0.4	-	-	-	-	0.4	0.4
FGT Interconnect	0.3	0.3	-	-	-	-	0.3	0.3
KM-Tejas Interconnect	-	-	-	-	0.2	0.2	0.2	0.2
Valero Interconnect and MLV	0.3	0.3	-	-	-	-	0.3	0.3
Gulf South/KM Texas Interconnect	0.5	0.5	-	-	-	-	0.5	0.5
NGPL Interconnect	0.3	0.3	-	-	-	-	0.3	0.3
Transco Interconnect	0.3	0.3	-	-	-	-	0.3	0.3
Tennessee Interconnect, Pig Receiver, and MLV	0.3	0.3	-	-	-	-	0.3	0.3
Subtotal Aboveground Facilities	**3.0**	**3.0**			**0.5**	**0.5**	**3.5**	**3.5**
Access Roads	6.2	2.7	-	-	0.2	0.2	6.4	2.9
Additional Temporary Workspace	33.7	-	3.9	-	2.5	-	40.1	-
Contractor Pipe Yard	-	-	-	-	21.8	-	21.8	-
Project Total	**338.6**	**93.0**	**27.4**	**5.4**	**123.6**	**80.4**	**489.6**	**178.8**

a/ The LNG terminal would be entirely on manmade industrial land.
b/ Includes nominal 100- and 75-foot-wide construction right-of-way for the main pipeline and laterals, respectively and a 30-foot- and 25-foot-wide operational right-of-way.
c/ Of this amount, 19.0 acres would be agricultural land and 276.7 acres would be range land.
d/ Of this amount, 22.8 acres would be industrial land and 2.8 acres would be residential land.

4.7.1.2 Pipeline

Existing land uses along the pipeline and laterals right-of-way consist primarily of open land (i.e., agricultural and range land) with some industrial, residential, and forest land. Calhoun Point Comfort proposes to use a 100-foot-wide construction right-of-way in upland areas. Calhoun Point Comfort requested use of a 100-foot-wide construction right-of-way in wetland areas; however, in section 2.4 of this EIS, we recommended that Calhoun Point Comfort use a 75-foot-wide construction right-of-way in all wetlands crossed by the Point Comfort Pipeline. The construction rights-of-way would comprise about 328.4 acres for the Point Comfort Pipeline and about 16.4 acres for both the Formosa and Transco Laterals, respectively, for a total of 344.8 acres. Following construction, a 30- and 25-foot-wide permanent right-of-way would be maintained for operation of the respective pipeline and laterals (approximately 97.7 acres for the pipeline, 0.8 for the Formosa Lateral, and 0.9 acres for the Transco Lateral).

Construction of the pipeline would affect a total of about 384.9 acres of land, including the pipeline construction right-of-way and additional temporary extra workspaces (see table 4.7.1-1). Construction of the ten proposed interconnect/delivery points, pig launcher and MLV at MP 0.0, and pig receiver and MLV at MP 27.1, would affect about 3.0 acres of agricultural and range land, and 0.5 acre of industrial land. Calhoun Point Comfort would use 26 access roads related to its proposed pipeline facilities. Of these, 20 are existing roads and six roads would be newly constructed (see table 2.3.2.3-1). Improvement activities including the placement of additional gravel and grading would take place within the existing road footprint, which consist of about 6.2 acres of agricultural and range land and 0.2 acre industrial land.

During construction, Calhoun Point Comfort would use one pipe storage and contractor warehouse yard, a 21.8-acre tract of industrial land at MP 1.6. This is the same site that would be used as a construction yard during the construction of the terminal. No additional impacts would result in the site's use during pipeline construction.

About 19.0 acres of agricultural and 279.7 acres of range land would be the primary land use affected by construction of the pipeline, laterals, and associated aboveground facilities (combined total of 298.7 acres, 85.7 percent). The remaining land uses that would be affected consist of forest lands (23.5 acres, 6.7 percent), and industrial (23.1 acres) and residential (3.0 acres) lands (combined total of 26.1 acres, 7.6 percent).

Typical crops grown in the project area include cotton, corn sorghum, soybeans, rice, and wheat (USDA, 2005). No special crops or orchards were identified along the pipeline route that would require unique construction techniques.

Land Use Impacts and Mitigation

Land use impacts associated with the pipeline and laterals would include disturbance of existing land uses within construction work areas along the rights-of-way during construction and creation of new permanent rights-of-way for operation and maintenance of the facilities. There would be a short-term disruption to agricultural land. Calhoun Point Comfort would incorporate the measures included in our Plan, as well as landowner requests, to minimize impacts on agricultural land. Landowners would be compensated for loss of agricultural production in terms agreed upon with the landowners.

About 99.4 acres of land would become part of the permanent right-of-way for Point Comfort's pipeline, the Formosa and Transco Laterals, and related facilities (see table 4.7.1-1). About 3.0 acres of range land and 0.2 acre of residential land would be permanently converted to industrial use for the operation of the meter stations and MLVs. We do not consider this to be a significant impact because the surrounding land remains agricultural. About 416.6 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 aboveground facilities, crops could be planted over both the permanent pipeline right-of-way and the temporary workspace.

About 25.2 miles of the pipeline route (93 percent) would be immediately adjacent to existing rights-of-way. The Formosa Lateral would be immediately adjacent to existing rights-of-way for 0.2 mile (80 percent) and the Transco Lateral would be immediately adjacent to existing rights-of-way for its entire length (see table 2.3.2.1-2 in section 2.0 of this EIS). Following construction, a 30-foot- and 25-foot-wide right-of-way would be maintained adjacent to the existing rights-of-way to operate and maintain the new pipeline and laterals, respectively. Overlap of the proposed right-of-way with existing rights-of-way would occur between MP 1.6 and 2.2 and affect 0.5 acre. No other overlap is anticipated.

Calhoun Point Comfort would construct and maintain the pipeline in accordance with measures contained in our Plan and Procedures. In accordance with our Plan, Calhoun Point Comfort would locate irrigation systems and develop procedures for constructing through irrigated areas, maintaining irrigation systems during construction, and repairing irrigation systems after construction. Our Plan also 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 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.

Pipeline Easements

Calhoun Point Comfort 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 Calhoun Point Comfort. The easement would give Calhoun Point Comfort the right to construct, operate, and maintain the pipeline, and establish a permanent right-of-way. In return, Calhoun Point Comfort 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 Calhoun Point Comfort and individual landowners. If the necessary land cannot be obtained through good faith negotiations with property owners and the Project has been certificated by the

Commission, Calhoun Point Comfort may use the right of eminent domain granted under Section 7(h) of the NGA and the Federal Rules of Civil Procedure (Rule 71A) to obtain easements. Calhoun Point Comfort would still be required to compensate the landowner for the right-of-way and damages incurred during construction; however, the level of compensation would be determined by a court according to state or federal law.

4.7.2 Residences and Structures

4.7.2.1 LNG Terminal

No existing residences or structures are within one mile of the proposed LNG terminal. The nearest existing residential areas to the proposed LNG terminal are about 2.5 miles north of the terminal within the City of Point Comfort and 3.0 miles west within the community of Port Lavaca. The Lavaca Bay Place housing development and Clement Cove Townhouses are west of Port Lavaca near State Route 238 and about 6.0 miles west of the LNG terminal. Both of these residential areas are continuing to be developed. The nearest schools are the Point Comfort Elementary School and Our Little Munchkin Daycare located about 2.5 miles north of the proposed LNG terminal site, and the nearest hospital is the Memorial Medical Center in Port Lavaca, about 4.0 miles west of the LNG terminal site.

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 the LNG ship berth. Potential impact of noise from pile driving would be minimal for those residences located over one mile from the construction site. Additional discussion of noise impacts is included in section 4.11.2 of this EIS.

Calhoun Point Comfort would prepare and implement a dust control plan that would include measures to be implemented during construction to prevent fugitive dust emissions. Given the distance between proposed construction activity and the nearest residences and Calhoun Point Comfort's proposed dust control measures, we believe impact on residences from dust generated during construction would not be significant.

During operation of the proposed LNG terminal, the primary impact to those residences discussed above would be visual. The LNG storage tanks would be about 133 feet tall and would be visible from points east, northwest, west, and south of the terminal site. While the proposed tanks would be visible, they would be viewed against the existing backdrop of the Port of Port Lavaca-Point Comfort and nearby industries and visual impact would be minimal. See section 4.7.4 for further information on visual resources.

4.7.2.2 Pipeline

One residence and 15 other structures, including industry buildings, tanks, and a communication tower, would be located within 50 feet of the Transco Lateral work areas.

One residence and 14 existing structures including industry buildings, tanks, and a communication tower would be within 50 feet of the proposed work areas for the Point Comfort Pipeline and Transco Lateral (see table 4.7.2.2-1). In addition to the structures shown in the table below, eight residences would be within the construction right-of-way between MP 2.5 and MP 2.6.

TABLE 4.7.2.2-1

Structures Within 50 Feet of the Proposed Work Areas for the Point Comfort Pipeline and Transco Lateral

Milepost	Structure	Distance from Construction Work Area (feet)
Point Comfort Pipeline		
0.03	Building (CCND)	22
0.03	Tank (CCND)	Within a/
0.07	Abandoned Meter Run (CCND)	44
0.10	Guard Building (CCND)	Within b/
0.15	Building (CCND)	38
1.49	Building (Formosa Hydrocarbons Company)	50
1.54	Bullet Tank (Formosa Hydrocarbons Company)	35
1.56	Communications Tower (Formosa Hydrocarbons Company)	21
5.58	Air Sampling Equipment (Formosa Plastics Corporation)	Within b/
13.22	Residence	25
13.56	Storage Shed	c/
24.52	Enterprise Production Facility	0
24.73	Enterprise Production Facility	2
26.55	Barn	40
Transco Lateral		
0.22	Building (Formosa Hydrocarbons Company)	10

a/ Tank is no longer in use and would be removed before construction begins.
b/ Temporary fencing would be installed around these structures to avoid disruption during construction.
c/ Impacts would be avoided due to the HDD method that would be used in this area.

Sea Lake, a defunct development planned in the 1980s is near MP 4.2. This development was abandoned and the land has since been sold to Formosa Plastics Corporation.

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 structures 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.

To minimize construction noise, Calhoun Point Comfort would construct the Point Comfort Pipeline and laterals during daylight hours and it would implement its dust control plan to minimize potential impact on residences from dust generated during pipeline construction. At MP 13.2, Calhoun Point Comfort would reduce the size of its temporary workspace and be on the south side of an existing tree line, thereby minimizing impacts on the residences near this location. To minimize impacts on the barn at MP 26.5, Calhoun Point Comfort would maintain a 40-foot clearance between the closest corner of the barn and the construction work area.

Calhoun Point Comfort would use the HDD method to cross the area between MP 2.5 and MP 2.6, thereby minimizing impacts on the eight residences within the construction right-of-way. Residences would be notified of HDD activities 48 to 72 hours prior to the start of drilling. Calhoun Point Comfort submitted a draft project-specific HDD Frac-Out Monitoring and Response Plan that addresses how potential frac-outs would be minimized, procedures for detecting a frac-out, measures to be implemented should a frac-out occur, remediation of an affected area, and reporting and notification (see section 4.3.2.2 in section 4.3 of this EIS). To further minimize impacts from a potential frac-out, we have recommended that additional measures be included in this plan.

4.7.3 Recreation and Special Interest Areas

The land that would be used for the LNG terminal is owned by the Port and most of the land crossed by the pipeline and laterals is privately owned. No Indian reservations, scenic areas, developed recreational facilities, parks, forests, wildlife management areas, wilderness areas, trails, or registered natural landmarks have been identified in the vicinity of the proposed LNG terminal site or natural gas pipeline. At MP 2.2, the pipeline would cross land owned by the City of Point Comfort and used as a baseball field. The field is at the northwest corner of the intersection of State Route 35 and FM 1593 and would be avoided by Calhoun Point Comfort's use of the HDD method. Between MP 3.1 and 3.8, the Point Comfort Pipeline would cross the southern edge of a recreational park owned by Formosa Plastics Corporation. Calhoun Point Comfort would install warning signs and orange safety fence during construction and restore the area in accordance with our Plan.

Recreational fishing occurs in the greater Matagorda Bay system and nearby lakes and rivers. Several public boat ramps and fishing piers occur between 2.1 and 6.1 miles of the LNG terminal site. As discussed in section 4.2.4 of this EIS, the TDH issued a fish closure of a 1 square mile area of Lavaca Bay to the taking of finfish and crabs on April 20, 1988. However, on January 13, 2000, the TDH reopened a portion of the closure area, Cox Bay, located due south of the LNG terminal site. The closure for Cox Bay was reopened based on the reduced contaminants in surface sediments and reduced burden of mercury in fish tissues (EPA ROD, 2001).

During the past 30 years, TPWD estimates indicated that the top three recreational fish species for Matagorda Bay are the spotted seatrout, red drum, and southern flounder. Of the eight bay systems assessed by the TPWD, Matagorda Bay typically ranked third in terms of annual recreational catches. Operation of the LNG facility would not affect recreational fishing. Calhoun Point Comfort estimates that up to 120 LNG ships would unload at the LNG terminal each year, or between two and three ships per week. While in transit or docked, LNG vessels would have a security zone enforced around them. Other vessels, including recreational boats,

would be prohibited within the security zone during the arrival and potentially the departure of LNG ships. These effects would be temporary, occurring only during the transit of the ship, and is a moving zone which is established by the Coast Guard.

In addition to fishing, the Lavaca and Navidad rivers support general recreation activities such as canoeing and swimming. These rivers are accessible by public boat ramps and private roadways. The Project would not affect uses along these rivers since they would be crossed using the HDD method.

The Lake Texana State Park, a 575-acre park managed by the TPWD, is located about 6.5 miles east of Edna. The proposed Project would not affect this park.

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 a historically industrial area along the southeastern shoreline of Lavaca Bay. The LNG terminal would be within the CCND's Port and south of the industrial facilities of Alcoa PCO and Formosa Plastics Corporation.

The most prominent visual feature of the proposed LNG terminal would be two LNG storage tanks, each about 133 feet above the current grade and 262 feet in diameter. In addition to the LNG storage tanks, the LNG ship berth and process area would contain several additional structures of a lower profile.

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

- State Route 35 bridge over Lavaca Bay (about 2.0 miles northwest of the LNG terminal);
- Public waterfront access along southeastern side of Port Lavaca (about 4.0 miles southwest of the LNG terminal);
- Magnolia Beach south of Port Lavaca (about 5.0 miles south of the LNG terminal);
- Miller's Point south of Port Lavaca (about 6.0 miles south of the LNG terminal);
- Public beach commemorating Indianola (about 10.0 miles south of the LNG terminal);
- Public waterfront access in Olivia (about 6.0 miles southeast of the LNG terminal); and
- Lighthouse Beach in Port Lavaca (about 3.0 miles west-northwest of the LNG terminal).

Calhoun Point Comfort 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.

The observation point on the State Route 35 bridge over Lavaca Bay is about 2.0 miles northwest of the LNG terminal site. The simulated observation point in figure 4.7-2 is from a high point on the bridge looking southeast at the terminal site. As shown on the visual simulation, the LNG storage tanks would be visible from vehicles traveling over the State Route 35 bridge. Although the LNG storage tanks would be a prominent feature in the views from this area, we believe they would not represent a significant visual impact from this observation point.

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The public waterfront access along the southeastern side of Port Lavaca is about 4.0 miles southwest of the LNG terminal site. The simulated observation point in figure 4.7-3 is looking northeast at the terminal site. As shown on the visual simulation, the LNG storage tanks would be visible from the southeastern side of the City of Port Lavaca at this location; however, they would be visible along with nearby industries to the north including the Alcoa PCO, Formosa Plastics Corporation, Formosa Hydrocarbons Company, and Port facilities. We believe the LNG storage tanks would not represent a significant visual impact to viewers from the public waterfront access along the southeastern side of Port Lavaca.

The third observation point of the LNG storage tanks is from Magnolia Beach south of the City of Port Lavaca, looking north to the LNG terminal site, about 5.0 miles south of the site. The visual simulation of the proposed LNG storage tanks from this observation point is depicted in figure 4.7-4. While the LNG storage tanks would be visible from Magnolia Beach, they would be visible against a backdrop of the existing industries including the Alcoa PCO, Formosa Plastics Corporation, Formosa Hydrocarbons Company, and Port facilities located north 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 Magnolia Beach.

The observation point from Miller's Point south of the City of Port Lavaca is about 6.0 miles south of the LNG terminal site and looks north-northwest at the terminal site. The visual simulation of the proposed LNG storage tanks from this observation point is depicted in figure 4.7-5. As with the views from Magnolia Beach, the LNG storage tanks would be visible from Miller's Point against a backdrop of the existing area industries located north of the proposed LNG terminal site. From this observation point, the LNG storage tanks would not dominate the landscape and we believe they would not represent a significant visual impact to viewers from Miller's Point.

The fifth observation point of the LNG storage tanks is from a public beach commemorating Indianola located about 10.0 miles south of the LNG terminal site. The visual simulation of the proposed LNG storage tanks from this observation point is depicted in figure 4.7-6 and looks in a north-northwesterly direction towards the terminal site. As with the views from Magnolia Beach and Miller's Point, the LNG storage tanks would be visible; however, at this distance they would be difficult to discern from other area industry structures located north of the LNG terminal site. We believe the LNG storage tanks would not represent a significant visual impact to viewers from the public beach commemorating Indianola.

The public waterfront access in Olivia is about 6.0 miles east of the LNG terminal site. The observation point of the LNG storage tanks from this area is shown in figure 4.7-7, looking westerly at the terminal site. Although the LNG storage tanks would be visible from this location, they would not be a prominent feature in the views from this area. We believe the LNG storage tanks would not represent a significant visual impact from the public waterfront access in Olivia.

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The Lighthouse Beach observation point in Port Lavaca is about 3.0 miles west-northwest of the LNG terminal site near the west end of the State Route 35 bridge. The visual simulation of the proposed LNG storage tanks from this observation point is depicted in figure 4.7-8. As shown in this figure, the LNG storage tanks would be visible from Lighthouse Beach with a backdrop of existing area industries located north of the proposed LNG terminal. Although the LNG storage tanks would be a prominent feature in the views from this area, we believe they would not represent a significant visual impact from Lighthouse Beach.

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. 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 and, on agricultural lands, 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.

Calhoun Point Comfort proposes to install several aboveground facilities associated with the pipeline, including ten interconnect/delivery points, pig launcher and pig receiver, and three MLVs. A typical station would include perimeter fencing, piping, MLVs, and flowmeters. Because some of the facilities would be collocated, aboveground facilities would be constructed at eleven separate locations along the pipeline (see section 2.2.2 of this EIS).

The aboveground facilities would be located along 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 industrial, agricultural, and range land uses. No sensitive visual resources, such as schools or residential subdivisions, or public lands 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 route.

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, as does a portion of the proposed pipeline.

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, Calhoun Point Comfort must first obtain a COE 404 Permit.

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Figure 4.7-8

Calhoun Point Comfort submitted its application with the COE during June and July 2005, but has not received its consistency determination from the TGLO. A determination 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:**

- **Calhoun Point Comfort should not begin construction of any component of its Project until it files with the Secretary a copy of the consistency determination issued by the Texas General Land Office**.

4.7.6 Hazardous Waste Sites

As part of Calhoun Point Comfort's determination of the likelihood to encounter contaminated soils at the LNG terminal site or along the pipeline route, EDR conducted a search of available environmental database records within 0.25 mile of the LNG terminal site and pipeline route. EDR found that eight potentially contaminated sites and facilities with historic releases of hazardous substances occur in the vicinity of the Project (table 4.2.2-1). Seven sites would be between 260 and 2,270 feet of the pipeline route. In addition, although the proposed pipeline would cross through the Alcoa (Point Comfort)/Lavaca Bay Superfund Site from approximately MP 0.29 to MP 2.27, the releases of hazardous materials that caused the site to be classified as a Superfund site occurred about 0.5 mile west of the pipeline route. Calhoun Point Comfort would consult with Alcoa and the EPA, Region 6, regarding any contaminated soils issues within this Superfund site and we have recommended that Calhoun Point Comfort file the results of its consultation (see section 4.2.2).

The LNG terminal site would be located on 73 acres of manmade, industrial land that was created by the placement of dredged material from Lavaca Bay and Cox Bay. Calhoun Point Comfort sampled the soils at four locations within the LNG terminal site, one at each LNG tank site and two within the process area, including the firewater tank site, and the samples were tested for PAHs and mercury. The results of the analyses revealed that PAHs did not exceed the reportable limit; however, mercury did exceed the reportable limit in one sample, taken at a depth between 13 and 15 feet from the process area.

Calhoun Point Comfort would implement its *Contaminated Soils Management Procedures* should contaminated soils be encountered within the LNG terminal site and along the pipeline construction right-of-way. In addition, Calhoun Point Comfort has developed a draft *Water Quality Management Plan* and SPCC Plan that would describe spill prevention practices, spill handling and emergency notification procedures, and training requirements. Implementation of its *Contaminated Soils Management Procedures* would address steps that would be taken should soil contamination be encountered and include cleanup procedures and reporting guidelines such as: visual and olfactory inspection all disturbed soils; segregation of any contaminated soils encountered and proper containerization, labeling, and storage; sampling and characterizing of contaminated soils; transportation and disposal at an approved disposal facility; or, if approved by the TCEQ and TRRC, treated *in situ*. We believe that using the measures detailed in this procedure would minimize spread of contaminated soils.

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 Calhoun Point Comfort. 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, and tax revenue is provided below.

4.8.1 Population

The proposed Project would be located in Calhoun and Jackson Counties, Texas along the southeastern shoreline of Lavaca Bay, south of Point Comfort, Texas. The Project site is part of the Victoria Metropolitan Statistical Area (VMSA), which includes Calhoun and Jackson Counties. Nearby cities and towns include Port Lavaca, Point Comfort, Olivia, Lolita, and Edna.

Table 4.8.1-1 provides a summary of selected population and socioeconomic statistics for the State of Texas, Calhoun County, Jackson County, and cities surrounding the project area. Both Calhoun and Jackson Counties had a slight population decline from 2000 to 2005. However, the cities of Port Lavaca, Edna, and Victoria grew although at a much lower rate than the state, 1.2, 1.5, and 1.4 percent, respectively. The cities of Lolita and Edna experienced a population decline during this period. The population density in Calhoun and Jackson County continued to be lower than the state density.

TABLE 4.8.1-1

Existing Socioeconomic Conditions in the Vicinity of the Proposed Calhoun LNG Project

State/County/Town	Population			Population Density (person/ sq. mi.)	Per Capita Income		Civilian Labor Force (monthly average)	Unemploy-ment Rate (percent)
	2000	2005 (Estimate)	Percent Change	2000	1999	2002	2004	2004
Texas	20,851,820	22,859,968	9.6	80	$26,250	$29,039	11,069,100	5.4
Calhoun County	20,647	20,606	-0.2	40	$20,082	$21,151	8,497	8.7
Jackson County	14,391	14,339	-0.4	17	$22,471	$22,279	7,873	4.4
City of Port Lavaca	12,035	11,885	1.2	1,228	NA	NA	NA	NA
City of Point Comfort	781	722	-7.6	601	NA	NA	NA	NA
City of Lolita	548	544	-0.7	211	NA	NA	NA	NA
City of Edna	5,899	5,987	1.5	1,512	NA	NA	NA	NA
City of Victoria	60,603	61,454	1.4	1,836	NA	NA	NA	NA

NA - data not available
Sources: US Census Bureau (2006); Texas Data Center and Office of the State Demographer (2006); Texas Health and Human Services Commission (2006); Texas Water Development Board (2006); City-data.com (2006), ESRI (2004);.

Project area population impacts are expected to be temporary and relatively minor. The total population change would equal the total number of non-local construction workers, plus any family members accompanying them. The Project would be located near the Cities of Point Comfort, Port Lavaca, and Edna. It is assumed that workers could find housing in these communities, as well as Port O'Connor and Ganado, or in Victoria County, including the City of Victoria. As discussed further in section 4.8.2, Calhoun Point Comfort expects to utilize predominately local workers. Therefore, the estimated number of people who would temporarily relocate to the area during construction would not constitute a major impact on the local population of the area. Once completed, operation of the proposed LNG terminal and pipeline would require approximately 43 and 2 full-time positions, respectively. This small staff could be comprised of existing residents or non-local personnel, but would not have a significant impact on the local population.

4.8.2 Economy and Employment

The manufacturing, government, and construction sectors are the largest economic sectors in the project area. Alcoa POC, Formosa Plastics Corporation, Formosa Hydrocarbons Company, and the Port of Port Lavaca-Point Comfort are the primary employers in the area. There has been a 40 percent reduction of manufacturing jobs in the project area due to mergers, acquisitions, and declining market conditions in the minerals and petrochemical industry. The 2002 per capita income in Calhoun and Jackson Counties was less than the 2002 state per capita income, at $21,151 and $22,279, respectively. The 2004 unemployment rate in Calhoun County was higher than the state average of 5.4 percent, at 8.7 percent, whereas the unemployment rate in Jackson County was lower, at 4.4 percent (Texas Workforce Commission, 2004).

The Calhoun LNG Project would be constructed over a 35-month period. During construction of the LNG terminal, Calhoun Point Comfort estimated it would employ an average of about 270 workers. A maximum of approximately 513 workers would be employed during the peak construction period, during the last five months, when the LNG terminal and Point Comfort Pipeline, and associated facilities, are both under construction.

The average workforce requirements for pipeline and meter station construction are estimated at approximately 112 persons, and anticipated to peak at a combined total of approximately 132 personnel. Construction of the proposed 27.1-mile, 36-inch-diameter pipeline and meter stations would be performed by one contractor spread over a 5-month time period.

Calhoun Point Comfort expects to utilize predominately local workers who reside within 50 miles 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 average of approximately 140, with a peak of 350, non-resident personnel would be required for the construction of the LNG terminal, whereas an average of 56, with a peak of 66, non-resident personnel would be required for the construction of the Point Comfort Pipeline and associated facilities.

During the proposed 35-month construction period, Calhoun Point Comfort estimates that the total project payroll would amount to about $33 million. Of this amount, about $30 million would be for the LNG terminal and $3.0 million would be for the Point Comfort Pipeline and associated facilities. 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. Sales tax would be paid on any construction materials as well as any goods and services purchased with payroll monies. Calhoun Point Comfort estimates that $78 million would be spent on materials and services during construction of the Project. Of this amount, about $54 million would be spent during construction of the LNG terminal and $24 million would be spent during construction of the Point Comfort Pipeline and associated facilities. 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 project's employees and their families, such as restaurants, retail stores, grocery stores, and banks.

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.

Construction of the Project would result in increased tax revenue. Calhoun Point Comfort estimated that total franchise taxes to be paid to the State of Texas would be approximately $156,400 annually. Estimated property taxes of $238,372 would be received by Calhoun County and $1.1 million would be received by Jackson County. Also, during construction of the LNG terminal and pipeline, the state and county would benefit from estimated payroll taxes of $30 million and $3.0 million, respectively. During operation of the Project, property taxes would be paid for the land that the LNG terminal occupies.

4.8.3 Housing

Housing statistics are presented in table 4.8.3-1. The median values of owner-occupied units in Calhoun and Jackson Counties have a lower median rent than the state median and were more than $26,100 lower than the state median value of $82,500. Calhoun and Jackson Counties had a higher percentage of vacant housing units than the state, estimated during the 2004 Census at 2,796 and 1,209 units, respectively.

TABLE 4.8.3-1

2000 Housing Characteristics in the State of Texas and Calhoun and Jackson Counties

State/County	Total Housing Units	Vacant Housing Units	Median Value, Owner-Occupied Units	Median Contract Monthly Rent	Vacancy Rate (Percent)
Texas	8,157,575	764,221	$82,500	$602	9
Calhoun County	10,238	2,796	$56,400	$440	27
Jackson County	6,545	1,209	$52,700	$406	18

Source U.S. Census Bureau, 2006; ESRI, 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. It is assumed that workers could find housing in the Cities of Point Comfort, Port Lavaca, and Edna as well as Port O'Connor and Ganado, or in Victoria County, including the City of Victoria. During 2004 and 2005, Calhoun, Jackson and Victoria Counties had combined vacant housing units of 7,055, including 4,586 units available for rent (apartment, motel, and/or hotel) and 2,269 units available for seasonal, recreational, or occasional use (table 4.8.3-2).

TABLE 4.8.3-2

Vacant Housing Units in the Calhoun LNG Project Area

Type of Housing Unit	Calhoun County	Jackson County	Victoria a/
Apartment Rental	352	342	3,892
Motel or Hotel	509	86	718
Seasonal, Recreational, or Occasional Use (Campground and Recreational Vehicle Sites)	390	452	314
Total	**1,251**	**880**	**4,924**

a/ Victoria County is adjacent to and north and west of Calhoun and Jackson Counties, respectively.

On average, approximately 43 percent of the construction workers for Calhoun Point Comfort's primary construction contractor would come from within 50 miles of the project site and would not require temporary housing. The remaining 57 percent of the workers for the LNG terminal and Point Comfort Pipeline would require temporary housing in the project vicinity during construction. The average number of non-local workers for the LNG terminal and pipeline would be 196 in any given month, and possibly 416 at peak construction. Assuming double occupancy, these workers would require an average of 98 to 208 hotel and/or motel rooms per month.

Based on the information above, there is an adequate supply of local housing and temporary accommodations in Calhoun, Jackson, and Victoria Counties for the expected project demand. In addition, a significant number of employees are expected to be hired locally and therefore already have housing, which would reduce the overall demand from the project workforce. 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 facilities 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 and pipeline; therefore, no long-term major impacts on local housing are anticipated.

4.8.4 Public Services

Calhoun, Jackson and Victoria Counties have well-developed infrastructure to provide health, police, fire, emergency, and social services near the project site. Public health infrastructure in Calhoun, Jackson, and Victoria Counties includes five acute care hospitals and about 29 licensed emergency vehicles.

Police, ambulance, fire, and hazardous materials (HAZMAT) services are provided by county or municipal jurisdictions, as well as volunteer organizations, and private hospitals. In addition to these services, Alcoa POC, Formosa Plastics Corporation, Formosa Hydrocarbons Company, and the Port have firefighting equipment and trained emergency response personnel. As a group, these companies have procedures in place to cooperate and assist each other during an emergency response.

The nearest hospital, ambulatory service, and fire station to the LNG terminal is located in Port Lavaca about 4.0 miles from the terminal site. The Cities of Lolita, La Ward, Vanderbilt, and Victoria each have a fire department and are within 30 miles of the LNG terminal. The Cities of Point Comfort and Port Lavaca have police departments. The Calhoun County Sheriff's Office is located in Port Lavaca as are four Calhoun County Constable Precincts. The closest Texas Department of Public Safety patrol dispatch is in the City of Victoria.

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 Point Comfort, Port Lavaca, Lolita, La Ward, Vanderbilt, and Victoria, 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 surrounding area is an industrialized zone with existing petroleum and chemical processing plants, which are indicative of the residential property values in the project vicinity. Based on the location of the LNG terminal on an existing industrially zoned site, it is unlikely that the LNG terminal would 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, they 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.

4.9 TRANSPORTATION AND TRAFFIC

4.9.1 Land Transportation

The local road and highway system in the project area is well developed, consisting of U.S. highways, state highways, county roads, FM roads, and local streets. From the LNG terminal site, FM 1593 proceeds north, crosses State Route 35 and FM 616, passes through Lolita, and terminates at State Route 111, about 8.0 miles east-southeast of Edna. Once on the west side of the City of Port Lavaca, State Route 35 provides access to U.S. Highway 87 and other roadways. From the City of Victoria, about 30 miles northwest of the LNG terminal site, U.S. Highway 87 provides access to U.S. Highways 59 and 77. San Antonio, about 90 miles northwest of Victoria, is accessible from U.S. Highway 87 and Houston, about 126 miles northeast of Victoria, is accessible from U.S. Highway 59 (the Point Comfort Pipeline would terminate about 0.3 mile north of U.S. Highway 59). Hallettsville, about 40 miles north of Victoria, is accessible from U.S. Highway 77.

Existing roads would provide land access to the LNG terminal site via FM 1593 and the existing access road for CCND's Port facilities. These roads would provide primary access to the LNG terminal site during construction and operation. Existing roads in the vicinity of the pipeline include FM 1593, FM 616, FM 1822, FM 234, and State Route 59.

Construction workers commuting to the project area are expected to add an average of no more than approximately 834 vehicle trips per day (to and from the work site). At the peak of construction, a maximum of 1,410 construction worker vehicle trips are expected.

During construction of the LNG terminal, FM 1593 would experience an increase in vehicular traffic as would State Route 35 and other local roadways. Near the LNG terminal site, these roads are currently used by workers from Alcoa POC, Formosa Plastics Corporation, Formosa Hydrocarbons Company, the Port, and other industries.

Construction of the pipeline and associated facilities would increase traffic on local roadways for the delivery of equipment and materials, and for construction worker transportation. These roads are primarily two-lane local roads that cross mostly rural agricultural and range land. Calhoun Point Comfort would use 26 access roads related to its proposed pipeline facilities. Of this amount, 20 are existing roads and six roads would be newly constructed (see table 2.3.2.3-1). There may be some minor inconveniences for local traffic on lightly traveled and unimproved county roads crossed by the pipeline that would be open-cut. All construction operations, including repair and surface restoration, normally would be completed in one day. Where the pipeline crosses paved or improved roads, a hole will be bored under the road and the pipe would be installed in accordance with state and local regulatory requirements.

During peak construction, Calhoun Point Comfort estimates that there would be a maximum of 60 and 20 heavy truck deliveries a day to the LNG terminal site and Point Comfort Pipeline, respectively.

Calhoun Point Comfort notified the TDOT of its proposed Project and indicated that, one year prior to the start of construction, it would consult with the City of Point Comfort, Calhoun and Jackson County officials, and major industries in the project area to develop a traffic mitigation plan. Calhoun Point Comfort would prepare its traffic mitigation plan once construction details of its LNG terminal and pipeline are known.

Assuming one worker per vehicle, the operational workforce for the LNG terminal and pipeline would be about 43 and 2 workers, respectively, who would generate a maximum total of 45 vehicle trips per day (round trip). We believe that 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. Truck deliveries during operation of the LNG terminal are expected to be minimal.

The Union Pacific Railroad and Burlington Northern/Santa Fe Railway service the project area with railroad transportation. The Union Pacific Railroad is the region's primary rail carrier. Local industrial railroad lines in the vicinity of the project area include Formosa Plastics Corporation's 0.5-mile-long rail that parallels FM 1593 to local area industries.

The nearest commercial airport to the project area is the Victoria Airport, about 35 miles northwest of the LNG terminal site. General aviation facilities include the Calhoun County Airport, located about 3.0 miles northwest of Port Lavaca, and the Jackson County Airport, located about 5.0 miles northeast of the City of Edna, adjacent to U.S. Highway 59.

4.9.2 Marine Transportation

In its application, Calhoun Point Comfort indicated that materials required for construction of the LNG terminal may be delivered to the site by barge about two to three times per week. 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 the Matagorda Ship Channel, Lavaca Bay, and the Point Comfort Channel. Discussion of marine traffic and transportation as it relates to marine safety is included in section 4.12.5 of this EIS.

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. Calhoun Point Comfort, 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

Calhoun Point Comfort initiated consultation with the Texas Historical Commission (the SHPO) on December 10, 2004, requesting comments on its scope of work for cultural resources investigations for the Project.

The combined overview and survey of the proposed Project, specifically the Point Comfort Pipeline, resulted in the discovery of one isolated lithic find at MP 25.2; one historic surface scatter along an existing access road at MP 4.3; and four historic standing structures including a mobile home at MP 3.9, a water pumping shed and concrete water trough at MP 7.7, a windmill, elevated cistern and well at MP 11.2, and a collapsed/destroyed barn at MP 12.6 (Goodwin, 2005a, 2005b). These resources were recommended as not significant and not potentially eligible to the NRHP. The SHPO concurred with these findings (Goodwin, 2005c, 2005d).

Calhoun Point Comfort conducted a literature review of its proposed LNG terminal site and concluded that, since the proposed LNG terminal would be constructed entirely on manmade, industrial land that was created by the placement of dredged material from Lavaca Bay and Cox Bay, no further archeological investigations should be required. In addition, an aerial photographic review of the Point Comfort Pipeline between MP 0.0 and MP 1.2 and the Formosa Lateral revealed that these locations are within areas of extensive previous industrial disturbance and that no further archeological surveys should be necessary. The SHPO concurred with Calhoun Point Comfort's assessment that no additional surveys are required at these locations (Goodwin, 2005e).

Calhoun Point Comfort has filed an acceptable Unexpected Discoveries and Emergency Procedure Plan.

4.10.2 Native American Consultations

Our NOI for the Project, issued on July 7, 2005, 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. The NOI went to the Alabama-Coushatta Tribe of Texas, Caddo Nation, Comanche Penateka Tribe, Comanche Tribe, Comecrudo Nation, Kiowa Tribe, Lipan Apache Band of Texas, Mescalero Apache Tribe, People of LaJunta, Tap Pilum Coahuiltecan Nation, Wichita and Affiliated Tribes, and Ysleta del Sur Pueblo. In addition, Calhoun Point Comfort sent notification about the Project, in letters dated January 21, 2005 and April 8, 2005, and results of its archeological overview and surveys, in letters dated February 23, 2005 and May 13, 2005, to the above tribes and the Kickapoo Traditional Tribe of Texas and Tonkawa Tribe. No responses to our NOI or these letters have been received.

4.10.3 Compliance with the NHPA

We agree with the SHPO that no historic properties have been identified in the project areas inventoried to date. However, the CCND, on behalf of Calhoun Point Comfort, needs to document an underwater cultural resources survey of the CCND's new turning basin and Calhoun Point Comfort's ship berth that would be dredged in Lavaca Bay.

To ensure that no submerged archaeological sites or ship wrecks would be affected by dredging activities and that the Commission's responsibilities under Section 106 of the NHPA and its implementing regulations are met, **we recommend that:**

- **The CCND, on behalf of Calhoun Point Comfort, defer construction of its new turning basin and Calhoun Point Comfort's ship berth, until:**

  a. the CCND, on behalf of Calhoun Point Comfort, files a copy of the marine survey report with the SHPO and the Commission prior to the start of dredging and provides the SHPO comments on cultural resources investigation reports and plans;

  b. the ACHP has been given an opportunity to comment if any historic properties would be adversely effected by the Project; and

  c. the Director of OEP reviews and approves all marine survey reports and plans, and notifies the CCND, on behalf of Calhoun Point Comfort, in writing that it may proceed with treatment or construction.

  All materials 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 in the project area is predominately 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, on average, are seldom recorded. Normal monthly high temperatures range from about 63°F in January to 94°F in August. Average monthly low temperatures range from about 44°F in January to 70°F in September. The lowest and highest temperature on record in the project area was 9^{o}F and 111^{o}F during December 1989 and September 2000, respectively.

The prevailing winds are from the southeast, except when weather fronts move through the area and the prevailing winds are from the north or northwest. Wind speeds range from 6 to 8 miles per hour (mph) throughout the year with an annual average wind speed of about 7.1 mph. From

2002 to 2004, the highest and lowest monthly average wind speeds were 23.6 and 0.4 mph, recorded during July and November and December, respectively.

The average annual precipitation totals approximately 40 inches and is generally well distributed throughout the year. The highest amount of rainfall, about 5 inches, occurs during May and June and September and October. During the past 50 years, two hurricanes and four tropical storms have been recorded in the project area.

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: nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), sulfur oxides (SO_2), lead (Pb), and inhalable particulate matter (PM_{10}), or particles with an aerodynamic diameter less than or equal to 10 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.

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 EPA and state agencies in accordance with Section 107 of the CAA. The AQCRs are intra- and interstate regions such as large metropolitan areas where the improvement of the air quality in one portion of the AQCR requires emission reductions throughout the AQCR. The proposed Project would be in the Corpus Christi-Victoria Intrastate air quality control region (AQCR 214) as defined at 40 CFR 81.136. Based on the NAAQS for each criteria pollutant, the EPA classifies airsheds throughout the country as attainment areas and non-attainment areas. Attainment areas are airsheds that comply with NAAQS, while non-attainment areas are those that do not. A given area can be classified as both attainment and non-attainment since the NAAQS are pollutant-specific.

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. Calhoun and Jackson Counties are both classified as attainment areas for all criteria pollutants for which EPA has made attainment designations.

TABLE 4.11.1.2-1

National Ambient Air Quality Standards

Pollutant	Averaging Time	National Standards	
		Primary Standard ($\mu g/m^3$)	Secondary Standard ($\mu g/m^3$)
SO_2	Annual a/	80 (0.030 ppm)	-
	24-Hour b/, d/	365 (0.14 ppm)	-
	3-Hour c/, d/	-	1,300 (0.5 ppm)
PM_{10}	Annual a/, e/	50	50
	24-Hour b/, d/	150	150
$PM_{2.5}$	Annual a/, f/	15	15
	24-Hour b/, g/	65	65
CO	8-Hour b/, d/	10,000 (9 ppm)	10,000 (9 ppm)
	1-Hour b/, d/	40,000 (35 ppm)	40,000 (35 ppm)
Ozone	8-Hour c/, h/	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)
Lead	Quarter a/	1.5	-

a/ Arithmetic mean.
b/ Block average.
c/ Rolling average.
d/ Not to be exceeded more than once per year.
e/ To attain this standard, the 3-year average of the weighted annual mean PM_{10} concentration at each monitor within an area must not exceed 50 $\mu g/m^3$.
f/ To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 $\mu g/m^3$.
g/ To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 $\mu g/m^3$.
h/ To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
$\mu g/m^3$ = micrograms per cubic meter.
ppm = parts per million.

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 (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 six 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).

Calhoun and Jackson Counties are within the TCEQ Corpus Christi Region where monitoring of several criteria pollutants is conducted at seven active continuous air-monitoring stations. Six of these stations are in Nueces and one is Victoria Counties. Pollutants including O_3, hydrogen sulfide, SO_2, $PM_{2.5,}$ methane, and non-methane organics have been recorded at the stations in Nueces County while only O_3 has been recorded at the Victoria County station.

4.11.1.3 Regulatory Requirements for Air Quality

The proposed LNG terminal would generate air emissions through both short-term construction activities and long-term operation of the stationary emission units at the facility. Emissions from all phases of construction and operation of the emission units would be subject to applicable state and federal air regulations. The new stationary air emission sources associated with operating the proposed LNG terminal would include the following:

- Six natural gas fired Submerged Combustion Vaporizers (SCVs) with low NOx burners and a maximum heat input capacity of 50.1 million British thermal units per hour (MMBtu/hr);
- Six natural gas fired SCVs with low NOx burners and a maximum heat input capacity of 79.2 MMBtu/hr;
- Three 15.70 MMBtu/hr natural gas fired heating medium heaters;
- Two 11,459 BTU/kW-hr backup natural gas generators;
- One 660 horsepower (hp) backup diesel generator;
- Three 670 hp diesel firewater pumps;
- Emergency flare;
- Cold vent system for loading arms; and
- Fugitive emission sources (valves, flanges, and other equipment).

The CAA of 1970, 42 USC 7401 *et seq*., as amended in 1977 and 1990, and 40 CFR 50-99 are the basic federal statutes and regulations governing air pollution in the United States. We have reviewed the following federal requirements to determine their applicability to the proposed Calhoun LNG Project.

The TCEQ is the lead air permitting authority for the Project. The TCEQ's air permitting requirements are codified in Title 30 of the Texas Administrative Code (30 TAC). These requirements incorporate the federal program requirements listed in 40 CFR Parts 50-99, and establish permit review procedures for all facilities that can emit pollutants to the ambient air. New facilities are required to obtain an air quality permit prior to initiating construction. No other pre-construction air quality permits are generally required.

Facilities can trigger additional review by EPA if emissions exceed the major source thresholds listed in 40 CFR 52.21(b)(1)(i). Emission control devices would be installed at the proposed LNG terminal to prevent potential emissions from the facility from exceeding these major source thresholds. The federal and state regulations established as a result of the CAA and the TCEQ that are potentially applicable to the Project include:

- New Source Review/Prevention of Significant Deterioration;
- New Source Performance Standards;
- Title V Operating Permit;
- National Emission Standards for Hazardous Air Pollutants;
- Maximum Achievable Control Technology;
- General Conformity;

- Chemical Accident Prevention Provisions;
- Control of Air Pollution from Marine Compression-Ignition Engines;
- State Regulations; and
- Best Available Control Technology.

New Source Review (NSR)

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. Calhoun and Jackson Counties are both classified as attainment areas for all criteria pollutants. Therefore, the proposed project area is not subject to NNSR permitting.

Prevention of Significant Deterioration

One of the factors considered in the PSD permit review is potential impacts on protected Class I airsheds located throughout the country. Class I areas are specifically designated as pristine wilderness areas. The LNG terminal would not be located in a Class I area, nor would it be located within 100 kilometers (62 miles) of a Class I area; therefore, a full Class I analysis would not be required to be included in the permit application. The closest Class I areas to the LNG terminal site are the Breton National Wildlife Refuge in Louisiana and Wichita Mountains National Park in Oklahoma, both approximately 535 miles from the site. Big Bend National Park, located in west Texas, is approximately 607 miles west-northwest of the project area.

"Major sources" that produce a significant emissions increase are reviewed for compliance with the PSD regulations. PSD review for major stationary sources includes: an assessment of the existing air quality; the use of analytic dispersion models to demonstrate compliance with the NAAQS and applicable PSD increments; a demonstration that control of emissions through use of best available control technology (BACT) has been applied to the subject emission sources; and an assessment of the impact of new emissions on the environmental resources such as soils and vegetation.

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 any of the proposed facilities that are included as a specified source category; therefore, the PSD threshold for the proposed facilities is 250 tpy. The proposed facility emissions would not exceed the 250 tpy threshold any criteria pollutant and would not be considered a "major stationary source." Therefore, the proposed Project would not be subject to PSD permitting requirements.

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 Dc of 40 CFR Part 60, Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units, lists affected emission sources as fuel-fired steam-generating units with a heat input capacity of 10 million British thermal units MMBtu/hr to 100 MMBtu/hr. The definition of an applicable unit includes sources that produce steam or that heat water or any other heat transfer medium. The SCVs at the LNG facility are rated at 50.1 MMBtu/hr and 79.2 MMBtu/hr heat input, therefore, these units would be subject to the requirements of Subpart Dc.

Subparts Ka and Kb of 40 CFR Part 60, Standards of Performance for Volatile Organic Liquid (VOL) Storage Vessels, list affected emission sources as storage vessels containing VOL with regulatory applicability being dependent on the construction date of the storage vessel and the type and vapor pressure of the petroleum liquid. The new facility would have LNG storage tanks. Subpart Kb defines VOL as any organic liquid which can emit volatile organic compounds (VOCs) (as defined in 40 CFR 51.100) into the atmosphere. This would include the components contained in LNG (*i.e.*, propane and butane). Therefore, Subpart Kb potentially could be applicable.

However, 40 CFR 60.116b(b) states that Subpart Kb does not apply to storage vessels with a capacity greater than or equal to 151 m^3, storing a liquid with a maximum true vapor pressure less than 3.5 kilopascals (kPa) (approximately 0.5 psi absolute). By definition, the maximum true vapor pressure is the equilibrium partial pressure exerted by the VOCs in the stored VOL. The VOC content of LNG is less than 10 percent by volume with the two largest VOC constituents being propane and butane. The partial pressure of the components of LNG representing butane and propane range maintained at -260°F is less than 3.5 kPa. Therefore, the proposed LNG tanks are exempt from the Subpart Kb requirements.

Subpart GG of 40 CFR Part 60, Standards of Performance for Stationary Gas Turbines, defines effected stationary gas turbines as those that have a heat input at peak load equal to or greater than 10 MMBtu/hr. The proposed LNG terminal would have stationary gas turbines with greater than 10 MMBtu/hr heat input; therefore, these units would be subject to the requirements of Subpart GG.

Subpart KKK of 40 CFR Part 60, Standards of Performance for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants, includes a compressor station, dehydration unit, sweetening unit, underground storage tank, field gas gathering system, or LNG unit if it is located at an onshore natural gas processing plant. The proposed LNG terminal would have LNG units; therefore, would be subject to the requirements of Subpart KKK.

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 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 hazardous air pollutant (HAP), or 25 tpy for all HAPs. Emissions from the proposed Calhoun LNG Project are expected to exceed 100 tpy and would therefore require Title V permit. Calhoun Point Comfort would prepare and submit an abbreviated Title V permit application once final facility designs are complete and emission sources are fully defined for the Calhoun LNG Project.

National Emissions Standards for Hazardous Air Pollutants

The National Emissions Standards for Hazardous Air Pollutants (NESHAPs), codified in 40 CFR Parts 61 and 63, regulate HAP emissions. Part 61 was promulgated prior to the 1990 Clean Air Act Amendments (CAAA) and regulates only eight types of hazardous substances (asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride). LNG storage and processing facilities do not fall under one of the source categories regulated by Part 61; therefore, the requirements of Part 61 are not applicable.

Maximum Achievable Control Technology

The 1990 CAAA established a list of 189 HAPs; resulting in the promulgation of Part 63. Part 63, also known as the Maximum Achievable Control Technology (MACT) standards, regulates HAP emissions from major sources of HAP emissions and specific source categories that emit HAPs. Part 63 defines a major source of HAPs as any source that has the potential to emit 10 tpy of any single HAP or 25 tpy of HAPs in aggregate. Emissions of HAPs from the proposed Project would not exceed the associated major source thresholds; therefore, no MACT standards apply to the proposed facility.

General Conformity

A conformity determination must be conducted by the lead federal agency if a federal action would generate emission that would exceed the conformity threshold levels (*de minimis*) of the pollutant(s) for which an air basin is in non-attainment. According to Section 176(c)(1) of the CAA (40 CFR 51.853), a federal agency cannot approve or support any activity that does not conform to an approved State Implementation Plan. Conforming activities or actions should not through additional air pollutant emissions: cause or contribute to new violations of the NAAQS in any area; increase the frequency or severity of any existing violation of any NAAQS; or delay timely attainment of any NAAQS or interim emission reductions. Emissions from sources subject to NSR or PSD requirements are exempt and are deemed to have conformed. The requirements for a conformity determination are listed in 40 CFR Parts 6, 51, and 93, and became effective March 15, 1994. Since the project area is classified as in attainment for all criteria pollutants, a General Conformity Determination is not required.

Chemical Accident Prevention Provisions

40 CFR Part 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 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 Calhoun LNG Terminal would maintain awareness of hazard issues and meet the goals of the above-listed general duty provisions.

Control of Air Pollution from Marine Compression-Ignition Engines

Regulation 40 CFR 94 (*Federal Register*, 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. Calhoun Point Comfort 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 EPA if emissions exceed the major source thresholds listed in 40 CFR Section 52.21(b)(1)(i).

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; 101.8 – Sampling; 101.9 – Sampling Ports; 101.10 – Emissions Inventory Requirements; 101.13 – Use and Effect of Rules; 101.14 – Sampling Procedures and Terminology; 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. The proposed Project would minimize off-site impacts during the construction process as intended by the TCAA.

Chapter 106 – Exemptions from Permitting. The proposed Project has not claimed an exemption from permitting for any of the emission units at this facility.

Chapter 111 – Control of Air Pollution From Visible Emission and Particulate Matter. Construction activities for both the LNG terminal and Point Comfort Pipeline would be conducted pursuant to the applicable requirements of 111.145 – Construction and Demolition. The proposed Project would operate in compliance with 111.111 – Visible Emissions, Requirements for Specified Source, 111.153 – Emission Limits for Steam Generators, and 111.1555 – Ground Level Concentrations.

Chapter 112 – Control of Air Pollution from Sulfur Compounds. The proposed Project 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.

Chapter 113 – Standards of Performance for Hazardous Air Pollutants and for Designated Facilities and Pollutants. The proposed Project would not be a major source of HAPs; therefore, this regulation does not apply.

Chapter 114 – Controls of Air Pollution from Motor Vehicles. The proposed Project would not maintain a fleet on site; therefore, this regulation does not apply.

Chapter 115 – Control of Air Pollution from Volatile Organic Compounds (VOCs). The proposed Project 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 – 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.

The proposed Project 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. The proposed Project is complying with this chapter by applying for and obtaining a permit to construct prior to initiating construction of the proposed facility.

Chapter 117 – Control of Air Pollution from Nitrogen Compounds. No specific requirements would apply to the proposed.

Chapter 118 – Control of Air Pollution Episodes. The proposed Project 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 119 – Control of Air Pollution from Carbon Monoxide. The proposed Project would generate CO during the combustion process; however, these emissions would be minimized using proper combustion techniques and operating practices.

Chapter 120 – Control of Air Pollution from Hazardous Waste from Solid Waste Management Facilities. The proposed Project would not be a hazardous or solid waste management facility.

Chapter 122 – Federal Operating Permits. Emissions from the proposed Calhoun LNG Project are expected to exceed 100 tpy of any regulated air pollutant. Calhoun Point Comfort would prepare and submit an abbreviated Title V permit application once final facility designs are complete and emission sources are fully defined for the Calhoun LNG Project.

Best Available Control Technology – 30 TAC 116.111 (a)(2)(C)

Calhoun Point Comfort would utilize BACT for primary pollution control at the facility. A detailed BACT analysis is included in the facility's New Source Review Air Quality 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. A summary of the facility's proposed BACT limits is provided below.

Best Achievable Control Technology Analysis. As part of the New Source Review Air Quality Permit application, Calhoun Point Comfort conducted a top-down BACT analysis for the SCVs, natural gas generators, diesel generator, firewater pumps, and flare. Calhoun Point Comfort 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 125.76 tpy total from all 12 units is proposed as BACT. Good combustion control, which would limit CO emissions, is proposed as BACT. Good combustion practices and the use of natural gas are proposed as BACT for VOC, PM, and SO_2 emissions.

The natural gas and diesel generators would use low sulfur diesel fuel and would only be used to supply power to the facility when external electrical power is not available. Both generators would be limited to 100 hours per year of annual operation. The firewater pumps would supply water to the fire protection system in the event of an emergency. Good engine design and good combustion practices are proposed as BACT for CO, VOC, and PM emissions. The use of low sulfur fuel is proposed as BACT for SO_2 emissions. An emergency flare would be available with a continuous pilot. The flare would be fueled by natural gas and would be used under low sendout conditions while unloading the LNG ship. Control efficiency for the flare would be at least 98 percent, which is standard BACT.

The New Source Review Air Quality permit application did not include a state property line air quality impact analysis. However, the TCEQ will verify prior to New Source Review Air Quality permit issuance that Texas state property line limits for particulate matter and sulfur oxides would not be violated by the proposed Project.

4.11.1.4 Air Quality Impacts and Mitigation

Construction Air Pollutant Emissions

Construction of the Calhoun LNG Terminal would occur over a period of approximately 35 months. Air emissions would result from non-road sources such as construction and dredging equipment operation operating within the terminal property boundary, Lavaca Bay, 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. 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 during construction are shown in table 4.11.1.4-1 excluding fugitive dust emissions (see further explanation below).

TABLE 4.11.1.4-1

Total Estimated Construction Emissions (tpy)

Emission Activity a/	NO_2	VOC	CO	SO_2	PM_{10}	Operating Days
Construction Equipment						
Terminal facility construction	298.72	35.19	138.11	23.97	37.70	800
Haul trucks	18.24	1.64	5.31	1.69	1.52	800
Dredging activities	240.43	19.53	53.73	143.87	21.60	500
Dock and bulkhead construction	25.44	2.77	13.86	2.24	3.00	480
Pipeline	79.7	10.4	50.5	6.3	9.6	177

a/ Construction is anticipated to be completed within approximately 35 months.

The primary source of emissions would be from equipment 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. Construction equipment would include marine construction equipment; cranes; earthmoving equipment; forklifts and man-lifts; air compressors; welding machines; bulldozers, graders, backhoes, front-end loaders; generator; and drilling, dredging, and pile driving equipment. The pipeline construction would also include welding trucks, boring machines, small engines and pumps, and fill and test pumps. The non-road sources are primarily diesel-fueled units.

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 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 three minutes or less. Calhoun Point Comfort has stated that it would take all reasonable measures to reduce air emissions at the construction site. Calhoun Point Comfort, in conjunction with its construction contractor, would evaluate all feasible options for reducing emissions during construction.

Fugitive Dust

The existing industrial activities near the proposed LNG terminal area and vicinity currently generate dust as part of their ongoing operations, and this dust generation is expected to continue. Fugitive dust would be produced from equipment operating during construction of the proposed LNG terminal and pipeline. Calhoun Point Comfort would prepare a dust control plan to prevent fugitive dust generation during construction. If construction of the proposed LNG terminal and pipeline generates dust that causes a nuisance, then a surface wetting plan would be implemented to minimize dust generation. Water trucks, with a capacity of 2,000 to 4,000 gallons, would be used for dust suppression. There are no permanent residences located within 1 mile of the proposed LNG terminal.

Dust from the DMPAs is not anticipated to be a source of nuisance dust. Once the dredged material dries and is stable enough to be manipulated with equipment, the areas would be seeded with grasses for temporary and permanent stabilization. Until the areas are stabilized and if dust generation becomes a nuisance, the areas would be wetted as necessary until the temporary or final stabilization becomes established.

Air Pollutant Emissions from Operation

LNG Terminal Stationary Sources

New stationary air emissions sources associated with operation of the proposed Calhoun LNG Terminal include:

- six first-stage and six second-stage SCVs;
- three natural gas heaters;
- standby diesel and natural gas generators;
- three diesel driven firewater pumps; and
- emergency flare.

Anticipated annual emission levels for operation of the proposed stationary sources at the LNG terminal are shown in table 4.11.1.4-2. The emission data presented in this table are based on manufacturer-supplied emission factors supplemented with EPA default emission factors.

TABLE 4.11.1.4-2

Estimated Yearly Emissions from Terminal Operations – Stationary Sources (tons)

Equipment	NO_2	CO	SO_2	PM_{10}	VOC
Stationary Sources					
SCVs a/	125.76	100.14	1.98	25.32	18.30
Natural Gas Heaters b/	18.57	15.27	0.12	1.53	1.11
Standby Diesel Generator c/	0.45	0.04	0.07	0.01	0.01
Standby Natural Gas Generator c/	1.12	1.36	0.04	0.08	0.38
Diesel Firewater Pump c/	1.83	0.09	0.21	0.18	0.03
Emergency Flare d/	0.17	0.34	0.01	0	0.94
Fugitive Emissions e/	0.00	0.00	0.00	0.00	6.38
Facility Total	**147.90**	**117.24**	**2.43 f/**	**27.12**	**27.15**
PSD Threshold	250.00	250.00	250.00 f/	250.00	250.00
Title V Threshold	100	100	100 f/	100	100

a/ Total emissions based on 12 SCVs operating continuously year round.
b/ Annual emissions based on 3 natural gas heaters operating continuously year round.
c/ Annual emissions for standby equipment based on 100 hours per year per source.
d/ Annual emissions based on a continuous natural gas pilot supplied by natural gas produced at the LNG terminal.
e/ Fugitive emissions are VOCs associated with minor equipment leaks at valves, flanges, seals, etc.
f/ SO_2 emissions based on the presence of sulfur in the fuel and calculated for those sources to be operated by diesel fuel.

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 120 LNG carriers per year would be unloaded at the proposed facility. At least two tugboats would be available to assist each LNG carrier, although up to three 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 be in the project area less than 24 hours.

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 offloading 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 pollutants that LNG carriers and tugboats would emit are SO_2 and NO_2, along with smaller amounts of CO, PM_{10}, $PM_{2.5,}$ and VOCs, as shown in table 4.11.1.4-2. At 120 calls per year, the SO_2 emissions from LNG carriers would be about 568.33 tpy, and the emissions from tugboats working with the LNG carriers would be approximately 327.02 tpy, for a total of 859.35 tpy. The NO_2 emissions from LNG carriers would be about 313.45 tpy, and the emissions from tugboats working with the LNG carriers would be approximately 408.51 tpy, for a total of 721.96 tpy.

TABLE 4.11.1.4-2

Estimated Yearly Emissions from Terminal Operations – Mobile Sources (tons) a/

Equipment		NO_2	CO	PM_{10}	$PM_{2.5}$	SO_2	VOC
Mobile Sources							
LNG Carriers		313.45	24.61	20.65	16.60	568.33	9.57
Tug Boats		408.51	105.79	10.70	8.57	327.02	17.28
	Total	**721.96**	**130.4**	**31.35**	**25.17**	**859.35**	**26.85**

a/ Total mobile emissions of HAPs would be 37.22 tpy.

Pipeline

Calhoun Point Comfort's supporting documentation does 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 Calhoun LNG Terminal and Point Comfort Pipeline. 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 Calhoun 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 Calhoun County has noise regulations that would limit noise from the Calhoun LNG Terminal, the FERC criterion is the basis for determining the acceptability of expected facility noise levels at the noise sensitive areas (NSAs). The City of Point Comfort has a noise ordinance that provides limitations for noise disturbances during evening hours, weekends, and holidays.

4.11.2.1 Noise Levels

LNG Terminal

The nearest NSA to the Calhoun LNG Terminal is along the southern edge of the City of Point Comfort and consists of several residences on the south side of the city, north of State Route 35, about 12,000 feet north of the LNG terminal site. The Calhoun LNG Terminal would be separated from this NSA by the Alcoa POC and Formosa Hydrocarbons Company industrial facilities and State Route 35.

In lieu of conducting an ambient noise survey, Hoover and Keith, Inc. (H&K) prepared a noise impact analysis to establish estimated ambient noise levels at the NSA nearest to the LNG terminal site (Kiteck, 2005a). The noise impact analysis considered the maximum operational noise produced by all significant sound sources associated with the LNG terminal that could impact the sound contribution at the NSA. The analysis was based on current operating design conditions and project drawings, and noise source level data for the equipment was obtained from direct measurements of similar equipment at other LNG terminals. The sound power levels of the equipment, after considering the quantities of each type, ranged from a low of 99 dBA to a high of 125 dBA. The estimated sound level attributable to the Calhoun LNG Terminal at the nearest NSA and the estimated total L_{dn} and potential noise increase above ambient is summarized in table 4.11.2.1-1.

TABLE 4.11.2.1-1

Noise Impact Analysis at the Nearest Noise Sensitive Area

NSA Distance and Direction from Terminal Site	Estimated Ambient L_{dn} for Quiet Suburban Residential Area (dBA)	Calculated L_{dn} of the Calhoun LNG Terminal (dBA)	Estimated Total L_{dn} (dBA)	Potential Noise Increase (dBA)
12,000 feet North	50.0	38.0	50.3	0.3

The calculated operational noise level of 38.0 dBA is less than the estimated ambient level L_{dn} of 50.0 dBA. The addition of the LNG terminal's maximum operating capacity noise level to the existing environment would raise the ambient noise level by only 0.3 dBA, which would not be perceptible. An increase of 3 dBA is generally considered to be the smallest increase that is perceptible. In addition, the predicted level of 38.0 dBA is significantly below the 55 dBA level

required by the FERC. Thus, noise from operation of the LNG terminal facility should not create a significant noise impact at the NSAs along the south side of the City of Point Comfort.

Construction activities for the Calhoun LNG Terminal could contribute short-term noise increases at the NSAs, but these would largely be masked by industrial noise from the Alcoa POC and Formosa Hydrocarbons Corporation facilities and Port activities which occur 24 hours a day 7 days a week. Construction activities could proceed for 35 months and would normally be limited to daylight hours.

The highest level of construction noise would occur during site earthwork (*e.g.,* grading/clearing/grubbing) when the largest amount of construction equipment would be in operation. Dredging and excavation operations would be required for the CCND's new turning basin and Calhoun Point Comfort's ship berth and pile driving activities would be required for the construction of the LNG ship berth.

The predicted sound level contributed by each of the three specific construction-related activities was calculated from estimated A-weighted scale of noise sources (*i.e.,* equipment) that typically operate during the specific construction activity. To produce a conservative result, this analysis was based on the most equipment intensive phase of each activity. The results of this analysis are presented in table 4.11.2.1-2 below. Construction of the LNG terminal and pile driving are expected to produce the highest levels at the NSAs. The highest predicted L_{dn} level is 41.4 dBA, which is significantly below the 55 dBA level identified by the FERC as significant. It is also below the existing L_{dn} of about 50 dBA at the NSAs, which means that the sound would generally not be noticeable. Therefore, construction of the LNG terminal is not expected to result in a significant noise impact at any NSA.

Dredging activities would be continuous and take place over a four-month period. Expected noise levels at the NSA would be about 8 dBA lower than for the other construction activities since less equipment would be needed. Dredging noise and much of the normal terminal construction noise would be indistinguishable from existing noise from the Port. Noise generated by pile driving would depend upon the type of pile and equipment used.

TABLE 4.11.2.1-2

Expected Construction Noise Levels at NSAs

LNG Terminal Construction (12,000 feet to NSA)		**Pile Driving Operations (12,000 feet to NSA)**		**Dredging Operations (12,000 feet to NSA)**	
L_{eq}	**L_{dn}**	**L_{eq}**	**L_{dn}**	**L_{eq}**	**L_{dn}**
35.0 dBA	41.4 dBA	35.0 dBA	41.4 dBA	27.0 dBA	33.4 dBA

Because the existing and construction noise levels discussed above are estimates, **we recommend that**:

- **Calhoun Point Comfort should conduct a noise survey at the nearest noise sensitive areas to establish actual existing and construction noise levels. If the actual noise levels during construction (*i.e.,* dredging and pile driving activities) exceed ambient noise levels, then Calhoun Point Comfort should develop a noise mitigation plan to reduce noise levels and document that the noise mitigation plan effectively reduces noise from construction activities. The noise survey, noise mitigation plan, and documentation should be filed with the Secretary, for review and written approval by the Director of OEP, prior to the initiation of any construction activities.**

Pipeline

During construction of the Point Comfort Pipeline, neighbors in the vicinity of the construction right-of-way would hear construction noise. Traffic and farm machinery are the primary sources of ambient noise. Pipeline construction would proceed at rates of from several hundred feet to 1 mile per day. However, due to the assembly line nature of construction, activities in any area could last from several weeks to several months on an intermittent basis.

Construction equipment would be operated on an as-needed basis. Exact noise levels cannot be determined; however, we can estimate noise levels as a function of the distance of the receptor from the equipment. Assuming the operation of a piece of equipment results in typical noise levels of 88 dBA at 50 feet, the noise impact of that equipment would be 82 dBA at 100 feet and 72 dBA at 300 feet from the equipment. Noise would diminish rapidly as the distance from the noise source increases.

Normally there would be no nighttime noise from construction. Most construction, except for HDD, would be limited to daytime hours. Directional drilling operations are usually 24-hour per day operations requiring up to two weeks for completion. While individual receptors in the immediate vicinity would experience an increase in noise, the effect would be temporary and local.

H&K prepared an acoustical assessment to establish ambient noise levels of NSAs along the pipeline route within 1.0 mile of proposed HDD activities. The acoustical assessment considered the operational noise produced by HDD activity that could impact the sound contribution at the NSA and was based on operating conditions of HDD equipment, project drawings, and ambient sound survey measurements recorded at HDD locations (Kiteck, 2005b). Seven HDD locations were evaluated (see figure 4.11-1) and consist of the following:

- HDD 1 (MP 0.2 to 0.3) – Two NSAs located 10,500 feet and 9,500 feet north-northwest of the HDD entry and exit point, respectively. These are houses are on Wood Street in the City of point Comfort; however, the HDD would occur within an industrialized area (see figure 4.11-2).

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- HDD 2 (MP 0.7 to 0.8) – Two NSAs located 8,000 feet and 7,000 feet north-northwest of the HDD entry and exit point, respectively. These are houses on Wood Street in the City of point Comfort; however, the HDD would occur within an industrialized area (see figure 4.11-2).
- HDD 3 (MP 2.2 to 2.8) – Two NSAs located 800 feet northwest and 600 feet south-southwest of the HDD entry and exit point, respectively. These are homes along Jones Street and Julia Street, respectively (see figure 4.11-3).
- HDD 4 (MP 13.5 to 13.7) – Two NSAs located 400 feet northwest and 700 feet south-southeast of the HDD entry and exit point, respectively. These include a house and railroad office on FM 616, respectively (see figure 4.11-4).
- HDD 5 (MP 16.3 to 17.0) – Two NSAs located 2,000 feet east and 5,000 feet east-southeast of the HDD entry and exit point, respectively. These are houses on the east side of the Navidad River (see figure 4.11-5).
- HDD 6 (MP 22.8 to 23.5) – Two NSAs located 2,200 feet east and 1,600 feet south-southwest of the HDD entry and exit point, respectively. These are house on the east and west side of the Lavaca River, respectively (see figure 4.11-6).
- HDD 7 (MP 25.2 to 25.6) – Two NSAs located 2,000 feet west and 1,000 feet southwest of the HDD entry and exit point, respectively. These include houses along FM 234 (see figure 4.11-7).

H&K conducted an ambient sound survey on September 21, 2005 (Kiteck, 2005b). Sound levels were measured during the late morning and mid-afternoon to establish average daytime L_{eq} levels. Nighttime ambient sound surveys were not conducted due the arrival of Hurricane Rita. As a result, these levels were estimated based on the daytime measurements and observed surrounding environment. These were then used to calculate the L_{dn} levels. In addition to noise level measurements, H&K 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 each location.

During the ambient sound survey, the primary noise sources that were observed during were the noise of industrial plants, farm equipment, vehicle traffic, and birds and insects. The temperature ranged from 85 to 92°F, relative humidity from 40 to 60 percent, winds were primarily from west-northwest and north-northwest at one to eight mph, and the sky was mostly clear during the morning and with some in the afternoon. The estimated sound level attributable to the seven HDD locations at the nearest NSA and the estimated total dBA L_{dn} and potential noise increase above ambient is summarized in table 4.11.2.1-3.

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

TABLE 4.11.2.1-3

Noise Impact Analysis at the Nearest Noise Sensitive Area

HDD Location	NSA Distance and Direction from HDD Entry and Exit Point	Calculated Ambient L_{dn} at the HDD Entry and Exit Point (dBA)	Calculated Sound Contribution of HDD Activity (dBA)	Potential Noise Increase (dBA)
1	10,500 feet and 9,500 feet north-northwest	52.4	a/	a/
2	8,000 feet and 7,000 feet north-northwest	52.4	a/	a/
3	800 feet northwest and 600 feet south-southwest	52.4 – 52.8	62.7 – 61.8	10.3 – 9.0
4	400 feet northwest and 700 feet south-southeast	46.6 – 48.2	70.7 – 59.3	24.1 – 11.1
5	2,000 feet east and 5,000 feet east-southeast	46.9	50.7 – 33.7	3.8 - (13.2)
6	2,200 feet east and 1,600 feet south-southwest	38.7 – 38.0	48.0 – 48.8	9.3 – 10.8
7	2,000 feet west and 1,000 feet southwest	45.9	50.7 – 54.4	4.8 – 8.5

a/ Sound contribution of HDD location not calculated since NSAs are great than 7,000 feet from the HDD would occur in highly industrial area.

In relation to the NSAs, the addition of HDD activity at HDD locations 5, 6, and 7 would remain below 55.0 dBA; however, HDD activity at HDD locations 3 and 4 could exceed this threshold and increase the ambient noise level between 9.0 and 24.1 dBA, which would be perceptible (an increase of 3 dBA is generally considered to be the smallest increase that is perceptible). To mitigate the potential increase in noise at HDD locations 3 and 4, H&K recommended several noise mitigation measures including installing a temporary noise barrier system around the equipment area. This could reduce noise levels at the entry and exit points to 54.4 and 53.5 dBA at HDD location 3 and 62.0 and 51.3 dBA at HDD location 4. In its November 1, 2005 data response, Calhoun Point Comfort indicated it would require the HDD contractor to use these mitigation measures, or equivalent, to reduce noise to the NSAs. Although, Calhoun Point Comfort would implement measures to reduce noise levels at HDD locations 3 and 4, to ensure that all NSAs are not exposed to excessive noise during nighttime drilling operations, **we recommend that**:

- **Calhoun Point Comfort submit, prior to the end of the comment period, a drilling noise analysis, mitigation and compliance plan for HDD locations 3 through 7 for review and written approval. This plan should demonstrate that noise due to drilling operations are below 55 dBA Ldn at the nearest NSAs and specify all noise mitigation equipment necessary to reduce noise below 55 dBA Ldn. Calhoun Point Comfort should detail the method by which they will ensure compliance and where surveys indicate that noise attributable to drilling exceeds 55 dBA Ldn, Calhoun Point Comfort should:**

a. immediately stop drilling and mitigate the noise at the affected NSAs to reduce the noise levels at those NSAs to 55 dBA L_{dn} or below, or

b. offer temporary housing until Ldn levels at the NSAs are 55 dBA or below.

Operational noise impacts would be limited to the meter station's vicinity. The buried pipeline would not contribute to aboveground noise levels, and noise from metering stations would be insignificant. The meter stations would primarily be in rural/agricultural areas of Calhoun and Jackson Counties; however, the Formosa Hydrocarbons interconnect, at MP 1.7, would be in an industrial area. Calhoun Point Comfort indicated that it would employ noise mitigation measures to ensure that the predicted levels at its meter/interconnect sites are below an L_{dn} of 55 dBA. To ensure that there would be no significant impact to noise quality at a nearest NSA as a result of meter station/interconnect operations, **we recommend that:**

- **Calhoun Point Comfort should make all reasonable efforts to assure its predicted noise levels from meter stations/interconnects are not exceeded at NSAs and file noise surveys showing this with the Secretary no later than 60 days after placing the meter station/interconnects in service. If the noise attributable to the operation of meter station/interconnects exceeds 55 dBA L_{dn} at an NSA, Calhoun Point Comfort should file a report on what changes are needed and should install additional noise controls to meet the level within one year of the in-service date. Calhoun Point Comfort should 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.**

4.12 RELIABILITY AND SAFETY

Three federal agencies share in the oversight of the safety and security of LNG import terminals: the FERC, the Coast Guard, and the DOT. 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 Coast Guard has authority over the safety of LNG vessels and the marine transfer area. The Coast Guard also has authority over security of LNG vessels and the entire LNG facility. In conjunction with this, the Coast Guard determines the suitability of waterways for LNG marine traffic by issuing a LOR. 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.

The operation of the proposed Calhoun 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 off-site hazard including events occurring during the course of but not limited to LNG

vessel transits. 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.

With the exception of the October 20, 1944 fire at the LNG facility in Cleveland, Ohio, the operating history of U.S. LNG facilities has been free of LNG safety-related incidents resulting in adverse effects to the public or the environment. The 1944 Cleveland incident was attributed to the use of materials inadequately suited for cryogenic temperatures and the lack of spill impoundments at the site.[8] More recently, 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 worker 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 firebox which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and liquid petroleum gas (LPG) separation equipment of Train 40, and spread to Trains 20 and 30. Although Trains 10, 20, and 30 had been modernized in 1998-1999, Train 40 had been operating with its original equipment since start-up in 1981.

Although there are major differences between the equipment involved in the accident at Skikda and that of the proposal by Calhoun Point Comfort (*i.e.,* high-pressure steam boilers that power refrigerant compressors would not be used here nor are they used at any LNG facility under FERC jurisdiction), the sequence of cascading events identifies potential failure modes that warrant further evaluation. To ensure that all potential hazards are addressed, we have provided a recommendation in section 4.12.2, *Cryogenic Design and Technical Review,* to address this issue.

A discussion of the principal properties and hazards associated with LNG is presented in section 4.12.1. 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.

[8] For a description of the incident and the findings of the investigation, see "U.S. Bureau of Mines, Report on the Investigation of the Fire at the Liquefaction, Storage, and Regasification Plant of the East Ohio Gas Co., Cleveland, Ohio, October 20, 1944, February 1946."

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 United States.

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.

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 trinitrotoluene (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 which 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 of about 20-25 m/sec (66-82 ft/sec) and local over pressures up to 0.2 psig have been estimated for methane-rich fuels, well below the flame speeds and over pressures associated with explosion.

A rapid phase transition (RPT) can occur when a portion of LNG spilled onto water changes from liquid to gas, virtually instantaneously. Unlike an explosion that releases energy and combustion products from a chemical reaction as described above, an RPT is the result of heat transferred to the liquid inducing a change to the vapor state. The rapid expansion from the liquid to vapor state can cause locally large overpressures. RPTs have been observed during LNG test spills onto water. In some test cases, the overpressures generated were strong enough to damage test equipment in the immediate vicinity of the LNG release point. The sizes of the overpressure events have been generally small and are estimated to be equivalent to several pounds of TNT. Such a small overpressure is not expected to cause significant damage to an LNG vessel. However, the RPT may increase the rate of LNG pool spreading and the LNG vaporization rate.

4.12.2 Cryogenic Design and Technical Review

The cryogenic design and technical review emphasizes the engineering design and safety concepts as well as 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 Calhoun LNG Terminal has been performed by the FERC staff. The design and specifications submitted for the proposed facility to date are considered to be preliminary but would be the basis for any detailed design to follow. A significant amount of the design involving final selection of equipment manufacturers, process conditions, and resolution of some safety related issues would be completed in the next phase of the project development if authorization is granted by the Commission. This information would need to be submitted to FERC staff for review and approval.

As a result of the technical review of the information provided by Calhoun Point Comfort in the submittal documents, a number of concerns were identified by staff relating to the reliability, operability, and safety of the proposed design. In response to staff's questions, Calhoun Point Comfort provided written answers prior to the technical conference on November 15, 2005. As discussed at that technical conference, Calhoun Point Comfort was in the process of revising the facility design, which was subsequently re-submitted on January 31, 2006. After review of the revised information, staff notes several areas of concern that require additional consideration and/or action on behalf of the company. Follow up on those items requiring additional action should be documented in reports to be filed with the FERC. As a result, **we recommend that:**

The following measures should apply to the LNG terminal design and construction details. Information pertaining to these specific recommendations should be filed with the Secretary for review and approval by the Director of OEP either: prior to initial site

preparation; prior to construction of final design; prior to commissioning; or prior to commencement of service as indicated by each specific condition. Items relating to Resource Report 13-*Engineering and Design Material* and security should be submitted as critical energy infrastructure information (CEII) pursuant to 18 CFR Parts 388.12 and PL01-1. Information pertaining to items such as: off-site emergency response; procedures for public notification and evacuation; and construction and operating reporting requirements would be subject to public disclosure. This information should be submitted a minimum of 30 days before approval to proceed is required.

- **A complete plan and list of the hazard detection equipment should be filed prior to initial site preparation. The information should include a list with the instrument tag number, type and location, alarm locations, and shutdown functions of the proposed hazard detection equipment. Plan drawings should clearly show the location of all detection equipment.**

- **Calhoun Point Comfort should provide a technical review of its proposed facility design that:**

  a. **Identifies all combustion/ventilation air intake equipment and the distances 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 indicate how these devices would isolate or shutdown any combustion equipment whose continued operation could add to or sustain an emergency.**

Calhoun Point Comfort should file this review prior to initial site preparation.

- **A complete plan and list of the fixed and wheeled dry-chemical, fire extinguishing, and high expansion foam hazard control equipment should be filed prior to initial site preparation. The information should include a list with the equipment tag number, type, size, equipment covered, and automatic and manual remote signals initiating discharge of the units. Plan drawings should clearly show the planned location of all fixed and wheeled extinguishers.**
- **Facility plans showing the proposed location of, and area covered by, each monitor, hydrant, deluge system, hose, and sprinkler, as well as piping and instrumentation diagrams, of the fire water system should be filed prior to initial site preparation.**
- **A copy of the hazard design review and list of recommendations that are to be incorporated in the final facility design should be filed prior to initial site preparation.**
- **Drawings of the storage tank piping support structure and support of horizontal piping at grade should be filed prior to initial site preparation.**
- **The design pressure of the fractionation system should be not less than the maximum shut off pressure from the low pressure LNG pumps, the same design pressure as the LNG/Gas exchangers, tube side of the process vaporizers and the**

LNG surge drum. The revised P&IDs and design information for the NGL fractionation system should be submitted prior to initial site preparation.

- **Procedures should be developed for offsite contractors' responsibilities, restrictions, limitations and supervision of these contractors by Calhoun Point Comfort staff, prior to initial site preparation.**
- **The final design should provide LNG drain and LNG relief valve discharge piping to the LNG tank, to contain LNG within the storage system as the LNG containment design philosophy and minimize the discharge of liquid and cryogenic vapor to the cold vent system.**
- **The final design should include details of the pipe supports and restraints designed to prevent damage to piping systems and equipment in the event of a storm surge anticipated for a class 4 hurricane.**
- **The final design of the hazard detection equipment should identify manufacturer and model.**
- **The final design of the fixed and wheeled dry-chemical, fire extinguishing, and high expansion foam hazard control equipment should identify manufacturer and model.**
- **The final design should specify that unloading line check valves should be located upstream of the block valve and adjacent to the manifold isolation valves as per note 15 of the P&ID.**
- **The final design should specify that check valves be installed in the LNG drain lines round the unloading arm SDVs.**
- **The final design should specify that the unloading recycle line 4"-P-1031 should be connected at the end of the unloading header.**
- **The final design should include provisions to install LNG transfer pumps at Jetty LNG sump, V-603.**
- **The final design should include detailed drawings of the spill control system to be applied to the LNG tank roof.**
- **The final design should include details of the LNG tank tilt settlement and differential settlement limits between each LNG tank and piping and procedures to be implemented in the event that limits are exceeded.**
- **The final design should include with high flow alarm for the LNG tank fill flow measurement for each tank.**
- **The final design should include details of the boiloff gas flow and temperature measurement provided for each tank.**
- **The final design should include check valves in the intank LNG pump discharge piping downstream of the minimum flow recycle connection.**
- **The final design should include LNG recycle from the recondenser to the LNG storage tank, designed to allow the vessel to be stabilized prior to LNG pump operation and recycle to storage for LP LNG pumps start up and testing.**
- **The final design should specify that the LP and HP LNG pump recycle lines to the**

storage tanks, P-2019 and P-2511, shall be the same pressure class as the LNG pump discharge piping including the final block valve to the tank.

- **The final design should include provisions to recycle LNG from the suction header of the LP LNG pumps to storage.**
- **The final design should specify that the LNG surge drum, V-241, should be equipped with weld-end connections for piping.**
- **The final design should minimize the use of flanged nozzles for connection of piping to high pressure vessels containing LNG and NGL.**
- **The final design should specify that 4"-P-2143 be connected to the 24" bottom outlet line, to eliminate the connection to the vessel and provide drainage for the 24" outlet and elbow.**
- **The final design should include provisions to recycle LNG from the suction header of the HP LNG pumps to storage.**
- **The final design should specify that relief valves in the discharge piping of the HP LNG pumps and sendout vaporizers be designed and set for the system design pressure, consistent with the maximum shutoff pressure of the LNG pumps.**
- **The final design should include dual low low temperature alarm and shutdown at the discharge of the vaporizer.**
- **The final design should consider locating the vaporizer flow measurement device upstream of the vaporizer.**
- **The final design should specify that redundant pressure transmitters for high pressure alarm and shutdown should be provided for the fractionation system and for protection of the pipeline.**
- **The final design should specify that all piping with service temperature at or below -20°F shall be stainless steel.**
- **The final design should specify that piping specifications should state that spiral wound gaskets should be of type CGI, to include both outer and inner retaining rings.**
- **The final design should specify that cryogenic piping and equipment should be designed for cool down with liquid nitrogen.**
- **The final design should include P&IDs and drawings of the meter station.**
- **The final design should include a fire protection evaluation carried out in accordance with the requirements of NFPA 59A, chapter 9.1.2.**
- **The final design should include details of the shut down logic, including cause and effect matrices for alarms and shutdowns.**
- **The final design should include emergency shutdown of equipment and systems activated by hazard detection devices for flammable gas, fire, and cryogenic spills, when applicable.**

- **The final design should include details of the air gaps to be installed downstream of all seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system. Each air gap should vent to a safe location and be equipped with a leak detection device that should: continuously monitor for the presence of a flammable fluid; alarm the hazardous condition; and shutdown the appropriate systems.**
- **The final design should include a HAZOP review of the completed design. A copy of the review and a list of the recommendations should be filed with the Secretary.**
- **The P&IDs in the final design should show and number all valves including drain, vent, main, and car sealed.**
- **The final design should include safeguards to be installed to protect above ground fire water piping, including post indicator valves, from inadvertent damage.**
- **The final design should specify that all hazard detection equipment should include redundancy and fault detection and fault alarm monitoring in all potentially hazardous areas and enclosures.**
- **All valves including drain, vent, main, and car sealed valves should be tagged in the field during construction and prior to commissioning.**
- **The design details and procedures to record and to prevent the tank fill rate from exceeding the maximum fill rate specified by the tank designer should be filed prior to commissioning.**
- **A tabulated list of the proposed hand-held fire extinguishers should be filed prior to commissioning. The information should include a list with the equipment number, type, size, number, and location. Plan drawings should include the type, size, and number of all hand-held fire extinguishers.**
- **Operation and Maintenance procedures and manuals, as well as safety procedure manuals, should be filed prior to commissioning.**
- **The contingency plan for failure of the LNG tank outer containment approved by the tank manufacturer should be filed prior to commissioning.**
- **A copy of the criteria for horizontal and rotational movement of the inner vessel for use during and after cool down should be filed prior to commissioning.**
- **The maintenance procedures to be filed prior to commissioning should state that a foundation elevation survey of all LNG tanks should be made on an annual basis.**
- **The FERC staff should be notified of any proposed revisions to the security plan and physical security of the facility prior to commencement of service.**
- **Progress on the construction of the LNG terminal should be reported in monthly reports filed with the Secretary. Details should include a summary of activities, projected schedule for completion, problems encountered and remedial actions taken. Problems of significant magnitude should be reported to the FERC within 24 hours.**

In addition, we recommend that the following measures should apply throughout the life of the facility:

- **The facility should be subject to regular FERC staff technical reviews and site inspections on at least an annual basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, the Company 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. 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, should be submitted.**
- **Semi-annual operational reports should be filed 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 boiloff 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)" also 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.**
- **In the event the temperature of any region of any secondary containment, including imbedded pipe supports, becomes less than the minimum specified operating temperature for the material, the Commission should be notified within 24 hours and procedures for corrective action should be specified.**
- **Significant non-scheduled events, including safety-related incidents (*i.e.*, LNG or natural gas releases, fires, explosions, mechanical failures, unusual over pressurization, major injuries) and security related incidents (*i.e.*, attempts to enter site, suspicious activities) should be reported to FERC staff. 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. In all instances, notification should be made to FERC staff within 24 hours. 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. estimated property damage of $50,000 or more;

d. death or personal injury necessitating in-patient hospitalization;

e. free flow of LNG 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 condition that could lead to a hazard and cause a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility;

l. safety-related incidents to LNG vessels occurring at or en route to and from the LNG facility; or

m. an event that is significant in the judgment of the operator 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, FERC staff would determine the need for an on-site inspection by FERC staff; and the timing of an initial incident report (normally within 10 days) and follow-up reports. All required follow-up reports should include investigation results and recommendations to prevent a reoccurrence of the incident. The incident investigation should be done in accordance with FERC procedures.

Recent hurricane activity in the Gulf Coast region has increased concerns about the possible effects of natural disasters on existing and proposed LNG facilities. The 2005 Atlantic hurricane season was the most active season on record with hurricanes Katrina and Rita directly affecting Gulf Coast port areas in which existing, under-construction, and planned terminals are located. The FERC staff, recognizing the recent trend in the region towards more numerous and powerful storms, has intensified its review of the design criteria for the Calhoun LNG facility with respect to high wind speed and storm surge conditions.

All critical structures at the Calhoun LNG terminal would be designed per Title 49, CFR, Part 193.2067 for an assumed sustained wind velocity of not less than 150 miles (183 mph 3-second wind gust speed). Calhoun Port Comfort states that a maximum storm surge height of approximately 15 feet has been modeled for industrial sites to the north of the proposed facility using the Estuarine and Coastal Ocean Model (a similar model to SLOSH). In addition, Hurricane Carla, a 1961 Category 3 hurricane which came ashore at Lavaca Bay, produced a storm surge approximately 19 feet. The proposed location of the Calhoun LNG Terminal is at an approximate elevation of 30 feet above sea level. All process areas and major equipment would be located at or above 29 feet over seal level. In addition, the impoundment berm around the LNG storage tanks would be constructed to an elevation of 36 feet above sea level.

4.12.3 Storage and Retention Systems

LNG storage tanks come in a variety of categories. The following are descriptions of the tank designs most commonly used worldwide:

- single containment cylindrical metal tanks (predominately used in the U.S., currently proposed by Calhoun Point Comfort in this project);
- 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 (seven authorized by the Commission; several applications currently proposed to the Commission);
- 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 are summarized below for the LNG storage tanks commonly found in proposals before the Commission.

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 aboveground 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.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 3 to 6 feet (1 to 2 meters) in 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.

Single-, double- and full-containment LNG storage tanks have been authorized by the Commission for use at new LNG import facilities or expansions of existing terminals; and single- and double-containment tanks have been constructed and operated. Although construction of full-containment tanks has not yet started in the U.S., approximately 50 have been constructed world wide. Calhoun Point Comfort is proposing to install two single-containment tanks. NFPA 59A requires a separation of 0.7 times the diameter from the property line. The proposed tanks for the Calhoun Point Comfort Project would meet the separation requirement.

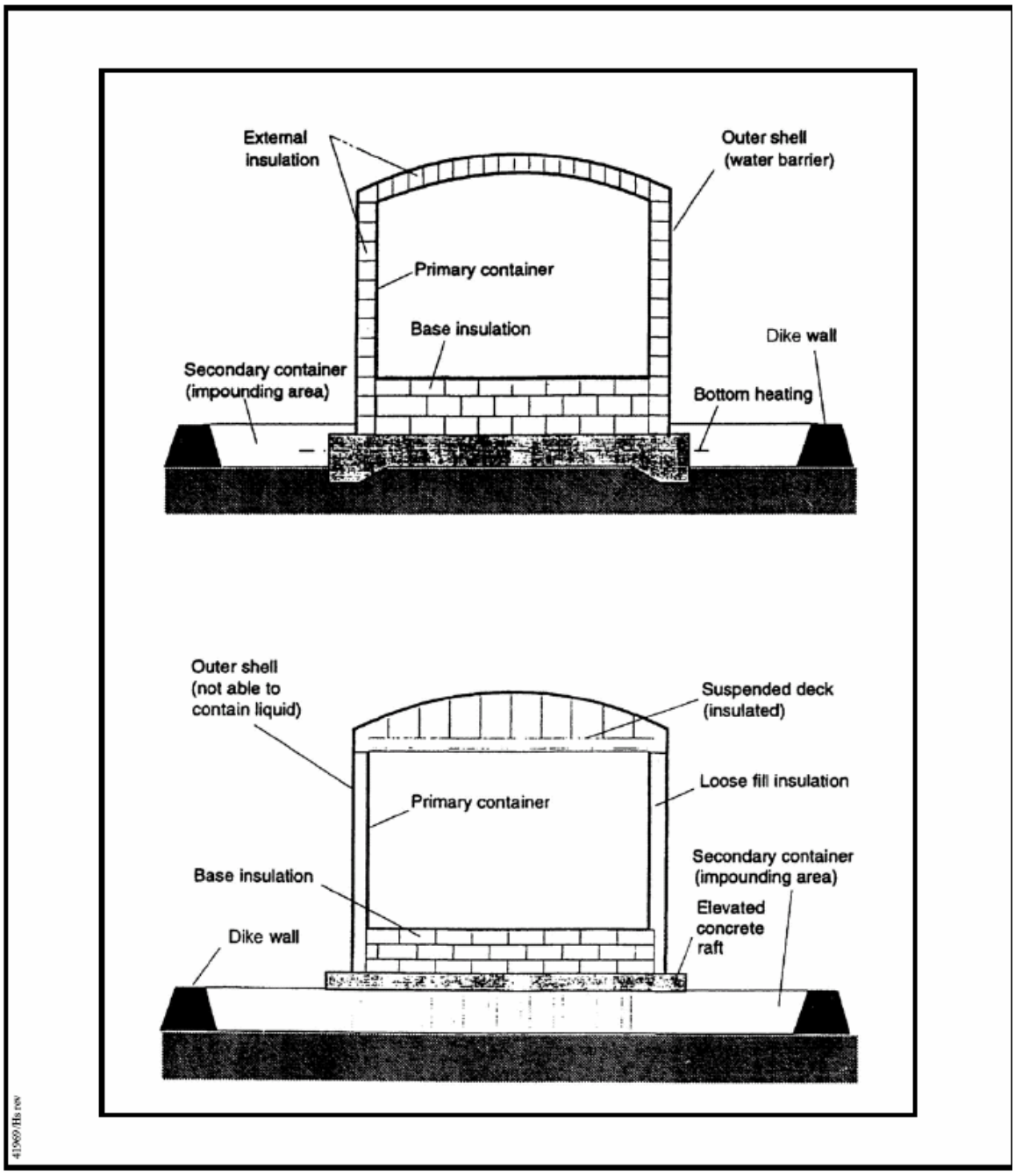

Figure H-1
Examples of Single Containment Tanks

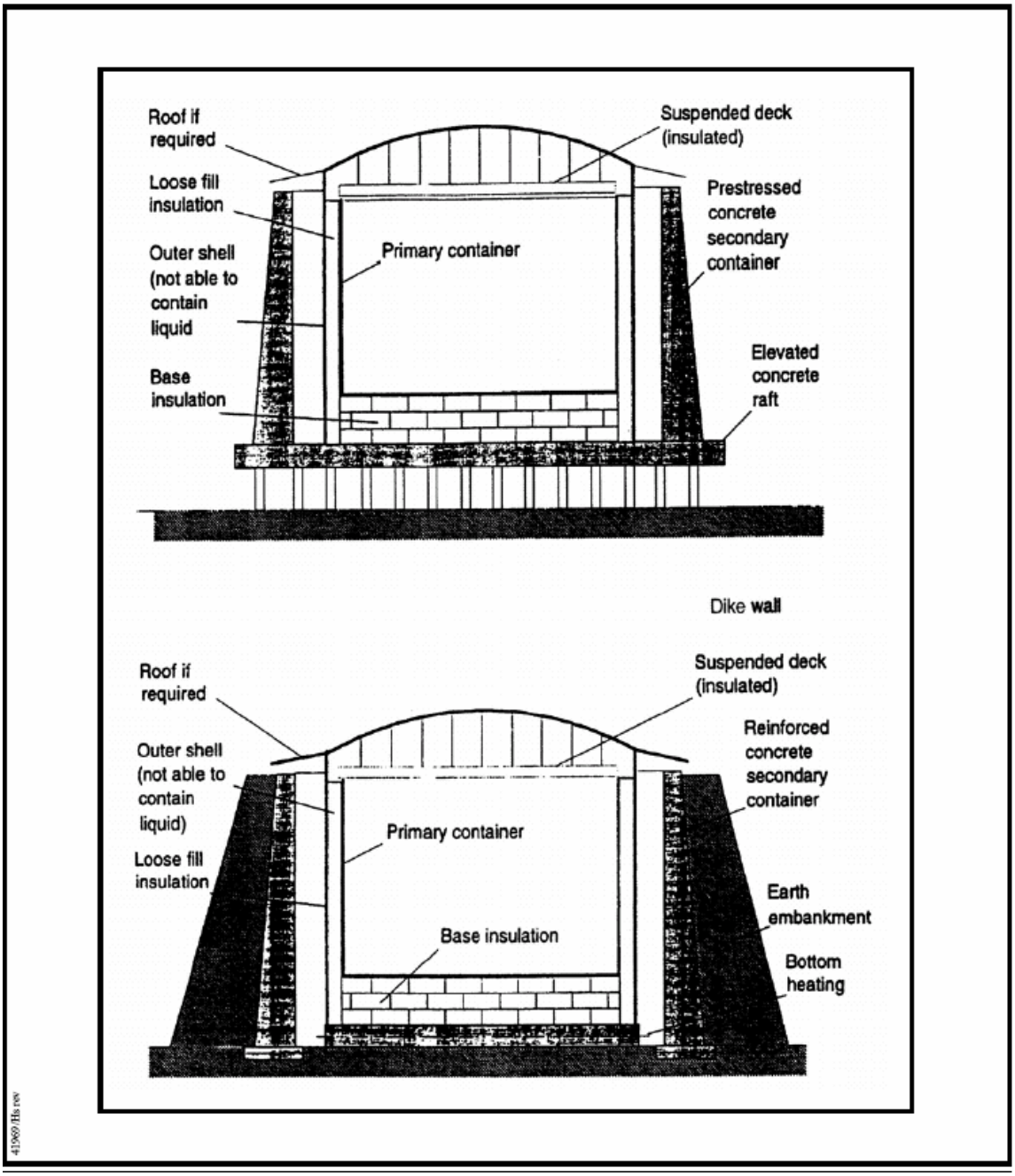

Figure H-3
Examples of Double Containment Tanks

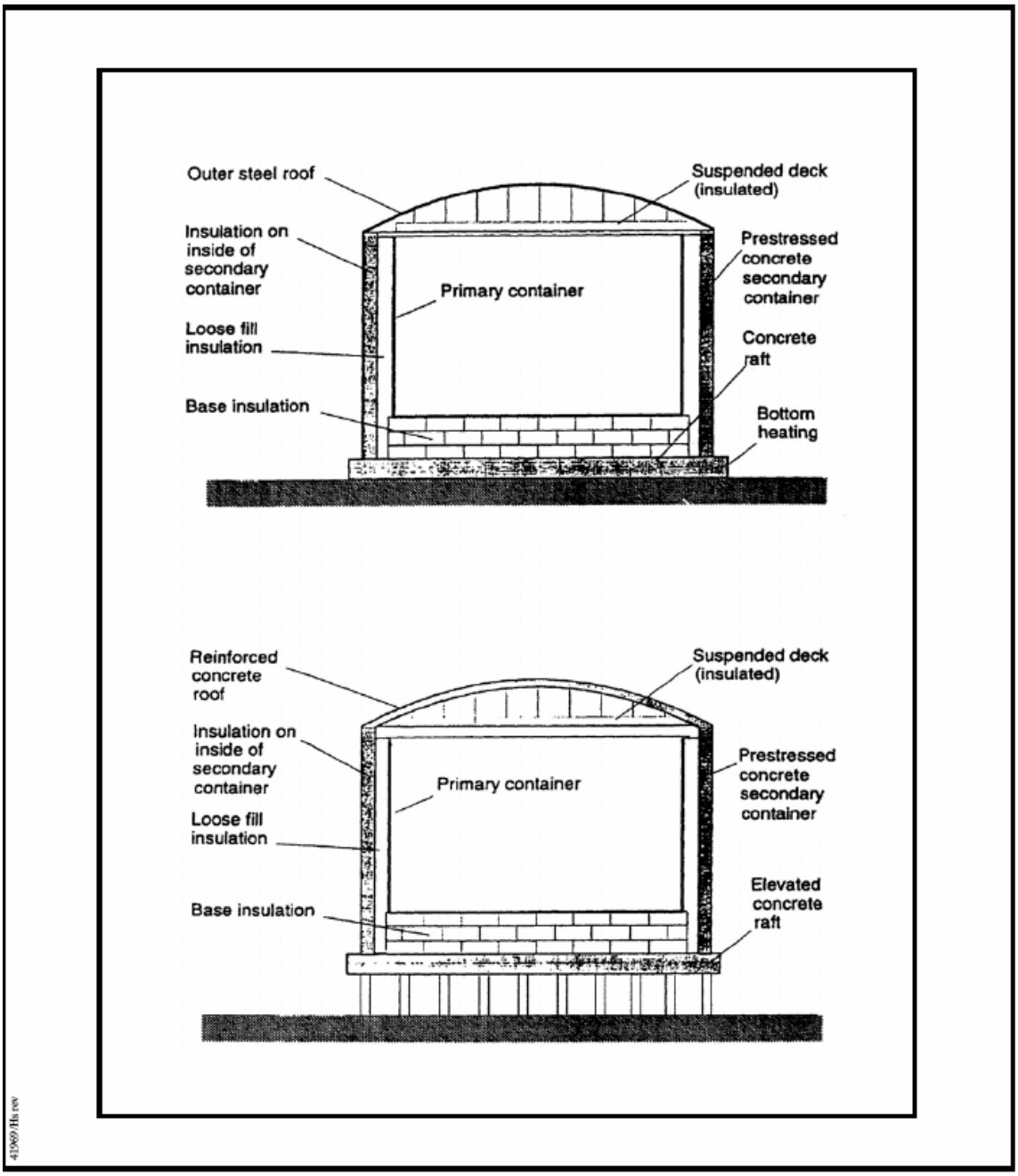

Figure H-4
Examples of Full Containment Tanks

4.12.4 Siting Requirements – Thermal and Dispersion Exclusion Zones

Regulatory Requirements

The LNG facilities proposed in 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 off-site 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 Sections 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:

- Two 1,006,000-barrel (160,000 m^3) single containment 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. NFPA 59A Sections 2.2.3.3 and 2.2.3.4 specify a flammable vapor exclusion zone for the design spill which is determined with Section 2.2.3.5.

- Marine cargo transfer system consisting of three 16-inch-diameter liquid transfer arms; one 16-inch-diameter vapor return arm; and a 36-inch-diameter transfer line - 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.

- Six 5,500-gpm in-tank pumps (three per tank with a spare pump tube); and four low pressure and four high pressure sendout pumps, each capable of discharging 3,217 and 4,133 gpm, respectively - 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 2.2.3.4 specifies the flammable vapor exclusion zone based on the design spill.

- Twelve 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 such as cargo transfer lines. Additionally, NFPA 59A Section 2.2.3.1 (2001) specifically excludes transfer area 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 accidental leakage source or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the authority having jurisdiction. Similar criteria appear in Section 2.2.3.5 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 rupture of a single transfer pipe with the greatest overall flow capacity, for not less than 10 minutes (old Part 193.2059(d)). As a result, the spill rate 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 duration must be 10 minutes unless the authority having jurisdiction (*i.e.,* DOT), 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 to calculate exclusion zones. 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. This approach is the result of discussions with DOT concerning the basis for design spills and application to exclusion zone determinations for proposals before the Commission.

Impoundment Systems and Sizing Spills

Part 193.2181(b) specifies that the impoundment system serving more than one LNG storage tank must have a volumetric capacity of 100 percent of all tanks or 110 percent of the largest tank's maximum liquid capacity, whichever is greater.

Calhoun Point Comfort proposes two single-containment storage tanks (Tank 111 and 112). Each tank would have a working volumetric capacity of 160,000 m^3 and a gross volumetric capacity of 180,000 m^3 (1,008,000-barrel). Impoundment for these tanks would be provided by an irregularly shaped, mechanically stabilized earthen berm ranging from 15-feet to 28 feet in height. This berm would encompass an area measuring approximately 704-feet by 1,426-feet and would completely surround both tanks. The southeastern portion of this impoundment would have a lower elevation than the tank area, allowing any spill to drain away from both tanks into this lower half. This area would be 361-feet-wide by 1,426-feet-long with an average height of 12.5 feet.

A square sub-impoundment would be located within this lower half and would measure 150-feet-wide by 150-feet-long with a depth of 4 feet. The lower half of the impoundment and the square sub-impoundment would provide 48,135,831 gallons and 586,473 gallons of spill capacity, respectively. The lower half of the impoundment, including the square sub-impoundment, would entirely contain the total contents of one LNG storage tank.

Including the volume provided by the lower half and the sub-impoundment, the entire berm surrounding the tanks would provide 169,404,128 gallons of spill containment. When full, both storage tanks would hold a combined total of 92,905,997 gallons of LNG. Therefore, the LNG storage tank impoundment system would meet the requirements of Part 193.2181(b).

LNG spill containment would also be provided at several other locations around the facility. These LNG spill containment structures would consist of concrete slabs, surrounded by a 3-foot-high concrete retaining wall, and graded to direct LNG into sloped trenches and concrete sumps.

Two identical sumps would be located to capture any LNG spills along the pipe racks that connect the unloading dock to the storage tanks. Both of the sumps would be 40-feet-wide by 80-feet-long with a usable depth of 25 feet. The capacity of each would be 598,442 gallons. The first of these, the Dock Area Sump, would be west of the marine unloading platform outside of the LNG storage tank impoundment berm. The other sump, the Process Area Sump, would be east of the marine unloading platform in proximity to the natural gas liquids and vaporization area. The largest 10-minute spill which could occur in either of these areas would be from the 36-inch-diameter marine unloading line. This spill would be 572,688 gallons and would be contained by either the Dock Area or Process Area sump, depending on the location of the spill.

The area surrounding the vaporizer trains and the natural gas liquids recovery systems would be curbed so that any spilled LNG would be directed into two identical LNG Vaporization Area Sumps. These sumps would be 15-feet-wide by 15-feet-long with a usable depth of 29 feet and a capacity of 48,810 gallons. The largest 10-minute spill in this area would be from the second stage vaporizer suction piping, a spill of 40,919 gallons. This would be contained by either LNG Vaporization Area Sump.

The calculation of thermal and flammable vapor exclusion zones for the proposed LNG facility are based on the dimensions of the proposed spill containment systems and the design spills according to 49 CFR 193 and NFPA 59A. In accordance with section 2.2.3.5 of NFPA 59A, the design spill for an LNG storage tank with no penetrations below the liquid level is defined as the largest flow from any single line that could be pumped into the impounding area with the tank withdrawal pumps considered to be operating at full rated capacity over a 10-minute period. For

the proposed design, this would be a guillotine rupture of the discharge header for the in-tank pumps. Since each pump is rated at 5,500 gallons per minute and there are three pumps per tank, the resulting 10-minute design spill would be 165,000 gallons. This spill would be completely contained by the square sub-impoundment located in the lower half of the LNG storage tank impoundment.

Section 2.2.3.5 also defines design spills for impounding areas serving only vaporization, process, or LNG transfer areas as the flow from any single accidental leakage source for a 10-minute duration. After a review of the piping and instrumentation diagrams for small diameter attachments, staff determined the design spill for the Dock Area Sump and Process Area Sump to be the rupture of a 6-inch-diameter drain connection to the marine unloading line. This 10-minute design spill would generate a volume of 130,481 gallons and would be contained in the either the Dock Area Sump or the Process Area Sump.

Similarly, the design spill for the LNG Vaporization Area Sumps would result from a rupture of a 4-inch-diameter connection to the low-pressure pump discharge line. This 10-minute design spill would result in a volume of 30,070 gallons and would be contained by either of the LNG Vaporization Area Sumps.

Table 4.12.4-1 presents the impounding areas and spill size volumes used to determine adequate impounding capacity, as well as the design spills used in the thermal radiation and flammable gas dispersion modeling.

TABLE 4.12.4-1

Impoundment Areas

Source	Spill Size (gallons)	Impoundment System	Impoundment Size (gallons)
Impoundment sizing spills:			
Two LNG Storage Tanks	92,905,997	Earthen Berm	169,404,128
Unloading Line	572,688	Process Area Sump or Dock Area Sump	598,442
2nd Stage SCV Suction	40,919	LNG Vaporization Area Sumps	48,810
Design spills:			
Tank - Pump withdrawal header	165,000	Sub-impoundment	586,473
Unloading Line - 6-inch connection	130,481	Process Area Sump or Dock Area Sump	598,442
Low Pressure Pump Discharge - 4-inch connection	30,070	LNG Vaporization Area Sumps	48,810

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 supersedes these requirements and stipulates that 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, Calhoun Point Comfort selected the following ambient conditions to produce the maximum distances: wind speed of 25.0 mph; ambient temperature of 34°F; and 70 percent relative humidity. These conditions yield longer distances than the 0 mph wind speed, 70°F ambient temperature, and 50 percent relative humidity specified in NFPA 59A.

Under Title 49, Code of Federal Regulations, Section 193.2057, the LNG storage tank impoundment must have a thermal exclusion zone in accordance with NFPA 59A. The referenced Section 2.2.3.2 of NFPA 59A requires thermal radiation distances ranging from 1,600- to 10,000-BTU/ft^2-hr to be calculated for a volume of LNG determined in accordance with Section 2.2.2.1. For impounding areas serving more than one container, NFPA 59A Section 2.2.2.1 defines this volume as the total amount of LNG in all tanks unless provisions are made to prevent low temperature or fire exposure from causing failures of adjacent tanks.

The design of the storage tank impoundment would direct any large spill from a single tank into the lower portion of the impoundment common to both tanks. As fire exposure protection, Calhoun Point Comfort states that fire-water monitors placed along the top of the impoundment berm would be used to cool the adjacent tank. Based on this, Calhoun Point Comfort modeled thermal radiation distances for the total volume of liquid from a single tank. However, FERC staff believe the ability of these monitors to maintain the integrity of the tank by cooling effectively is questionable. The position of the monitors would not allow complete coverage of the affected area. In addition, several monitors would be located at the edge of the lower portion of the impoundment, placing them within tens of feet of the flame from a single tank fire.

Consequently, staff calculated thermal radiation distances for a fire based on the total volume of liquid in both tanks. These resulting distances would be 1,535 feet for the 10,000 BTU/ft^2-hr zone; 2,166 feet for the 3,000 BTU/ft^2-hr zone; and 2,741 feet for the 1,600 BTU/ft^2-hr zone. All three of these zones would extend off of the facility site over the Matagorda Ship Channel and Cox Bay. The 1,600 BTU/ft^2-hr level would also extend north across the Matagorda Ship Channel and encroach upon another industrial site located on Point Comfort. Therefore, **we recommend that:**

- **Calhoun Point Comfort provide in its comments on the draft EIS, or in a separate document submitted at the same time, supplementary measures to effectively prevent fire exposure resulting from leakage from any one tank affecting an adjacent tank.**

As required by Section 2.2.3.6 of NFPA 59A, heat flux from a fire over the impounding area shall not cause damage to any LNG marine carrier which would prevent its movement. However, the 10,000 BTU/ft^2-hr thermal flux zone based on a full impoundment fire would completely encompass the LNG carrier berth. Consequently, **we recommend that:**

- **Calhoun Point Comfort re-evaluate the proposed design of the LNG storage tank impoundment system and the tank fire protection systems to meet the requirement of Section 2.2.3.6 of NFPA 59A. This information should be provided in Calhoun**

Point Comfort's comments on the draft EIS, or in a separate document submitted at the same time.

Thermal radiation distances were also determined for the 1,600-Btu/ft^2-hr incident flux level centered on the Dock Area Sump, Process Area Sump, and the two LNG Vaporization Area Sumps. In each case, the thermal radiation levels would remain on the proposed plant site.

Table 4.12.4-2 presents the maximum distances for incident flux levels ranging from 1,600 to 10,000-Btu/ft^2-hr, as calculated by FERC staff.

TABLE 4.12.4-2

Thermal Exclusion Zones

Source	Exclusion Area NFPA 59A Section 2-2.3.2(a)	Incident Flux (Btu/ft^2 hr) (a/)	Exclusion Zone (feet)
LNG Storage Tank Impoundment	Outdoor assembly area occupied by 50 or more people.	1,600	2,741
LNG Storage Tank Impoundment	Offsite structures used for occupancies or residences.	3,000	2,166
LNG Storage Tank Impoundment	Property line that can be built upon.	10,000	1,535
LNG Storage Tank Impoundment Sump	Property line that can be built upon.	1,600	668
Dock Sump and Process Area Sump	Property line that can be built upon.	1,600	286
Vaporization Area Sumps	Property line that can be built upon.	1,600	104

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. Sections 2.2.3.3 and 2.2.3.4 of NFPA 59A and Part 193.2059 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.

In performing the vapor dispersion analysis required by 49 CFR 193.2059, Calhoun Point Comfort selected a wind speed of 4.5 mph, an atmospheric temperature of 71°F, a relative humidity of 50 percent, and atmospheric stability Class F. A ground temperature of 71°F was also assumed. In its analysis, Calhoun Point Comfort modeled a spill of the full flow from the marine unloading line into the square sub-impoundment within the storage tank berm. Using SOURCE5 and DEGADIS, Calhoun Point Comfort calculated a distance of 633 feet to the 2.5 percent average gas concentration isopleth. However, this analysis assumed very effective vapor retention within the storage tank berm, resulting in no vapor escaping for a period of over 6 hours after the spill. This is not a reasonable assumption.

Consequently, FERC staff calculated flammable vapor dispersion distances using Calhoun Point Comfort's atmospheric conditions for the sub-impoundment with the berm artificially set to 0 feet. This allows the scenario to be modeled without accounting for any vapor retention by the storage tank berm. As previously discussed, the design spill for each LNG storage tank would be a rupture of the discharge header for the in-tank pumps. This would be a spill of 165,000 gallons and would be contained by the square sub-impoundment located in the lower half of the LNG storage tank impoundment. According to staff's calculations, vapor overtopping would occur within 13 seconds. The DEGADIS results indicate a distance of 1,678 feet to the 2.5 percent average gas concentration isopleth. This is a conservative estimate as the berm would provide some vapor retention. The actual dispersion distance would be shorter. The dispersion distances calculated by FERC staff, as well as by Calhoun Point Comfort extend beyond the plant property line over the waters surrounding the site.

Staff also performed a vapor dispersion analysis for the Dock Area Sump, Process Area Sump, and the two LNG Vaporization Area Sumps with SOURCE5 and DEGADIS. The 130,481 gallon design spill would be contained by either the Dock Area Sump or the Process Area Sump. DEGADIS indicates a distance of 694 feet to the 2.5 percent average gas concentration isopleth for this design spill. The 30,070 gallon design spill would be contained by either LNG Vaporization Area Sump. In this case, DEGADIS indicates a distance of 465 feet to the 2.5 percent average gas concentration isopleth.

Although the flammable vapor gas dispersion exclusion zones associated with these design spills would extend offsite into the Matagorda Shipping Channel and Cox Bay, there are no prohibited land uses within them. Consequently, the proposed terminal location would satisfy the vapor exclusion zone requirements of 49 CFR 193.2059.

4.12.5 Marine Safety

The February 2004 Interagency Agreement provides the framework for the participating agencies to work in a coordinated manner to address the full range of issues regarding safety and security at LNG import terminals and the suitability of waterways for LNG marine traffic. The FERC closely coordinates its pre-certificate review of the proposal with the Coast Guard, which has authority over the safety of LNG vessels and the marine transfer area as well as the security of the LNG vessels and the entire LNG facility, and the suitability of waterways for LNG marine traffic.

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, an LNG spill on water may be unconfined and may 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 4.12.5.5). 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[9] with the terminal or a structure in Matagorda and Lavaca Bays;
- 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 and security:

- 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 a conceptual LNG ship voyage, as proposed by the applicant, from the liquefaction facility to the import terminal, disclosing the risks at each step and how they would be 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 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. At this time, Calhoun Point Comfort has not confirmed the source(s) of LNG supplies.

The LNG ships used to import LNG to the U.S. would be constructed and operated in accordance with the International Maritime Organization (IMO) *Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk*, the SOLAS, and 46 CFR Part 154, which contain the U.S. safety standards for vessels carrying bulk liquefied natural gas. Foreign flag LNG ships are required to possess a valid IMO Certificate of Fitness and a Coast Guard Certificate of Compliance.

[9] "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.

In 1993, amendments to the IMO's Code for the *Construction and Equipment 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, and ports servicing those regulated vessels, must adhere to these IMO and SOLAS standards. Some of the IMO requirements are listed below:

For the ships, these requirements must include:

- Ships must develop security plans and have a Vessel Security Officer (VSO);
- 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:

- The port facility must have a security plan and a Facility Security Officer (FSO); 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 activities of people and cargo;
- Ensuring security communications and that they are readily available; and
- Completion of a Declaration of Security that is signed by the FSO and VSO.

LNG Vessel Transit in Matagorda Ship Channel

From open seas and the wider Gulf of Mexico, LNG ships are navigated by their own Captain towards the Texan coast via a series of Safety Fairways. These shipping lanes are designated as clear routes by marine authorities to assist ships in maintaining clearance from the many offshore oil and gas structures present in coastal waters.

Once arriving at the Texas coast, LNG ships would transit about 22 miles from the Gulf of Mexico to the proposed LNG terminal along the Matagorda Ship Channel (MSC). All ships in the MSC are required to have a Matagorda Pilot (Pilot). If the Coast Guard issues a LOR, as described in Section 1.3 "Permits, Approvals, and Regulatory Requirements," finding the waterway suitable for LNG marine traffic, the LNG ship would board a Pilot approximately 3.5 miles southeast of the Matagorda jetties. The Pilots are presently the controlling body in terms of scheduling, monitoring of weather conditions, establishing working conditions, and declaring channel closure days based on inclement weather. After boarding the LNG ship, the Pilot would navigate the vessel through the narrowest part of the MSC - the Jetties Channel – which is the land cut in the Matagorda Peninsula. From there, vessels would travel in a straight line along the MSC until reaching the area close to Point Comfort Channel where the vessel would swing in readiness for berthing.

Although the MSC is transited both day and night, large ships, such as an LNG carrier, are restricted to one-way traffic as coordinated by the Pilots. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the LNG ship would normally transit, arrive, and enter the port during early daylight hours and would be assisted by the two larger tractor tugs in the approach to the LNG terminal. Final marine operating procedures would be developed in partnership between Calhoun Point Comfort, the Pilots and the Port, but it would be common for tugs to rendezvous with inward bound LNG ships some time prior to the swinging area.

The berth would be aligned such that the LNG vessels would be turned by the tugs and backed onto berth. Docking, LNG offloading, and undocking would take less than 24 hours. The LNG ship would depart during daylight hours on the second day.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, in addition to the Pilots, the Coast Guard would control the transit of the LNG vessel through the harbor and while unloading cargo. Typical Coast Guard requirements for other LNG import terminals include 96- and 24-hour advance notification of the vessel arrival. Upon arrival at the sea buoy, Coast Guard personnel may board the LNG vessel for an inspection of the ship safety systems and review of the manifest. Other requirements may include: a Coast Guard 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; and monitoring of all operations until the vessel departs. Maintaining security of the dock and vessel would be the responsibility of the

facility in cooperation with other federal, state, and local agencies as described in the Facility Security Plan (see section 4.12.5).

LNG Vessel Casualties

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the operational controls by the Coast Guard and the Pilots, as well as the characteristics of the MSC and Point Comfort Channel, minimize the possibility of an LNG cargo spill from groundings, collisions, and allisions.

The soft nature of the sea bottom in the MSC 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 constraining the LNG ships to operating within the dredged channel.

The Coast Guard 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 Coast Guard 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 4.12.5.5 under "Hazards").

Deliberate Attack on an LNG Vessel

In addition to addressing the potential hazards from LNG vessel incidents, the possibility of a deliberate attack on an LNG ship by a terrorist group must also be considered. Security of the LNG vessel would be the responsibility of the owner/operator and the master of the vessel. Security of the facility would be the responsibility of the owner/operator of the facility. Protection of the LNG vessel and the import terminal would involve personnel from the Coast Guard, Calhoun Point Comfort security staff, and state and local law enforcement. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the Coast Guard would conduct random shoreside and waterside security patrols to include visits/passes of the LNG facility. In addition, the Coast Guard 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.

Calhoun Point Comfort would provide security for the terminal according to a Facility Security Plan that must be prepared under 33 CFR 105. This plan would need to be approved by the Coast Guard Captain of the Port. The requirements of this plan may include:

- 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;
- a designated FSO responsible for implementing and periodically updating the Facility Security Plan and Assessment;
- 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.,* a 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. Calhoun Point Comfort would be required to submit their Facility Security Plan to the Captain of the Port for approval 60 days prior to commencement of operations. In order to ensure that the responsibilities of Calhoun Point Comfort's security staff enhance overall security, **we recommend that:**

- **Prior to commissioning, Calhoun Point Comfort coordinate, as needed, with the Coast Guard to define the responsibilities of Calhoun Point Comfort's security staff in supplementing other security personnel and in protecting the LNG tankers and terminal.**

The U.S. Department of Energy (DOE) released a study by Sandia National Laboratories, *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water* (Sandia Report) December 2004. The report included an LNG cargo tank breach analysis using modern finite element modeling and explosive shock physics modeling to estimate a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings and low speed collisions could result in minor ship damage but not a cargo spill; while high speed collisions could cause a 0.5 to 1.5 m^2 cargo tank breach area. For intentional scenarios, the size of the cargo tank hole depends on the location of the ship and source of threat. Intentional breach areas were estimated to range from 2 to 12 m^2. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 m^2, which is a more appropriate range to use in calculating potential hazards from spills. These hole sizes are equivalent to circular hole diameters of 2.5 and 3 meters.

The FERC commissioned a study by ABSG Consulting Inc. (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. The methodology described in the ABSG study, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*, and revised in 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 several holes ranging in diameter from 1 meter to 3.9 meters. Using the methodology, we have estimated distances for a nominal 2.5-meter to 3-meter diameter hole to range from 4,182 to 4,652 feet for a thermal radiation of 1,600 Btu/ft^2-hr, the level which is hazardous for persons located outdoors and unprotected; from 3,232 to 3,591 feet for 3,000 Btu/ft^2-hr, an acceptable level for wooden structures; and from 1,934 to 2,143 feet for 10,000 Btu/ft^2-hr, a level sufficient to damage process equipment for these size holes, respectively.

These intentional breach scenarios provide guidance to the Coast Guard in developing the operating restrictions for LNG vessel movements in the MSC and Point Comfort Channel, as well as in establishing potential impact areas for emergency response and evacuation planning. Except for the 22 mile transit through the inland end of the Matagorda Ship Channel to the LNG berth, the transit would be in the open water of the Gulf of Mexico. Large portions of the Matagorda Ship Channel have no development or communities adjacent to the channel. The closest would be Port O'Connor, which is passed at approximately 1 mile and would be outside of the longest distance for a thermal radiation of 1,600 BTU/ft^2-hr.

Assuming an LNG vessel transit through the channel at 8.0 knots, areas adjacent to the channel would be exposed to a potential transient hazard of approximately 12 minutes. In addition, a temporary hazard would exist around the ship berth during part of the 24-hour period while the LNG vessel is at the dock and unloading cargo.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the LNG vessel movement requirements that would be imposed by the Pilots on LNG vessel movements through this area, as well as the requirements that the Coast Guard would impose in its *Liquefied Natural Gas Vessel Management and Emergency Plan* (see section 4.12.5.2) would minimize the possibility of a hazardous event occurring along the vessel transit.

Emergency Response and Evacuation Planning

As part of its application, Calhoun Point Comfort filed a draft Emergency Response Plan. This draft plan outlines some of the operating philosophies necessary for the organization, training, and emergency procedures needed to comply with 49 CFR Part 193.2509. Prior to commencing operations, Calhoun Point Comfort would be required to prepare final emergency procedures manuals, as required by 49 CFR Part 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. Specifically, section 193.2509(b)(3) requires "Coordinating with appropriate local officials in preparation of an emergency evacuation plan…"

While the worst-case scenarios evaluated for the onshore facility in section 4.12.4 and for marine spills in 4.12.5 provide guidance on the maximum extent of potential hazards, they should not be assumed to represent the evacuation zone for ***every*** potential incident. As with any other fuel or hazardous material, the actual severity of the incident would determine what area needs to be evacuated, if any, rather than a worst-case maximum zone. It is anticipated that the emergency evacuation plans would identify evacuation distances based upon increasing severity of events.

On several LNG import terminal proposals, a number of organizations and individuals commented on the need to consider emergency response procedures. Subsequently, Section 3A(e) of the Natural Gas Act, added by Section 311 of the Energy Policy Act of 2005, stipulated that in any Order authorizing an LNG terminal, the Commission shall the LNG terminal operator to develop an Emergency Response Plan in consultation with the Coast Guard and state and local agencies. The FERC must approve the Emergency Response Plan prior to any final approval to begin construction. Therefore, **we recommend that:**

- **Calhoun Point Comfort develop an Emergency Response Plan (including evacuation) and coordinate procedures with the Coast Guard, state, county, and 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 residents and other public use areas that are within any transient hazard areas along the route of the LNG vessel transit;

  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 initial site preparation. Calhoun Point Comfort should notify FERC staff of all planning meetings in advance and should report progress on the development of its Emergency Response Plan at 3-month intervals.

FERC has also received comments on other LNG terminal proposals expressing concern that the local community would have to bear some of the cost of ensuring the security and emergency management of the LNG facility and the LNG vessels while in transit and unloading at the berth. In addition, Section 3A(e) specifies that the Emergency Response Plan shall include a Cost-Sharing Plan that contains a description of any direct cost reimbursements the applicant agrees to provide to any state and local agencies with responsibility for security and safety at the LNG terminal and in proximity to vessels that serve the facility. To allow the FERC an opportunity to review the plan, **we recommend that**:

- **The Emergency Response Plan should include a Cost-Sharing Plan identifying the mechanisms for funding all project-specific security/emergency management costs that would be imposed on state and local agencies. In addition to the funding of direct transit-related security/emergency management costs, this comprehensive plan should include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. The Cost-Sharing Plan should be filed with the Secretary for review and written approval by the Director of OEP prior to initial site preparation.**

4.12.5.1 Matagorda Bay and the Port of Port Lavaca

Matagorda Bay has a number of port and waterfront facilities, most of which are centered around Lavaca Bay at the northwest corner of Matagorda Bay. Port Lavaca (on the west side of Lavaca Bay) and Point Comfort (on the east side of Lavaca Bay) are both reached by separate dredged Federal channels which are extensions from the northern end of the MSC.

The Port is operated by the CCND and has facilities for handling general cargo (i.e., break bulk, containerized, and heavy-lift cargoes), dry bulk, and bulk liquid cargoes. These cargoes are transported both in ships and also by the busy tug and barge trade that is common in Gulf states, particularly given that the Gulf Intracoastal Waterway (GIWW) cuts across the MSC.

Additionally, there are "secondary" marine facilities including limited ship repair, bunkering, lay-up berths, fishing and leisure piers, largely centered in Port O'Connor. A Coast Guard facility is also established at Port O'Connor.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, all LNG shipping would enter and depart the Matagorda Bay area by the MSC, as is the case with all of the seagoing shipping bound for the Port. The MSC is approximately 37.5 nautical miles long from the MSC buoy in the Gulf of Mexico to the commercial areas of the Port. Of the 37.5 miles, the seaward 15.5 miles is carried out under the navigation of the Captain of the LNG vessel and the remaining 22 miles is carried out with a Pilot embarked. 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 4.12.5.2-1.

TABLE 4.12.5.2-1

Channel Characteristics for Route That Would be Used by LNG Ships Calling on Proposed LNG Terminal

Channel Segment	Length (NM)	Width (ft)	Depth (ft)
MSC Buoy to MB Buoy a/	15.0	12000 a/ (note a)	40 to 49
Under Pilotage			
MB Buoy to Jetty Channel	2.5	300	42
Jetty Channel	1.8	300	38 c/
Jetty Channel to Matagorda Ship/Point Comfort Channel Intersection	16.0	200-300 b/	38 c/
Matagorda Ship/Point Comfort Channel Intersection to Turning Basin	2.2	200-300 b	38 c/
Total Length Under Pilotage	**22.5**		

a/ This 15 miles is within the Safety Fairway in the Gulf of Mexico and is carried out entirely under the navigation of the Captain of the LNG vessel. The Matagorda Bay Pilot boards at the Matagorda Buoy (MB).
b/ This is the existing channel width. The ship maneuvering studies by Calhoun Point Comfort were based on a future widths increased to 350 feet.
c/ This is the existing channel depth. The ship maneuvering studies carried out by Calhoun Point Comfort were based on a future depth increased to 45 feet.

Upon reaching the Calhoun LNG Terminal, an LNG ship would be required to turn in a specially constructed turning basin west of the terminal location. Once turned in the basin with tug assistance, the ship would be maneuvered back and onto the LNG berth. The LNG ship berth would be moored and oriented along the southeast side of the Point Comfort Channel pointing outward towards the MSC so that the LNG ship would not affect ship traffic. 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.

Current Traffic

Vessel movements in Matagorda Bay are dominated (numerically) by barge traffic, much of which transits to and from the Port via the GIWW. The number of inbound vessel transits in the Port from 1995 to 2004 are shown in the tables 4.12.5.2-2 and 4.12.5.2-3 and in figures 4.12-1

and 4.12-2. All vessel values relate to vessel arrivals. Therefore, the number of vessel movements would be almost exactly double the number shown – one movement inward and one movement outward. In addition, all vessels that are categorized as ships would enter the Matagorda Bay area via the Jetty Channel and would navigate within the MSC. This includes deep sea tug and barges.

Barge traffic would enter and depart the Matagorda Bay area via the GIWW. As such, the barge traffic would use the MSC between the GIWW and the Port area. This common use of the MSC (by barges and by LNG vessels) would be managed to ensure a separation between vessels is maintained. Fishing and leisure craft are, for the most part, not restricted to navigation within the MSC as their shallow draught enables them to pass LNG ships at a safe distance outside the channel.

TABLE 4.12.5.2-2

Vessel Movement in Port Lavaca-Point Comfort - 1995 to 2004

Year	TOTAL VESSELS			Weekly Averages		
	Ships	Barges	Total	Ships	Barges	Total
1995	101	574	675	1.9	11.0	13.0
1996	108	590	698	2.1	11.3	13.4
1997	121	597	718	2.3	11.5	13.8
1998	136	462	598	2.6	8.9	11.5
1999	188	486	674	3.6	9.3	13.0
2000	239	543	782	4.6	10.4	15.0
2001	238	503	741	4.6	9.7	14.3
2002	289	640	929	5.6	12.3	17.9
2003	248	762	1010	4.8	14.7	19.4
2004	274	952	1226	5.3	18.3	23.6

TABLE 4.12.5.2-3

Cargo Throughput in Port Lavaca- Point Comfort - 1995 to 2004

Year	Cargo Throughput (Short Tons)			
	Liquid Bulk and Chemical	Dry Bulk	Liquid Fertilizer	Total Cargo
1995	2,793,583.0	44,572.3	90,409.4	2,928,564.7
1996	2,812,447.3	110,335.1	119,968.9	3,042,751.3
1997	3,040,192.9	184,160.5	67,891.8	3,292,245.2
1998	2,832,709.2	50,474.7	84,249.2	2,967,433.1
1999	3,167,202.2	27,280.8	75,524.4	3,270,007.4
2000	3,572,780.5	7,520.5	82,308.3	3,662,609.3
2001	3,858,920.8	6,374.7	103,540.7	3,968,836.2
2002	5,261,084.7	0.0	161,201.2	5,422,285.9
2003	5,083,540.2	15,028.2	209,314.5	5,307,882.9
2004	4,968,705.5	0.0	139,388.5	5,108,094.0

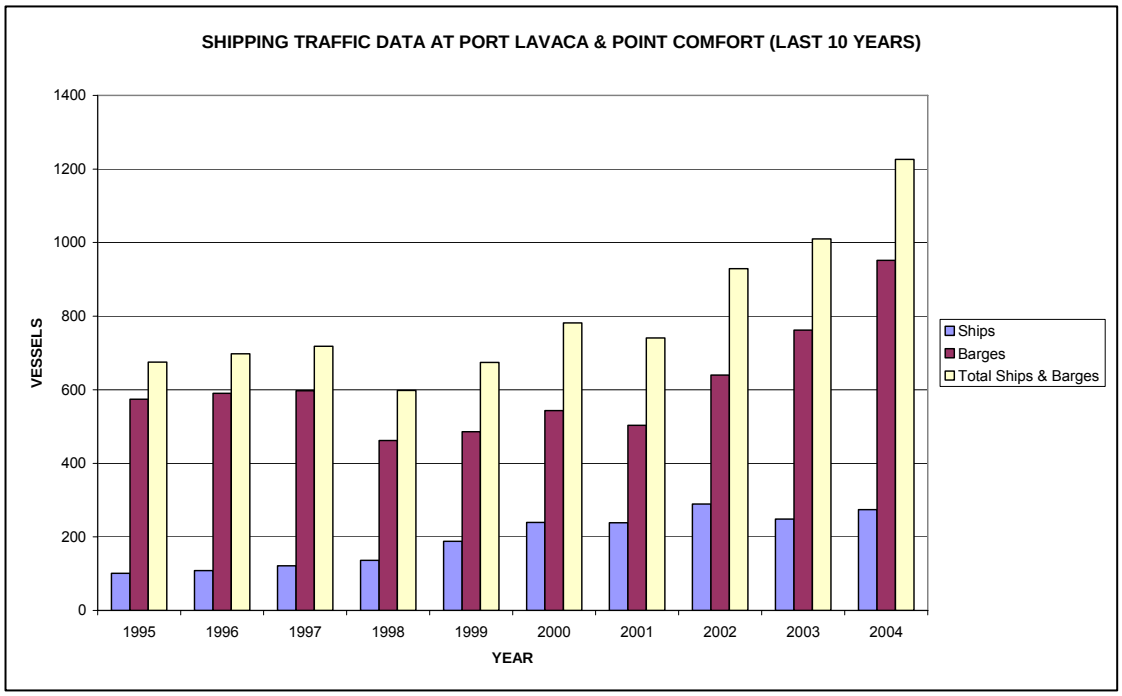

Figure 4.12-1
Vessel Movements in Lavaca Bay

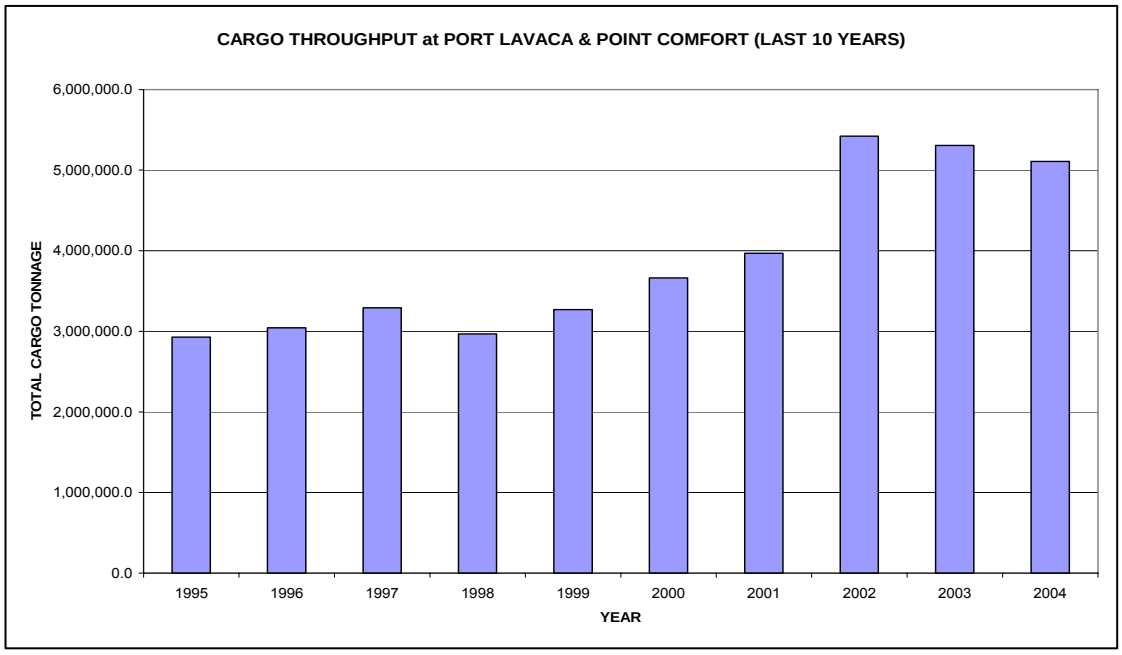

Figure 4.12-2
Ship Cargo Volumes (Tons) by Year, Lavaca Bay

Future Traffic

As described above, the shipping traffic at Port Lavaca-Point Comfort has steadily increased in both ship and barge traffic. Ship arrivals have increased from 101 per year in 1995 to 274 in 2004 – an increase of 171 percent. The estimated shipments of LNG would add a further 120 ship arrivals per year (a further 44 percent increase on 2004 shipping), making a total number of ship arrivals of 394 per year. Although the actual increase in ship traffic is high, this number of future ship movements, up to 120 LNG ships per year, or between two and three ships per week, cannot be regarded as excessive or likely to result in an over utilized Port. The Pilots have stated that they believe the LNG vessel traffic can be accommodated without any significant impacts to existing Port users. In addition, barge traffic, which at a draught of about 14 feet can often navigate outside the main channel, would be largely unaffected by changes in ship arrivals.

Ship Traffic in the Navigation Channels

There are a number of factors that influence the movement of ship traffic in the MSC. These include:

- ***Jetty Entrance Channel and Cross-Current*** – The COE-designated entrance channel has the objective of being a "land cut" to allow shipping to pass through the Matagorda Peninsula between the waters of the Gulf and Matagorda Bay. The jetty entrance includes the critical maneuvering area from just outside to just inside the ends of the jetty where ships transit from exposure to cross-currents (in the open Gulf) to waters where no cross current exists (between the jetties).

  The Jetty Channel is approximately 1,000 feet wide between the physical jetty structures above water level, but is reported to be as little as 200- to 300-feet wide at the navigable part of the 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. Pilots would restrict entrance of some ships when the crosscurrent exceeds 6.0 mph (approximately 5 percent of the time).

  Entrance of the largest deep draughted ships Calling at Port Lavaca-Point Comfort is possible only when the crosscurrent is negligible or 70 to 75 percent of the time.

- ***Matagorda Ship Channel Width and Depth*** – Currently, the MSC has a minimum width of 200 feet and a depth of 36 feet, limiting the size of LNG carriers which could be received by the facility. A vessel maneuvering study by Moffatt & Nichols analyzed the inbound transit of a fully loaded 90,000 m^3 LNG carrier with a loaded draft of 34 feet using bathymetric data of the MSC from 2003. Based on this study, Calhoun Point Comfort states that the MSC at its current depth and width would be able to safely accommodate LNG carriers up to 90,000 m^3 in capacity. These size vessels already transit the MSC to existing Port berthing facilities in the project vicinity.

  According to Calhoun Point Comfort, the COE is investigating dredging the MSC to a maintained depth of 43 feet and increasing the width to as much as 400 feet as part of

overall navigation improvements. In anticipation of these channel improvements, Calhoun Point Comfort intends to construct the proposed LNG facility to accommodate existing deeper draft LNG carriers, as well as future generations up to a capacity of 220,000 m^3.

- ***Day Transit and One–way Traffic*** – It is existing practice for large vessels carrying hazardous cargoes using the MSC to do so is during daylight hours only. This would be the case with LNG vessels. One-way traffic is currently enforced within the MSC based on the combined beam and combined draft of passing vessels. In addition, the moving safety zone around LNG vessels would prohibit any passing of these vessels. As a result, a convoying system would maximize the number of vessels traveling into and out of port on any given day. In this instance, all inbound traffic would travel as a group, with approximately 15 minutes to one hour between vessels. After the last of the inbound vessels is in port, all outbound shipments would commence with incremental spacing until all these vessels are out of port. This cycle then repeats. The need to convoy would primarily occur during periods where multiple ships are prepared to travel at any one time.
- ***Tugs*** – LNG ships delivering cargo to the proposed terminal would have tug support for all phases of arrival and departure, channel navigation, and for standby and fire fighting duties during LNG unloading operations. Calhoun Point Comfort would ensure that two dedicated tugs of at least 50 tonnes bollard pull would assist every LNG ship movement. Where additional towage capability is required (for example, due to strong winds) these two dedicated tugs would be augmented by use of additional tugs from the resident tug fleet that serves the existing customer base at Port Lavaca and Point Comfort.
- ***Moving Safety Zone*** –The Coast Guard currently imposes a 500-yard radius moving safety zone around incoming and outgoing LPG carriers while transiting the nearby MSC. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the Coast Guard may impose a moving safety zone for LNG ships that restricts other traffic ahead, astern, and to the sides. This moving safety zone could result in short delays to other ships, but as the MSC is a one-way channel anyway and ships proceeding in the same direction do so in a convoy, these will be minimal.
- ***Reduced Visibility*** – Fog has the potential to eliminate all vessel movements for days at a time and is the primary source of weather-related channel traffic restrictions. Fog is worst between November and April, with a peak in January of approximately six days average for the month. The average number of heavy fog days is 29 days per year. The Pilots indicate that the fog mainly affects the coastal reaches of the channel and that while the fog may break inland, there are days in which it does not clear along the coast. As such, fog may sometimes stop vessel movements for 24 hours or more. The most frequent channel closures due to fog span 12 to 18 hours during the months of January and February. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the Coast Guard may implement transit restrictions on LNG vessels during periods of reduced visibility.
- ***High Winds*** – Wind data from Port O'Connor indicates that winds are predominately from a south south-easterly direction and are less than 23 mph for 95 percent of the time. Exceedance of 34 mph winds is only 0.09 percent of the record, normally associated with

hurricane activity. LNG ships present a relatively high wind sail area and as such are more susceptible to delays due to wind. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the Coast Guard may establish a specific limit for LNG ship movement and berthing in high winds (typically 28 mph). 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. The Pilots have indicated that the wind associated with offshore squalls which crop up on short order tend to produce choppy swells. It is sometimes the case where weather of this variety prompts a channel shutdown until seas subside. Weather related shutdowns are subjective in nature and are declared by the Pilots on a case-by-case basis.

- ***Pilot Availability*** – Based on size and tonnage, LNG ships would likely be categorized as a two-pilot vessel. The Pilots have stated that they have enough manpower to handle all the traffic at the Bay ports, as well as the additional LNG traffic.

Ship Navigation

As previously discussed, Moffatt & Nichol conducted a successful vessel maneuvering study for the transit of a fully loaded 90,000 m^3 LNG carrier through the MSC at its current depth and width. This would be the largest LNG carrier which could safely navigate to the proposed facility without the COE channel improvements. In addition, Moffatt & Nichol conducted a vessel berthing study for the MSC to determine the characteristics required for a turning basin and berthing area for larger LNG carriers (2005).

Although the existing Point Comfort turning basin has a depth of 36 feet, CCND is proposing to dredge a new turning basin to a depth of 45 feet. The vessel berthing study utilized fast-time, autopilot simulations software to perform a computer-based simulation of the approach maneuvers required for an LNG ship to successfully maneuver from Gallinipper Point to the CCND's new turning basin and then to Calhoun Point Comfort's ship berth. Various current and wind velocities and directions were used and were based on modeled currents and historic wind data. The study assumed an LNG vessel of 138,000m^3 and two, 5,000 hp, 50 tonne, bollard pull tugs. The existing channel characteristics were not modeled. Rather the channel depth and width were set to 40 feet and 350 feet, respectively, to model the channel improvements proposed by the COE. Eight sets of runs with varying currents and wind direction were performed.

The results of the vessel berthing study revealed that the planned channel improvements and CCND's new turning basin would be sufficient to allow for navigation and berthing, provided the use of auxiliary power of two 50 tonne bollard pull tugs, of 138,000 m^3 LNG carriers. In some cases, three or four smaller tugs would be required. Faster approach speeds of about 7.6 knots were successful with two tugs whereas a slower approach speed of about 6.0 knots generally required the use of three tugs. Tug assisted departures were not modeled; however, it is expected that departures would be successful with similar tug assistance under similar environmental conditions. The study recommended that modeling should be performed to assess departure maneuvers.

The ability of tugs to pull the LNG vessel off of the breasting fenders under winds from the north-northwest was not analyzed in the vessel berthing study. A basic mooring analysis was used to estimate the force required to pull the vessel off the fenders. The resulting force of about

140 tonne could be supplied by two 70 tonne tugs. The study recommended that the use of more than two tugs for maneuvering should be explored further.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, additional navigational safety measures may be necessary for LNG ships based on the procedures to be developed in the Coast Guard's *Liquefied Natural Gas Vessel Management and Emergency Plan* (see section 4.12.5.2).

4.12.5.2 Requirements for LNG Ship Operations in Matagorda Bay

The Coast Guard exercises regulatory authority over LNG facilities that affect the safety and security of port areas and navigable waterways under Executive Order 10173; the Magnuson Act (50 USC section 191); the Ports and Waterways Safety Act of 1972, as amended (33 USC section 1221, et seq.); and the Maritime Transportation Security Act of 2002 (46 USC section 701). The Coast Guard is responsible for matters related to navigation safety, vessel engineering and safety standards, and all matters pertaining to the safety of facilities or equipment located in or adjacent to navigable waters up to the last valve immediately before the receiving tanks. The Coast Guard also has authority for LNG facility security plan review, approval and compliance verification as provided in Title 33 CFR Part 105, and siting as it pertains to the management of vessel traffic in and around the LNG facility.

The Coast Guard 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. Title 33 CFR 127 regulates the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, firefighting, and security of LNG waterfront facilities. The safety systems, including communications, emergency shutdown, gas detection, and fire protection, must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, Calhoun Point Comfort would be required to submit two copies of its Operations and Emergency Manuals to the Captain of the Port for examination.

Title 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).

As required by its regulations (section 127.009), the Coast Guard is responsible for issuing a Letter of Recommendation (LOR) as to the suitability of the waterway for LNG marine traffic with respect to the following items:

- Density and character of marine traffic;
- Locks, bridges, or other manmade obstructions in the waterway; and
- The following factors adjacent to the facility:
  - Depth of water;
  - Tidal range;
  - Protection from high seas;
  - Natural hazards, including reefs, rocks, and sandbars;

- Underwater pipes and cables; and
- Distance of berthed vessels from the channel and the width of the channel.

On June 14, 2005, the Coast Guard published a Navigation and Vessel Inspection Circular – *Guidance on Assessing the Suitability of a Waterway for Liquefied Natural Gas (LNG) Marine Traffic* (NVIC 05-05). The purpose of NVIC 05-05 is to provide Coast Guard Captains of the Port/Federal Maritime Security Coordinators, members of the LNG industry, and port stakeholders with guidance on assessing the suitability of a waterway for LNG marine traffic that takes into account conventional navigation safety/waterway management issues contemplated by the existing LOI/LOR process, but in addition, will also take completely into account maritime security implications. In accordance with this guidance, each LNG project applicant is to submit a Waterway Suitability Assessment (WSA) to the cognizant COTP. The WSA process addresses the transportation of LNG from an LNG tanker's entrance into U.S. territorial waters, through its transit to and from the LNG receiving facility, including operations at the vessel/facility interface. In addition, the WSA should address the navigational safety issues and port security issues introduced by the proposed LNG operations. The NVIC 05-05 also provides specific guidance on the timing and scope of the WSA.

The process of preparing the LOR begins when an applicant submits a Letter of Intent (LOI) to the Captain of the Port. In accordance with 33 CFR 127.007, Calhoun Point Comfort submitted a LOI to the Coast Guard on March 15, 2005 (see Appendix G). As is the case at other waterways receiving LNG marine traffic, the arrival, transit, cargo transfer, and departure of LNG ships would be required to adhere to the procedures of a port specific *Liquefied Natural Gas Vessel Management and Emergency Plan* to be developed by the Coast Guard Sector Corpus Christi if the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic. In addition, Calhoun Point Comfort would develop Operations and Emergency Manuals in consultation with the Coast Guard. These procedures would be developed to ensure the safety and security of all operations associated with LNG ship transit and unloading. The *Liquefied Natural Gas Vessel Management and Emergency Plan* would contain specific requirements for the LNG ship, pre-arrival notification, transit through shipping channels, the waterfront facility, cargo transfer operations, Coast Guard inspection and monitoring activities, and emergency operations. The Coast Guard Sector Corpus Christi would monitor each LNG ship in accordance with the *Liquefied Natural Gas Vessel Management and Emergency Plan*.

Typical key provisions of the *Liquefied Natural Gas Vessel Management and Emergency Plan* developed for other ports have included the establishment of a moving safety and/or security zone for all inbound and moored LNG ships, and the use of tugs to assist in the channel and to maneuver the ship into the berth. Additional provisions may be necessary given changing circumstances.

Calhoun Point Comfort Waterway Suitability Assessment

On January 19, 2006, Calhoun Point Comfort submitted a WSA for the proposed project to the Captain of the Port Coast Guard Sector Corpus Christi. The Coast Guard, with input from the Area Maritime Security Committee, local law enforcement, and emergency response organizations, has completed a review of Calhoun Point Comfort's WSA in accordance with the guidance in NVIC 05-05. The WSA review focused on the navigation safety and maritime

security risks posed by LNG marine traffic, and the measures needed to responsibly manage these security risks.

Coast Guard Letter to FERC

On June 19, 2006, the Coast Guard sent a letter to FERC, based on the above WSA review, providing input on the capability of the port community to implement the risk management measures necessary to responsibly manage the risks of LNG marine traffic in the port (see Appendix G). As described in this document, the Coast Guard has preliminarily determined that to make the waterway suitable for the LNG marine traffic associated with this project, additional measures would be necessary to responsibly manage the safety and security risks. The specific measures, and, where applicable, the resources needed to implement them, are described in a separate supplementary report from the Coast Guard to the FERC on June 19, 2006. This supplementary report, and the specific details of these measures, have been designated Sensitive Security Information as defined in Title 49 CFR Part 1520. Because any unauthorized disclosure of these details could be employed to circumvent the proposed security measures, it is not releasable to the public. Additionally, any security plan is a dynamic document that is subject to change with advances in technologies and improvements in intelligence gathering. The Coast Guard preliminarily identified the additional resources, public and/or private, that would be needed to implement prevention and mitigation strategies necessary for LNG operations. Accordingly, we have recommended that Calhoun Point Comfort submit to FERC, concurrent with its Emergency Response Plan, a comprehensive plan identifying the mechanisms for funding all project-specific security/emergency management costs (see section 4.12.5 under "Emergency Response and Evacuation Planning").

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the necessary security measures would be further developed into the detailed *Liquefied Natural Gas Vessel Management and Emergency Plan*, which would become the basis for appropriate security measures for each Maritime Security threat level. This plan would clearly spell out roles, responsibilities and specific procedures for an LNG vessel transiting the MSC up to the proposed Calhoun LNG terminal, as well as for all agencies involved in implementing security and safety during the operation. It would be required that, prior to the LNG vessel being granted permission to enter the shipping channels, both the vessel and facility must be in full compliance with the appropriate requirements of the Maritime Transportation Security Act and International Ship and Port Facility Security Code, and the security protocols to be established by the Captain of the Port in the *Liquefied Natural Gas Vessel Management and Emergency Plan*. The plan may include security measures such as: Coast Guard and other law enforcement agency vessels to enforce safety and security zones around the LNG vessels while in transit and moored at the terminal; shoreside surveillance and monitoring; and other prevention/mitigation strategies.

We recognize that the *Liquefied Natural Gas Vessel Management and Emergency Plan* would be a dynamic document that would be prepared well before import operations would commence, and that the port's overall security picture may change over that time period. New port activities may commence, infrastructure may be added, or population density may change. Improvements in technology to detect, deter and defend against intentional acts may also develop. Therefore, **we recommend that:**

- **Calhoun Point Comfort should annually review its waterway suitability assessment relating to LNG vessel traffic for the project; update the assessment to reflect changing conditions which may impact the suitability of the waterway for LNG marine traffic; provide the updated assessment to the cognizant Captain of the Port/Federal Maritime Security Coordinator (COTP/FMSC) for review and validation and if appropriate, further action by the COTP/FMSC relating to LNG vessel traffic; and provide a copy to FERC staff.**

4.12.5.3 Impact of Vessel Security Requirements

The potential impacts of the proposed LNG vessel traffic for Calhoun Point Comfort on other commercial and recreational boaters can be addressed in relation to several general security requirements: 1) a moving safety zone for inbound LNG vessels; 2) a security zone around a moored LNG vessel; and 3) other measures as deemed appropriate.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the Coast Guard may promulgate a moving safety zone that would affect other vessels. Pursuant to such a regulation, no vessel would be allowed to enter the safety zone without first obtaining permission from the Coast Guard Captain of the Port. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, it is anticipated that the LNG ships would transit about 22 miles along the MSC to the Calhoun LNG terminal. For the majority of this trip, an LNG vessel would travel at an average speed of 8 to 10 knots. Based on these assumed speeds, it would take about 2.5 hours for LNG ships to complete the trip to the LNG terminal. Additional time would be required to maneuver the LNG ship into the berth. Minimum visibility conditions would have to be satisfied before the LNG ship would be allowed to proceed inbound from the Gulf of Mexico, ensuring that the Coast Guard could adequately monitor the safety zone.

If moving safety zones, security zones at the terminal, and one-way traffic were implemented, they would affect other commercial and recreational traffic using the channel. The magnitude of the effect would also be influenced by other factors: the amount of time it takes to obtain a pilot and other competing ship traffic in the federal navigation channel.

The moving safety zones, if implemented, may have the effect of temporarily limiting the channel to one-way traffic. This presently occurs with other large vessels that can sometimes delay other vessels using the waterway. It is expected that if the proposed LNG terminal is constructed, and if the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, as many as 120 LNG ships for the Calhoun LNG terminal could potentially move in and out of the MSC and Point Comfort Channel every year. This is an increase in vessel traffic of 44 percent for large vessels per year currently transiting these waterways. Other shipping activities would be moderately affected by this increase in traffic; however, based on the relatively modest current level of shipping activity, the impact is not expected to be substantial.

The moving safety zone could cause impacts on recreational and other commercial vessels but the impacts would be temporary while the LNG vessel is in transit or moored at the unloading facility. Because the safety zone would be a moving zone around the ship, the impacts would be of short duration at any given point along the shipping route. A recreational craft attempting to travel in the opposite direction of an LNG ship traveling at 8 to 10 knots may need to wait up to

15 minutes for the LNG ship to pass before proceeding on its way. The delay would increase to up to 36 minutes when the LNG ship is traveling at 5 knots and up to 60 minutes when the LNG ship is traveling at 3 knots. For other vessels near or upstream of the facility, an additional 60-minute delay may be experienced while the LNG ship is berthed. It should be noted that the Coast Guard moving safety and moored vessel security zones would not be treated as absolute exclusion zones that would preclude all other vessel movements. Rather, other vessels may be allowed to transit through the moving safety and moored vessel security zones with the permission of the Captain of the Port.

Additionally, any moving safety zone regulation that may be promulgated by the Coast Guard would affect a moving zone around the ship, so these impacts would be temporary and of short duration at any given point along the shipping route. In addition, depending on their individual drafts, commercial and recreational vessels might be able to go around the LNG ships at points in the waterway that are sufficiently wide for them to be outside of any moving safety zone. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, to mitigate any adverse impacts of moving safety zone, the Coast Guard may routinely provide Notice to Mariners prior to the arrival and departure of LNG ships. The notification system may include broadcasts on radio frequencies used by mariners. These practices and impacts currently occur in other waterways during LNG vessel transits.

FERC has received comments on other LNG terminal proposals expressing concern about the cost of applying additional security measures and the potential burden on local taxpayers. To meet its anticipated security responsibilities the Coast Guard most likely would need to request additional resources through its internal resource reprogramming process for inclusion in future appropriations. Additional funding for state and local resources would be provided by Calhoun Point Comfort. In order to precisely determine the additional resources that would be necessary to provide the additional security to ensure safe transit of the LNG vessels, it would be necessary to develop and finalize the Coast Guard's *Liquefied Natural Gas Vessel Management and Emergency Plan*. Funding for security and management costs are discussed further in section 4.12.5 under "Emergency Response and Evacuation Planning."

While the LOR would address the suitability of the MSC and Point Comfort Channel for LNG ship transportation, it would not constitute a final authority to commence LNG operations. The Coast Guard's recommendation is subject to certain safety and security provisions to be developed in its *Liquefied Natural Gas Vessel Management and Emergency Plan*. This plan would be reviewed and updated as necessary to address issues specific to the waterway and the proposed LNG terminal. In addition, the Coast Guard may establish a safety and security zone under 33 CFR 165 for LNG vessels in transit and while docked. Only personnel or vessels authorized by the Captain of the Port would be permitted in the safety and security zone.

4.12.5.4 Environmental Impacts Associated with Coast Guard Actions

The Coast Guard's issuance of a LOR is a federal action which requires compliance with NEPA, just as the FERC's authorization for construction and operation of a LNG facility requires compliance with NEPA. Alternatives regarding these actions are discussed in section 3.

Some of the potential environmental impacts resulting from LNG vessel activities and transit would not be unique to LNG carriers and may also be addressed by previous Coast Guard NEPA

analyses for existing regulations. Per the Coast Guard NVIC 05-05, all required Coast Guard NEPA analysis and documentation must be complete prior to the issuance of any LOR.

Potential impacts on wildlife and aquatic resources are discussed in sections 4.5 and 4.6. The potential impacts that result from LNG vessels in transit would be similar to those resulting from other ships using the navigation channel. Impacts include those related to prop wash, invasive species, vessel strikes, and water withdrawal for ballast and cooling. No significant impact on wildlife or aquatic resources as a result of LNG marine traffic is expected.

LNG ships and support vessels would emit criteria pollutants, VOCs and HAPS during transit. We have identified the magnitude of these emissions in section 4.11.1.4. LNG vessel emissions while in transit and during maneuvers are considered indirect emissions and are applicable towards the general conformity determination. The emissions from the LNG ships while at berth would be included in the general conformity determination. All LNG ship and support vessel emissions while in transit would be required to conform to the Texas State Implementation Plan.

The LNG tanker would be operating in the federally approved channel en route to the terminal. We believe the use of this channel is consistent with the CZMP. Consistency with the coastal zone plans would be determined by the TGLO. As such, consistency with the CZMA is required as appropriate. We have recommended in section 4.7.5 that Calhoun Point Comfort seek a determination that the Project is consistent with the Texas CZMP.

The potential impacts associated with a release of LNG are discussed generally in the preceding and following sections. The establishment of temporary safety and security zones by the Coast Guard has been considered as a potential effect on recreational use of the waterway (see section 4.7.3). However, we do not expect these zones to have a significant effect on environmental resources.

As a linear feature, the LNG transit corridor is an assemblage of varying socioeconomic and environmental characters determined by the presence of the waterway or other adjacent features. Further, the shipping route used by the LNG vessels is not discretional. That is, the corridor was developed prior to the concept of its use for LNG traffic and alternative corridors are not available. Therefore, it is not possible to determine the vessel transit corridor based on environmental justice considerations.

The LNG vessel transit route would traverse open water from the Gulf of Mexico through the Matagorda Ship Channel. From an outer bar and jetty, the Matagorda Ship Channel extends for about 21 miles to the Point Comfort Channel and the Alcoa Industrial Channel. Aquatic and shoreline habitats adjacent to the transit route include open water, salt and brackish marshes, tidal mud or sand flats, beaches, dunes, and submerged aquatic vegetation. Wildlife supported by these habitats are described in sections 4.5 and 4.6. Figure 4.12-3 shows the locations of residential, commercial, and service areas, refuges and parks, and other environmental areas along the transit corridor.

LNG is less dense than fresh or sea water, so it floats on the surface. Immediately upon contact with any warmer substance such as water or air, it begins to evaporate. As the LNG vaporizes, a vapor cloud may form which is initially heavier than air and may be dispersed by wind. An LNG vapor cloud cannot explode in the open atmosphere, but it could burn.

Non-Internet Public

DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE CALHOUN LNG TERMINAL AND PIPELINE PROJECT

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Figure 4.12-3

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

Since LNG is a cryogenic liquid, the greatest threat to aquatic life from an LNG spill would be thermal stress. Any aquatic life (including plankton, fish, birds, sea turtles, marine mammals, and any federally-listed species) that came into direct contact with the LNG would probably experience a sudden cold shock, and, depending in what context that contact occurred, the exposure could be lethal, especially to non-motile species. Most mobile underwater organisms would detect the temperature change and avoid the area. Wildlife occupying the water's surface near the release could intercept the vapor cloud and suffer asphyxiation. However, the duration of this exposure is short, as noted below. Impacts to shoreline habitats and associated wildlife could occur, primarily, through the subsequent ignition of the LNG. The potential damage could involve the combustion of both vegetation and wildlife.

The accident scenarios evaluated in section 4.12.5.5 include release and ignition of natural gas formed by evaporation of spilled LNG. Natural gas combustion typically is not complete in spill scenarios. The products of incomplete combustion of natural gas include criteria pollutants, ozone precursors, toxic air contaminants, and soot (carbon particulates). It should be noted that LNG fires typically do not last as long as liquid petroleum fires.

The duration of an ignited accidental LNG spill detailed in section 4.12.5.5 is approximately 48 minutes. For an ignited intentional LNG spill, the duration is approximately 7 minutes. The maximum increases in ambient pollutant concentrations due to the natural gas fire would occur downwind of the LNG spill. Ambient air pollutant concentrations in downwind areas could potentially exceed short-term NAAQS and State Ambient Air Quality Standards over the duration of the fire as well as soot deposition and diminished visibility due to soot transport. Given the distance to shore from a potential fire from most of the transit route in the Matagorda Ship Channel, it is unlikely that sensitive receptors (i.e., schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences) would be exposed to substantial pollutant concentrations for a significant period. There would be no long-term effects.

The pool formed from an unignited accidental LNG spill would completely evaporate in approximately 94 minutes. For an unignited intentional LNG spill, the pool would completely evaporate in approximately 7 minutes. As natural gas is not a criteria pollutant, no air quality impact would be expected from the evaporation of the LNG spill. However, methane, the primary component of LNG, is considered a greenhouse gas and may contribute to global warming. (Coast Guard, 2005).

However, the history of LNG shipping has been free of major incidents, and none have resulted in significant quantities of LNG being released. No incidents have occurred at existing LNG terminals during the 50 years of operation that resulted in any significant quantities of cargoes being released. Historically, the events most likely to cause a significant release of LNG were ship casualties such as collisions, allisions, or groundings. Any event causing a release of LNG would have to occur with sufficient impact to breach the LNG ship's double hull and cargo tanks. During the 44,000 voyages that have been completed since the inception of LNG maritime transportation, there has not been a serious accident at sea or in a port which resulted in a spill due to rupturing of the cargo tanks. Based on the extensive operational experience of LNG shipping, the structural design of an LNG vessel, and the operational controls imposed by the Coast Guard and local pilots, the likelihood of a cargo containment failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision – is highly unlikely.

However, the possibility of an LNG spill from a ship over the duration of the proposed project must be considered.

Given that an LNG cargo spill is highly unlikely, no significant socioeconomic impact associated with an accidental LNG release along the transit route would be expected. As described below, the duration of an LNG pool fire would be of short duration, i.e., from 1 to 2.5 hours. If there is an LNG spill on the transit route, it may result in a temporary interruption in ship traffic in the navigation channel; however, traffic in the navigation channel would quickly resume normal operations and any economic impact on the maritime industry would be minimal.

If a pool fire occurred where the transit route is closer to shore, businesses within 2,200 feet of the center of a spill could be subject to a long-term loss of use. Vegetation and wooden structures subjected to greater than 3,000 Btu/ft^2-hr may ignite. However, because the hazard area surrounding an LNG cargo vessel is transient (moving with the vessel along its route) it is not possible to accurately quantify the economic impact of an incident. Section 4.12.5.4 discusses the effects of an LNG spill in greater detail.

In accordance with Section 311 of the Energy Policy Act of 2005, we recommend in section 4.12.5 that Calhoun Point Comfort develop an Emergency Response Plan in consultation with the Coast Guard and state and local agencies that includes a Cost-Sharing Plan before any final approval to begin construction. Therefore, no long-term impact relating to emergency evacuation of communities would be expected.

The December 2004 Sandia Report, discussed in section 4.12.5.4 "Deliberate Attack on an LNG Vessel," included an analysis of potential LNG cargo tank breaches due to accidental causes. The report found that accidental groundings, collisions with small vessels and low speed collisions with large vessels could cause minor ship damage but would not result in a cargo spill. This is due to the protection provided by the double hull structure, the insulation layer and the primary cargo tank of an LNG vessel. We do not believe that there would be any environmental significance attributed to these types of accidents.

High speed collisions with large vessels striking at 90 degrees were found to potentially cause cargo tank breach areas of 0.5 to 1.5 square meters. For the resulting LNG spill and pool fire on water, the report determined that the most significant impact to public safety and property would exist within about 800 feet, with minimal impact beyond 2,400 feet. Depending on the actual size of the cargo tank breach, the duration of the spill and ensuing pool fire could range from approximately 1 to 2.5 hours. Using the methodology in the ABSG study, FERC staff determined that the site-specific distance to the 1,600 Btu/ft^2-hr transient hazard area for an accidental cargo tank breach in the MSC would be approximately 2,790 feet.

However, if the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, it must also be recognized that the operational controls imposed by the Coast Guard and local pilots, such as a moving LNG vessel safety zone and one-way traffic in narrow channels, would be specifically designed to prevent the collision scenarios that could result in an LNG cargo tank breach. As a result, the likelihood of an LNG spill from accidental causes is considered to be negligible.

In the unlikely event of an LNG spill, the physical properties of LNG would limit any potential impacts. If spilled into water, the cryogenic liquid would vaporize rapidly upon contact with the warm air and water over a period of approximately 1 to 2.5 hours. Being less dense than water, LNG would float on the surface prior to vaporizing. Because LNG is not soluble in water and the LNG would completely vaporize shortly after being spilled, there would be no liquid left that could mix with and/or contaminate the water.

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 the unlikely event that ignition did not occur, an LNG spill would rapidly vaporize on water and form a potentially flammable cloud. If the flammable vapor cloud encountered an ignition source, the cloud would burn back to the spill site, rather than outward towards shoreline habitats.

Given these considerations, impacts to shoreline habitats as a result of an accidental LNG spill are unlikely to occur. A spill would be unlikely to result in significant impacts to shoreline habitats and wildlife that occur along the transit route. Hazard distances for intentional breaches are discussed in section 4.12.5.4. Although an intentional breach scenario may result in greater hazard distances, such scenarios are associated with the desire to inflict damage to major infrastructure, population and commercial centers, rather than to environmentally sensitive areas along the vessel route. Also, given the navigation controls and safety and security procedures in place to specifically prevent such accidents and intentional spill scenarios, the indirect impact associated with Coast Guard actions are not reasonably foreseeable events.

As discussed in section 4.12.5.2, if the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the Coast Guard may establish a moving safety zone, moored vessel security zone, and/or regulated navigation areas around the transiting LNG vessels and provide some level of escort as part of finalizing the *Liquefied Natural Gas Vessel Management and Emergency Plan*. The LNG vessels would also undergo safety and security inspections to ensure compliance with U.S. and international standards. In addition, the LNG facility would submit a Facility Security Plan for review and approval by the Coast Guard. However, due to uncertainty in the scope, frequency, prevailing maritime security levels, and the number of resources that would be dedicated on a recurring or episodic basis, the Coast Guard would ensure the appropriate NEPA environmental documentation for such actions is complete prior to commencement of these activities rather than in this EIS.

4.12.5.5 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 680 cargoes, with volumes ranging from 60,000 to 125,000 m^3, have been delivered into the Port of Boston without incident. During 2005, a total of 241 cargoes of LNG was imported into the United States. For 35 years, LNG shipping operations have been safely conducted in the United States. The world's LNG ship fleet currently exceeds 173 carriers.

Over the last 45 years, LNG ships have made over 44,000 voyages. Currently, all of the ships in the LNG fleet operate under a foreign flag with foreign crews. A foreign flag ship must have a

Certificate of Compliance inspection by the Coast Guard to ensure compliance with international safety standards.

History

During the 44,000 voyages that have been completed since the inception of LNG maritime transportation, there has not been a serious accident at sea or in a port which resulted in a spill due to rupturing of the cargo tanks. However, insurance records, industry sources, and public websites identify a number of incidents involving LNG vessels, including minor collisions with other vessels of all sizes, groundings, minor LNG releases during cargo unloading operations, and mechanical/equipment failures typical of large vessels. Some of the more significant LNG vessel 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.
- ***El Paso Paul Kayser*** grounded on a rock in June 1979 in the Straits of Gibraltar during a loaded voyage from Algeria to the United States. 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 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.
- ***Mostefa Ben Boulaid*** had LNG spill onto its deck during loading operations in Algeria in 2002. The spill, which is believed to have been caused by overflow rather than a mechanical failure, caused significant brittle fracturing of the steelwork. The ship was required to discharge its cargo, after which it proceeded to dock for repair.
- ***Khannur*** had a cargo tank overfill into the ship's vapor handling system on September 10, 2001 during unloading at Everett, Massachusetts. Approximately 100 gallons of LNG were vented and sprayed onto the protective decking over the cargo tank dome, resulting in several cracks. After re-inspection by the Coast Guard, the Khannur was allowed to discharge its LNG cargo.
- ***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 m^3 LNG

tanker, which had just unloaded its cargo at Barcelona, Spain, sustained only minor damage to the outer layer of its double hull but no damage to its cargo tanks.

- ***Tenaga Lima*** grounded on rocks while proceeding to open sea east of Mopko, South Korea due to strong current in November 2004. The shell plating was torn open and fractured over an approximate area of 20 feet by 80 feet, and internal breaches allowed water to enter the insulation space between the primary and secondary membranes. The ship was refloated, repaired and returned to service.
- ***Golar Freeze*** moved away from its docking berth during unloading on March 14, 2006 in Savannah, Georgia. The powered emergency release couplings on the unloading arms activated as designed and transfer operations were shut down.

Vessel Construction

In 1980, at the initial peak of LNG import activity in the U.S., the Coast Guard published the report *Liquefied Natural Gas and Liquefied Petroleum Gas – Views and Practices – Policy and Safety*. The report summarized the Coast Guard'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 on LNG carriers is a complex assembly of many layers. The relief valve capacity of 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 Coast Guard in the mid-1970s when the U.S. regulation for LNG carriers in 49 CFR 154 were being developed. LNG carriers used in U.S. waters must also be constructed in accordance with the IMO Code for the *Construction and Equipment 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 the 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 proposed 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 (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 Federal Power Commission 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 Coast Guard 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 4.12.5.4-1 for the two principal cargo systems.

TABLE 4.12.5.4-1

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 on-beam 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 nor result in release of LNG.

As discussed in section 4.12.5 under "Deliberate Attack on an LNG Vessel", the DOE released the Sandia Report in December 2004. The Sandia Report included an LNG cargo tank breach analysis using modern finite element modeling and explosive shock physics modeling to estimate

a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings, collisions with small vessels and low speed (less than 7 knots) collisions with large vessels striking at 90 degrees could cause minor ship damage but would not result in a cargo spill. This is due to the protection provided by the double hull structure, the insulation layer and the primary cargo tank of an LNG vessel. High speed (12 knots) collisions with large vessels striking at 90 degrees were found to potentially cause cargo tank breach areas of 0.5 to 1.5 square meters.

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, LA) (September 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, March 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 DOE to determine the hazards associated with reopening the Distrigas LNG import terminal 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.

Since the Quest study, 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 FERC commissioned a study by ABSG Consultants 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 on May 14, 2004. On June 18, 2004, staff's responses to comments on the consequence assessment methods were issued. In addition, the model was updated to include a lower limit on the characteristic wind speed. 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 as 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 diameter hole on the outer hull, but only minor damage to the inner hull. 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.

As discussed in section 4.12.5 under "Deliberate Attack on an LNG Vessel", the DOE released the Sandia Report in December 2004. The report included an LNG cargo tank breach analysis using modern finite element modeling and explosive shock physics modeling to estimate a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings and low speed collisions could result in minor ship damage but not a cargo spill; while high speed collisions could cause a 0.5 to 1.5 m^2 cargo tank breach area. For intentional scenarios, the size of the cargo tank hole depends on the location of

the ship and source of threat. Intentional breach areas were estimated to range from 2 to 12 m^2. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 m^2, which is a more appropriate range to use in calculating potential hazards from spills.

The Sandia Report also included guidance on risk management for intentional spills, based on the findings that the most significant impacts to public safety and property exist within approximately 500 meters (1,640 feet) of a spill due to thermal hazards from a fire, with lower public health and safety impacts beyond 1,600 meters (5,250 feet). Large, unignited LNG vapor releases were found to be unlikely, but could extend to 2,500 meters (8,200 feet) for a nominal intentional spill.

Cascading damage due to brittle fracture from exposure to cryogenic liquid or fire-induced damage to foam insulation was evaluated and, while possible under certain conditions, is not likely to involve more than two or three cargo tanks. Cascading events are not expected to increase the overall fire hazard by more than 20 to 30 percent (1,920 to 2,080 meters [6,300 to 6,825 feet]), but would increase the expected fire duration. Rapid phase transitions are possible for large spills but the effects would be localized near the spill source and should not cause extensive structural damage.

The methodology described in the ABSG Consulting study and revised in staff's responses to comments was used to calculate the thermal radiation and flammable vapor dispersion distances for several holes ranging in diameter from 1 meter to 3.9 meters. Based on the penetration of the largest cargo tank of a 140,000 m^3 LNG ship, 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 4.12.5.4-2 below. Thermal radiation calculations are based on an ambient temperature of 50°F, a relative humidity of 50 percent, and a 20-mile per hour wind speed. This analysis is based on ships larger than those which can presently transit the MSC and Point Comfort Channel. However, it provides a conservative assessment on potential spills from the 90,000 m^3 capacity ships which could navigate the channels. In addition, should the planned channel improvements be made (see section 4.12.5.1 under "Ship Traffic in the Navigation Channels"), it is anticipated more typical 140,000 m^3 ships would call on the proposed facility. Although the channel cannot currently accept any LNG ships larger than a 90,000 m^3 capacity, Calhoun proposes the future potential use of up to a 220,000 m^3 LNG ship. The limited information available regarding the design of future 220,000 m^3 LNG ships suggests that the draft of the larger ships would remain the same due to typical port draft requirements, while the length and width of the larger ships would increase. This would in effect increase the length and width of the cargo tanks, but not change the height. Therefore, there should be no change in the hydrostatic head. Preliminary information shows that the larger class ships would have five cargo tanks instead of four as on a typical 140,000 m^3 ship. For a 220,000 m^3 LNG ship, the estimated distance to the 1,600 Btu/ft^2-hr zone would be less than 5 percent farther and the fire duration would be extended by less than 39 percent when compared to the modeling results for a 140,000 m^3 LNG ship.

TABLE 4.12.5.4-2

LNG Spills on Water

LNG Release and Spread					
Hole Area	0.8 square meters	1.5 square meters	5 square meters	7 square meters	12 square meters
Hole Diameter	1.0 meter	1.4 meters	2.5 meters	3.0 meters	3.9 meters
Spill Time	94.0 minutes	48.0 minutes	15.0 minutes	10.4 minutes	6.2 minutes
Pool Fire Calculations					
Maximum Pool Radius	341 feet	476 feet	817 feet	938 feet	1,102 feet
Fire Duration	94.1 minutes	48.1 minutes	15.2 minutes	10.7 minutes	6.5 minutes
Distance to:					
1,600 BTU/ft^2-hr	2,164 feet	2,790 feet	4,182 feet	4,652 feet	5,250 feet
3,000 BTU/ft^2-hr	1,690 feet	2,169 feet	3,232 feet	3,591 feet	4,047 feet
10,000 BTU/ft^2-hr	1,031 feet	1,312 feet	1,934 feet	2,143 feet	2,409 feet

Although Calhoun would design the terminal and unloading berth for LNG ships with capacities up to 220,000 m^3, detailed dimensions of these future ships and the associated cargo tanks is unavailable. FERC staff was required to make assumptions in order to analyze the LNG spills on water from these larger ships. Therefore, in order to allow the Coast Guard to determine the continued suitability of the waterway for LNG marine traffic, **we recommend that**:

- **Prior to accepting ships greater than 140,000 m^3 in capacity, Calhoun Point Comfort should provide the necessary information to demonstrate that the transient hazard areas identified in the EIS are applicable. Calhoun should file this information with the Secretary for review and written approval of the Director of OEP. This information should also be provided to the Coast Guard.**

Flammable vapor dispersion calculations were based on an ambient temperature of 70ºF, 50 percent relative humidity, a 4.5-mph 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 9,776 feet to the LFL and 14,377 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 vapor cloud could achieve its maximum distance over land surfaces without encountering an ignition source, and subsequently burning back to the source. Flammable vapor dispersion for larger holes 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.

Large portions of the MSC and Point Comfort Channel have no development or communities adjacent to the channel. The closest would be Port O'Connor, which is located within approximately 1 mile of the transit route. However, Port O'Connor would be outside of the longest distance for a thermal radiation of 1,600 BTU/ft^2-hr. Assuming an LNG vessel transit through the channel at 8.0 knots, areas adjacent to the channel would be exposed to a potential transient hazard of approximately 12 minutes. In addition, a temporary hazard would exist around the ship berth during part of the 24-hour period while the LNG vessel is at the dock and unloading cargo.

The operational restrictions that would be imposed by the Pilots on LNG vessel movements through the channels, as well as requirements that the Coast Guard would impose in its *Liquefied Natural Gas Vessel Management and Emergency Plan*, would minimize the possibility of a hazardous event occurring along the vessel transit.

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 Matagorda Ship and Point Comfort Channels, as well as in establishing potential impact areas for emergency response and evacuation planning.

4.12.5.6 Conclusions on Marine Safety

The operational safety of LNG ships is under the jurisdiction of the Coast Guard. 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 Coast Guard and the Pilots would minimize the potential for a hazardous event occurring in the Matagorda Bay area and affecting the safety of the nearby public.

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 United States. The FERC continues to coordinate with these agencies, specifically with the Coast Guard to address this issue. The Coast Guard 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 Coast Guard 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 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 DOT conducts subsequent on-site reviews of the security procedures.

On October 22, 2003, the Coast Guard 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 Coast Guard 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, all terminal owners or operators subject to 33 CFR 105 were required to submit a *Facility Security Assessment and Facility Security Plan* to the Coast Guard Captain of the Port for review and approval. The Facility Security Plans were 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:

- designating a FSO with a general knowledge of current security threats and patterns, risk assessment methodology, and the responsibility for implementing the Facility Security Plan and Assessment and performing an annual audit for the life of the project;
- conducting a Facility Security Assessment to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures;
- developing 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;

- implementing 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;
- conducting security exercises at least once each calendar year and drills at least every three 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 United States. 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 LNG import 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 from 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 Title 49, U.S.C. Chapter 601. The Pipeline and Hazardous Materials Safety Administration (PHMSA), 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. PHMSA 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 Parts 190-199 of Title 49 of the CFR. Part 192 of 49 CFR 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 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 Calhoun 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. 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. 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 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. About 25.8 miles of proposed pipeline route would be located in Class 1 areas and the remaining 1.3 miles would be in a Class 3 area. No portions of the proposed route would be located in Class 2 or 4 areas. In addition, all pipeline interconnects, and pipeline facilities within the fenced enclosures of the meter stations, launcher and receiver, and MLVs would be designed and constructed to meet Class 3 requirements.

If a subsequent increase in population density adjacent to the right-of-way indicates a change in class location above existing design for the pipeline, Calhoun Point Comfort would reduce the maximum allowable operating pressure or replace the segment with pipe of sufficient grade and wall thickness, if required to comply with the DOT code of regulations for the new class location.

In 2002, Congress recently passed an act to strengthen the Nation's 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. Since December 17, 2004, gas transmission operators are required to develop and follow a written integrity management program that contains all the elements described in Section 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 Section 192.903 of the DOT regulations.

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 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 of 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[10] is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle;[11] or
- any area in Class 1 or 2 where the potential impact circle includes an identified site.[12]

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 the HCAs. The DOT regulations specify the requirements for the integrity management plan at Section 192.911. The HCAs have been determined based on the relationship of the pipeline centerline to other nearby structures and identified sites. Of the 27.1 miles of proposed pipeline route, Calhoun Point Comfort has identified approximately 2.9 miles that would be classified as a HCA. The pipeline integrity management rule for HCAs requires inspection of the entire pipeline in HCAs every seven 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 staff would be assigned to operate and maintain the natural gas pipeline. The 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 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

[10] The potential impact radius is calculated as the product of 0.69 and the square root of the maximum allowable operating pressure of the pipeline in psi multiplied by the pipeline diameter in inches.

[11] The potential impact circle is a circle of radius equal to the potential impact radius.

[12] 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 five 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.

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.

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;
- 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. Calhoun Point Comfort 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 2005, 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.[13]

TABLE 4.12.7-1

Natural Gas Service Incidents by Cause

Cause	Incidents per 1,000 Miles of Pipeline (percentage)	
	1970-1984	**1986-2005**
Outside Force	0.70 (53.8)	0.10 (38.5)
Corrosion	0.22 (16.9)	0.06 (23.1)
Construction or Material Defect	0.27 (20.8)	0.04 (15.4)
Other	0.11 (8.5)	0.06 (23.1)
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 2005 data (as shown on table 4.12.7-1) show that the portion of incidents caused by outside forces has decreased to 38.5 percent.

[13] 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 pipelines included in the data set in table 4.12.7-2 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.

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 2005. 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 2005 decreased to 3.6 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 2.8 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
1984-2005 c/	-	-	3.6
1984-2005 c/	-	-	2.8 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 seven 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 301,000 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 Calhoun LNG Project might result in a public fatality every 3,690 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
Poisoning	9,510
Fires and Burns	3,791
Drowning	3,488
Suffocation by Ingested Object	3,206
Tornado, Flood, Earthquake, etc. (1984-93 average)	181
All Liquid and Gas Pipelines (1986-2003 average) b/	22
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

The CEQ defines cumulative impacts as the "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." Although the individual impact of each individual project may be minor, the additive or synergistic impacts from multiple projects could be significant. Impacts subject to cumulative effects analysis for the Calhoun LNG Project were identified by determining the environmental impact issues associated with the proposed action, establishing the geographic scope of the study area, establishing the timeframe of the analysis, and identifying other past, present, or future actions that have affected, or could affect, the resources of concern.

For this analysis, we looked at potential impacts from known projects existing or proposed along the Matagorda Ship Channel, within Lavaca Bay, and adjacent to the Port. Existing environmental conditions in the project area reflect changes based on past activities. In 1931, the causeway over Lavaca Bay was constructed and linked the area to the south Texas highway system. Natural gas and oil was discovered near Port Lavaca during the mid-1930s and private farming became commercialized during the 1950s. Alcoa opened its Point Comfort Operations in 1947. Other major industries in the project area included Hartzog Shipyard, U.S. Cold Storage Company, and fishing and shrimping. By 1958, Calhoun County had 11 manufacturers and 77 mineral related enterprises. In 1963, the Port of Port Lavaca-Point Comfort was designated a U.S. customs port of entry and in 1965 the Matagorda Ship Channel was completed to Point Comfort. During the 1960s and 1970s, National Starch (a manufacturer of vinyl acetate) began operation, Witco manufactured pitch oil at its plant in Point Comfort, and Vistron Corporation was in operation. The Formosa Plastics Corporation of Taiwan established a petrochemical factory at Point Comfort in 1988.

Existing conditions in much of the general project area, particularly along the pipeline route, consists of flat agricultural and range land. The area in the immediate vicinity of the proposed LNG terminal, and along the Point Comfort Channel, has been developed for industrial activities. As such, the coastal marsh and subtidal habitats in Lavaca Bay have been disturbed by previous industrial development.

Construction of the Calhoun LNG Project would result in both short- and long-term, minor to moderate environmental impacts. Impacts associated with construction of the pipelines generally are short-term and minor because resources in the project area that would be affected during construction can generally be restored or allowed to revegetate back to their original condition following pipeline installation. Some long-term impacts occur, however, when resources cannot be restored back to original conditions (*e.g.*, cleared forest lands), or when resources are permanently affected due to operational and maintenance requirements (*e.g.*, development of the proposed LNG terminal facilities and maintenance requirements along the proposed pipeline rights-of-way).

The environmental impact analysis contained in this draft EIS indicates that pipeline construction and operation activities for the Calhoun LNG Project would result in short-term and minor impacts associated primarily with construction across waterbodies and wetlands, fish and other wildlife habitats, recreation, socioeconomics, transportation, and noise. Long-term impacts associated with construction of the LNG terminal and pipeline-related aboveground facilities are considered more significant and may include both the temporary and permanent clearing of vegetation and maintenance of the permanent pipeline rights-of-way. Although these types of impacts were not considered significant for the Calhoun LNG Project, they were considered on a cumulative impact basis in association with the review of other LNG terminal and pipeline projects proposed or approved for the area. Environmental resources such as geology, soils, and cultural would not be measurably affected by the proposed Project, and therefore, have not been considered in this cumulative effects analysis.

Table 4.13-1 provides a list of activities and projects considered in our cumulative impact analysis. Projects included in our analysis are those known or reasonably foreseeable future projects with potential impacts to the same resources for which some effect has been evaluated for the Calhoun LNG Project. Following is a brief description of the Matagorda Ship Channel Deepening and Widening Project, Indianola Beach Restoration Project, Formosa Plastics Power Plant Project, and E.S. Joslin Power Plant Project, in addition to the Calhoun LNG Project, that are included in our analysis.

Table 4.13-2 depicts the resources that would be affected by construction and operation of the projects identified in table 4.13-1. Construction schedules of the future projects depend on factors such as economics, funding, and politics, but all are expected, if approved for development, to be constructed in the same general timeframe associated with the Calhoun LNG Project. Projects and activities included in this analysis are generally those of comparable magnitude and nature of impact with the proposed action, and are located within the same vicinity as the proposed Project.

TABLE 4.13-1

Existing, Approved, or Proposed Activities/Projects that Could Contribute to Cumulative Impacts Associated with Construction of the Calhoun LNG Project

Activity/Project	Description	Timeframe
Manufacturing/Refining	Manufacturing, storage, and transportation of petroleum and chemical products.	Ongoing
Dredging	Maintenance dredging of the Matagorda Ship Channel and Lavaca Bay.	Periodic
Recreation	Fishing, boating, and bird watching.	Ongoing
Shipping	Commercial traffic on the Matagorda Ship Channel and through the Port of Port Lavaca-Point Comfort.	Ongoing
Matagorda Ship Channel Deepening and Widening Project	Deepen the 22-mile-long ship channel from 36 feet to 45 feet and widen from 200 feet to 350 or 400 feet.	By 2015
Indianola Beach Restoration Project	Construct a shoreline stabilization project to protect State Route 316, the La Salle Historic Landmark, and marshes west of the road along the Indianola-Magnolia Beach shoreline.	Undetermined
Formosa Plastics Power Plant Project	Construct and operate two circulating fluidized bed steam electric generating units capable of producing up to 300 megawatts of electricity.	2006-2009
E.S. Joslin Power Plant Project	Repower and upgrade the existing turbine from 261 to 303 megawatts.	2006-2009

Matagorda Ship Channel Deepening and Widening Project

On August 16, 2004, the Galveston District of the COE issued a *Notice of Studies and Initial Public Scoping Meeting for Matagorda Ship Channel, Texas Feasibility Study* (Matagorda Project). The study would analyze and evaluate alternatives to reconfigure the Matagorda Ship Channel jetties to improve navigation safety, deepen and widen the 22-mile-long ship channel (including the Point Comfort Channel) to improve navigational efficiency and safety, and perform environmental restoration through the beneficial use of dredged material. The project would result in the dredging of about 20 to 30 mcy of material. The CCND is the non-federal sponsor for the project. The alternatives that would be evaluated in the feasibility study include:

- deepening the Matagorda Ship Channel from the currently authorized depth of 36 feet to between 36 feet and 45 feet;
- widening the Matagorda Ship Channel from its current 200-foot width to 350 feet or 400 feet; and
- improving the jetties by widening the entrance between North and South Jetties, widening the South Jetty, or widening and flanging the North and South Jetties.

TABLE 4.13-2

Resources of Concern that Could be Impacted by Construction or Development of Existing, Approved, or Proposed Activities in the Vicinity of the Calhoun LNG Project

Project	Primary Environmental Impact								
	Water Resources	Wetlands	Wildlife/ Vegetation	Aquatic Resources	Land Use and Recreation	Socio-economics	Land Transportation	Marine Transportation	Air and Noise Quality
Manufacturing/Refining	X	X	X	X	X	X	X	X	X
Dredging	X	X	X	X	X			X	X
Recreation	X		X	X	X	X	X		
Shipping	X			X				X	X
Matagorda Ship Channel Deepening and Widening	X	X	X	X	X			X	X
Indianola Beach Restoration	X			X	X				
Formosa Plastics Power Plant	X	X		X	X			X	X
E.S. Joslin Power Plant									X

Indianola Beach Restoration Project

On September 19, 2005, the Galveston District of the COE issued a *Public Notice* for the Indianola Beach Restoration Project, Permit Application No. 22787-01 (Indianola Project). The project would be located along the Indianola-Magnolia Beach shoreline along the west shore of Matagorda Bay. The CCND proposes to construct a shoreline stabilization project to protect State Route 316, the La Salle Historic Landmark, and marshes west of State Route 316. The CCND has constructed Phase I of the project and is proposing to extend the project in Phase II.

Due to funding considerations, two separate methods are being considered for this project: Method 1 includes placing sand along the shoreline between a series of rock groins which would use about 35,000 cubic yards of sand and 6,050 cubic yards of rock. This method would involve filling 10.3 acres of beach area and 1.8 acres of rock groins for a total impact of about 12.1 acres. Method 2 includes placing sand along the shoreline between a series of rock groins for a portion of the project, and using an articulated-concrete-mattress revetment system. The articulated-concrete-mattress-revetment system would be about 5,610 square yards (yds^2) in size, including about 1,980 yds^2 underwater. This method would involve filling about 9.0 acres, including 7 acres of beach area, 1.5 acres of rock groins, and 0.5 acres for the articulated-concrete-mattress-revetment system. The SHPO believes that no impact to historic properties would occur and preliminary indications are that no known threatened and/or endangered species or their critical habitat would be affected by the project. The COE's initial determination is that the proposed action would not have a substantial adverse impact on EFH or federally-managed fisheries in the Gulf of Mexico; however, a final determination regarding the need for mitigation measures is subject to review by and coordination with the NOAA Fisheries.

Formosa Plastics Power Plant Project

Formosa Plastics Corporation would construct and operate a generating facility at a leased site near the Point Comfort Turning Basin in Point Comfort, Texas. The generating facility would consist of two circulating fluidized bed steam electric generating units capable of producing up to 300 megawatts of electricity. Pulverized low sulfur, sub-bituminous coal and petroleum coke would be the primary fuels. Natural gas would be used to start up the generating units. In addition to installation of the generating units, a rotary railcar dumping facility, ship/barge unloading facility, fuel and limestone conveyors, feeders, crushers, storage buildings and silos, fly and bottom ash handling equipment, cooling towers, and water treatment storage tanks would be installed at the site. The project would be a Major Stationary source and trigger requirements for a PSD permit for NO_x, SO_2, PM_{10}, VOC, CO, sulfuric acid, and fluorides.

E.S. Joslin Power Plant Project

The CCND would repower and upgrade existing turbines at the E.S. Joslin Power Plant in Point Comfort, Texas from 261 to 303 megawatts. The existing natural gas fired boiler would be replaced with a petroleum coke boiler which would use a circulating fluidized bed capable of obtaining lower emission levels of NO_x, SO_2, and mercury. A limestone and coal unloading area and transfer, storage, and handling facilities would also be installed at the power plant site. Natural gas would continue to be used for start ups and during maintenance of solids handling equipment.

4.13.1 Water Resources

The proposed Calhoun LNG Project would involve the dredging of the CCND's new turning basin and Calhoun Point Comfort's ship berth in Lavaca Bay and along the Point Comfort Channel. In addition, the construction of the proposed pipeline would require the crossing of 65 waterbodies.

Cumulative effects on marine water resources could occur from the proposed Calhoun LNG Project, Matagorda Project, and the Indianola Project. The Matagorda Project would involve dredging to expand or maintain the channel(s); about 20 to 30 mcy of material would be dredged from the channel. Increased turbidity and sedimentation from initial dredging during the construction of new channels, the CCND's new turning basins, and Calhoun Point Comforts ship berth, in addition to future maintenance dredging, would temporarily decrease water quality in the immediate vicinity of each project. If dredging associated with the Calhoun LNG Project were to occur concurrently with the Matagorda Project, the reduction in water quality could be exacerbated. However, the negative effects of dredging in and adjacent to the existing Matagorda Ship and Point Comfort Channels would be temporary, and water quality would be expected to return to ambient conditions soon after completion of activities.

4.13.2 Wetlands and Submerged Aquatic Vegetation

In total, the Calhoun LNG Project, Matagorda Project, and Indianola Project would permanently impact tidal flats and salt marsh, submerged aquatic vegetation, and freshwater wetlands. Each of the project proponents would be required by the terms and conditions of their respective Section 404 permits to provide compensatory mitigation for unavoidable wetland impacts. Calhoun LNG and the proponents for the other projects would mitigate the loss of wetlands as required by the COE's Section 404 permit requirements that would ultimately be needed for the projects to proceed. The construction and operation of the proposed Project, along with the other potential projects and activities, could result in a cumulative reduction in the amount of wetlands in the vicinity of the Project. However, mitigation for wetlands affected by the proposed Project and the other projects listed would be required by the COE and could result in a net increase and/or improvement in the regional coastal marsh resource. Dredged material placement for these projects could, in fact, result in the creation of shallow emergent wetlands in the Lavaca Bay area.

As discussed in section 4.4.1, impacts from the pipeline on wetlands would generally be temporary, and none of the wetlands would be permanently drained or filled for operation of the Project.

4.13.3 Vegetation and Wildlife

When projects are constructed at or near the same time, the combination of construction activities could have a cumulative impact on vegetation, wildlife, and aquatic organisms living in the immediate area. Clearing and grading and other construction activities associated with the project, along with other area construction projects, would result in the removal of vegetation, alteration of wildlife habitat, displacement of wildlife, and other secondary effects such as increased population stress, predation, forest fragmentation, and establishment of invasive plant species.

The construction of multiple large industrial projects at or near the same time can result in a significant amount of land clearing activities that could have a cumulative impact on forest resources in the immediate area of the projects. However, the site proposed for Calhoun Point Comfort's LNG terminal and the Formosa Plastics and E.S. Joslin power projects are devoid of large stands of trees. Calhoun Point Comfort's LNG terminal would affect 73 acres of terrestrial habitat identified as disturbed, undeveloped, manmade industrial. The Formosa Plastics and E.S. Joslin power projects would be constructed on existing industrial land. For the small amounts of native upland vegetation that would be lost by the combined construction of these projects, similar habitats are widely distributed nearby. During construction activities, mobile species would be able to relocate to adjacent habitat and then reoccupy open project lands after they have been restored. Therefore, we believe cumulative impacts on terrestrial wildlife would be short-term and not significant.

4.13.4 Aquatic Resources

The Calhoun LNG Project, Matagorda Project, and the Indianola Project would impact shallow bottom habitat, Gulf of Mexico bottom habitat, and submerged aquatic vegetation. Nearly all of this area would be affected by dredging proposed to deepen and widen the Matagorda Ship Channel, the CCND's new turning basin, and Calhoun Point Comfort's ship berth. 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).

Designated EFH would also be affected by the Calhoun LNG, Matagorda, and Indianola Projects. Of the total potential acreage of impacted EFH, by far the largest contributor to the loss is the Matagorda Project. However, the beneficial utilization of dredge material to create wetlands may convert existing unvegetated shallow water habitat to intertidal wetlands. Creation of shallow marsh habitat could provide vital nursery habitat for early life stage development and production of shrimp and estuarine fisheries in the area. Impact on EFH as a whole would be 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.

4.13.5 Land Use, Recreation, and Visual Resources

The Calhoun LNG Project would incrementally add to the cumulative impact on land uses in the Project area. The majority of this additional impact would be permanent; however, the proposed LNG terminal site would be on manmade industrial land and the Formosa Plastics and E.S. Joslin power projects would be constructed on existing industrial land. The DMPAs that would be used by the Calhoun LNG Project are within Lavaca Bay and Cox Bay and include: Dredge Island Expansion North, Dredge Island Expansion South, Dredge Island Marsh, Enhanced Recovery Project Area, and Central Cox Bay Marsh and Shoreline Protection Area (see figure 2.4-2). Along the proposed pipeline route, most land uses would be allowed to revert to prior uses following construction. Some land uses would be restricted or prohibited on the new permanent pipeline rights-of-way, such as construction of aboveground structures.

With the exception of the Matagorda and Indianola Projects, the projects would have some visual impact on the immediate surroundings. For the pipeline, the construction work areas would be restored, as near as possible, to pre-construction contours and revegetated. Once revegetation is complete, there would be no significant cumulative alteration of the landscape in the region. Cumulatively, the projects in the area would be consistent with ongoing industrial activities and existing facilities along the Matagorda Ship and Point Comfort Channels, and would not significantly alter the visual landscape of the area.

Fishing, boating, and bird watching activities occur within, and from the shores of, Lavaca Bay. The proposed projects could have cumulative negative affects on recreational activities associated with boating and fishing, primarily during the period of active construction and dredging. Dredging causes temporary turbidity that may have short-term impacts on local fisheries; however, proposed dredging projects would benefit recreational boating by improving channel configurations. The potential increase of 120 LNG ships per year from the proposed LNG Terminal Project could also have an impact on recreational boating. However, most small crafts would use the Matagorda Ship Channel and a ship channel from Chocolate Bay, and would not use the Point Comfort Channel where the majority of the LNG ship traffic would be concentrated. The Calhoun LNG Project, Formosa Plastics Power Plant Project, and E.S. Joslin Power Plant Project are all located on lands dedicated to industrial uses and are not near beaches, parks, or other developed recreational facilities. The activities associated with the Indianola Project would enhance the beach area. Therefore, we do not believe that the projects would have a cumulative impact on recreation.

If Calhoun LNG Project, Matagorda Project, and the Indianola Project were constructed, dredging could total up to 33.5 million cubic yards. Yearly maintenance dredging for the projects would vary and could result in a shortage of viable DMPAs over the life of these projects and may result in the need to create new DMPAs.

4.13.6 Socioeconomics

Combined, the projects listed on table 4.13-1 would generate temporary construction jobs. Many of these workers would reside locally. The influx of non-local laborers could represent an increase in the percent for the total population of Calhoun and Jackson Counties (assuming half the construction workers are non-local). The potentially vacant or rental units available in the two counties would offer enough housing for non-local workers. Likewise, the counties have the necessary infrastructure to provide public services and utilities 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. Taxes generated from operation of the Calhoun LNG Project, Formosa Plastics Power Plant Project, and E.S. Joslin Power Plant Project would provide an overall increase annually. Permanent employment would also increase as a result of the operation of these projects, with the cumulative benefit of potentially lowering local unemployment rates.

4.13.7 Transportation

4.13.7.1 Land Transportation

Combined, the Calhoun LNG Project, Formosa Plastics Power Plant Project, and E.S. Joslin Power Plant Project would increase daily vehicle trips during peak construction periods. If all three projects were to be constructed at the same time, traffic would increase on FM 1593 and State Route 35. However, exact coincidence of the timing of all projects is unlikely and could be mitigated by staggering shift startup across the construction sites to minimize traffic congestion and reduce potential cumulative impacts to a level that is not significant. In addition, operation of these projects would result in an increase in daily vehicle trips entering and exiting the terminal and plant sites. Potential cumulative impacts on transportation systems are expected to be temporary and short-term.

4.13.7.2 Marine Transportation

In addition to the Calhoun LNG Project, estimates of potential increased traffic by large ships are available for facilities at the CCND's Port. Based on available information, the planned or proposed projects along the Matagorda Ship and Point Comfort Channels would result in an increased number of ship calls per year to these channels. During fiscal year 2004, about 1,230 deep-draft vessels and inland barges utilized the Matagorda Ship Channel. This resulted in about 103 vessel and barge trips per month. During fiscal year 2005, there was a slight decrease in vessel and barge traffic along the Matagorda Ship Channel, about 1,180 deep-draft vessels and inland barges utilized the channel during this period for an average of about 99 vessels and barges trips per month. Calhoun Point Comport reported that, according to the CCND, the Port is operating a 50 percent occupancy rate. Calhoun Point Comfort's LNG terminal would have the capacity to unload up to 120 LNG ships per year, or up to 12 ships per month. This would represent a 10 percent increase in ship traffic along the Matagorda Ship Channel and at the Port.

During the 35 month construction period for the terminal, Calhoun Point Comfort estimates that about 293 barges would supply construction material and equipment to the site thereby, resulting in an increase of about 9 barge trips per month. In addition, one dredging barge would be at the turning basin and ship berth site during the last 6 months of construction. With the traffic management and mitigation measures discussed in section 4.12.5.2, construction of the LNG terminal and the operation of LNG ships should have a similar impact as other large vessels, and should cause no more disruption than the vessel traffic increases planned by other channel users.

4.13.8 Air Quality and Noise

Construction of the proposed projects would involve the use of heavy equipment that produces noise, air contaminants, and dust. Operation of the projects and some of the reasonably foreseeable projects would also contribute cumulatively to ongoing air emissions. As shown in table 4.13.8-1 operation of the Calhoun LNG terminal would account for a small percentage of the proposed new project emissions.

Each of the individual projects would need to apply to the TCEQ for an air quality permit, which may require controls to limit the emission of certain criteria pollutants or hazardous air pollutants.

TABLE 4.13.8-1

Estimated Yearly Emissions from Operations of the Calhoun LNG, Formosa Plastics, and E.S. Joslin Power Projects (tons)

Projects	NO_2	CO	SO_2	PM_{10}	VOC
Sources					
Calhoun LNG Terminal	147.90	117.24	2.43	27.12	27.15
Formosa Plastics Power Project	920.00	1,972.00	1,084.00	476.00	68.00
E.S. Joslin Power Project	448.00	1,741.00	902.00	174.00	70.00
Total New Projects	**1,515.90**	**3,830.24**	**1,988.43**	**677.12**	**165.15**
Percent Total of Calhoun LNG Terminal	***9.8***	***3.1***	***0.1***	***4.0***	***16.4***

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, nesting birds and other wildlife in the area. Noise impacts during the construction phase would be localized and would attenuate quickly as the distance from the noise source increases. These impacts would be temporary and would only occur during construction of the projects. Therefore, cumulative noise impacts associated with construction of all of the projects are not anticipated to be significant, even in the unlikely event that multiple projects occur at the same time and in the same location.

4.13.9 Reliability and Safety

Impacts on reliability and public safety would be mitigated through the implementation of applicable federal, state, and local rules and regulations for each individual project. The specific rules and regulations that apply to each individual project would ensure that the applicable design standards are implemented to protect the public and to prevent accidents and failures. The LNG terminal facilities would be sited, designed, constructed, operated, and maintained in compliance with the federal safety standards summarized in table 2.8.1-1. The pipelines and aboveground facilities associated with the Calhoun LNG Terminal and Pipeline Project would be designed, constructed, operated, and maintained in accordance with DOT Minimum Federal Safety Standards in Title 49 CFR Part 192.

Several of the present or reasonably foreseeable future projects, including the proposed project, would involve cargo terminals that could be expected to ship hazardous materials. Accidents involving such materials represent a potential impact on public safety. Continued growth in international commerce is likely to result in increased quantities of hazardous materials being shipped to and from the region.

It is difficult to evaluate the cumulative risk that such growth represents or has represented. In addition, it is difficult to measure the cumulative risk for an intentional attack on the Port of Port Lavaca – Point Comfort or the LNG facility. The addition of the LNG facility and its associated LNG ships would not significantly change the risk of an intentional attack in the Matagorda Ship and Point Comfort Channels. It is reasonable to assume that the rate of ship accidents (including those involving the release of hazardous materials) is likely to rise with more vessel traffic, which could cumulatively increase the risk of an accident having an impact on public safety. As discussed in section 4.12.5, the Matagorda Bay Pilots manage vessel traffic to ensure safe transit

in the Matagorda Ship and Point Comfort Channels. The Coast Guard would also enforce a moving safety zone and moored vessel security zone around LNG ships. These and other operational controls by the Coast Guard and Matagorda Bay Pilots would minimize the risk of accidents involving LNG ships. Furthermore, the implementation of federal, state, and local rules and regulations concerning security and the results of the WSA with its associated operations and Emergency Response Plan would minimize the risk to the LNG ship and terminal.

Emergency response time is a key aspect of public health and safety. No significant cumulative impacts on emergency services are expected because sufficient emergency services and facilities exist in the area to accommodate the cumulative projects. No significant cumulative impacts on emergency services are expected during operation of the proposed project. Section 4.12.5 includes our recommendation that Calhoun Point Comfort prepare an Emergency Response Plan and coordinate procedures with local emergency planning group's fire departments, state and local law enforcement, the Coast Guard, and other appropriate federal agencies to be used in the event of an incident. Calhoun Point Comfort would be required to prepare a comprehensive plan that identifies the cost sharing mechanisms for funding these emergency response costs. With the implementation of the coordination procedures in the Emergency Response Plan and the funding of additional emergency management equipment and personnel, no cumulative impacts would be expected on emergency response services during operation of the proposed project.

4.13.9.1 Conclusions about Cumulative Impacts

A determination of significance for the cumulative impacts for a specific resource is problematic because well-defined threshold values are typically undetermined. However, the majority of cumulative impacts we have identified for the proposed Calhoun LNG Project would be temporary and minor. Consequently, their addition to other reasonably foreseeable impacts in the region does not result in an overall permanent increase of impacts.

The permanent conversion of woodlands and scrub/shrub communities to an herbaceous community along the proposed pipeline route in combination with other past, present, or reasonably foreseeable future projects, could potentially fragment some wildlife habitat. Additionally, the Calhoun LNG Project would contribute to increased ship traffic along the ship channels of Lavaca Bay.

Although the Calhoun LNG and Matagorda Projects would result in the degradation of some wetland habitats, compensatory mitigation programs for each of these projects would be designed to provide a net benefit to the ecosystem. As many of the Project stakeholders have commented on, the Calhoun LNG Project would cumulatively benefit the local economy through job creation and wages, purchases of goods and materials, tax revenues, and by providing a new source of competitively priced natural gas.