4.0 ENVIRONMENTAL ANALYSIS

The environmental consequences of constructing and operating the proposed Casotte Landing Project, including impacts from the operation of LNG marine traffic in the waterway from the territorial seas to the berthing areas at the facility, would vary in duration and significance. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impacts generally occur during construction with the resource returning to preconstruction conditions almost immediately afterward. Short-term impacts would continue for up to three years following construction. Impacts were considered long term if the resource would require more than three years to recover. A permanent impact would 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 impacts, and proposed mitigation for each resource. Bayou Casotte Energy, as part of its proposal, agreed to implement certain measures to reduce impacts. We evaluated Bayou Casotte Energy's proposed mitigation to determine whether additional measures are necessary to reduce impacts. 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 Bayou Casotte Energy.

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

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

4.1 GEOLOGY

4.1.1 Geologic Setting

The proposed Casotte Landing Project is located on Bayou Casotte within the East Gulf Coast Plain Physiographic Region, specifically the Coastal Zone, which is a low-lying 5 to 30-mile wide region of slight relief. The topography is gently undulating to flat, with elevations below 50 feet in most areas. The Coastal Zone is composed of several active, natural systems that include fluvial-deltaic and bay-estuary-lagoon depositional environments. Similar coastal systems have existed in the past, as indicated by older sedimentary deposits. The positions of the various coastal processes and resulting sedimentary deposits have shifted over time due to transgressive and regressive events that have occurred since the Jurassic Period. Vegetated and stabilized sand ridges of former beach dunes are occasionally found near the coast, with a height between 10 and 15 feet.

The gulf coastal plain is characterized by thick sequences of unconsolidated to semi-consolidated Cenozoic sediments several hundred feet thick. At a given temporal horizon, these sediments of sand, silt, and clay represent depositional environments ranging from nonmarine in outcrop areas away from the coast to marine towards the coast. The gulf coastal plain began developing in the middle Jurassic Period during a major transgression. Transgressive and regressive events occurred throughout the Cretaceous period, at which time carbonate and salt layers were deposited. During the late Cretaceous and early

Tertiary Periods, large volumes of siliciclastic sediment from the west was deposited in the gulf coastal plain, with the place of deposition moving from the Mississippi Embayment south to the Gulf Coast Basin over time. Salt domes began forming in the Tertiary Period and ceased forming during the Oligocene Epoch in the Quaternary Period.

Two different types of surficial soil deposited during the Holocene Epoch are present at the Project site: fill and surficial sand. The fill is generally present to depths of 6 feet below ground surface (bgs) and consists of gray to light brown, loose to very dense, dry to moist, clayey sand with gravel and shell fragments (URS 2005). The surficial sand contains interbedded silts and clays and is present to depths of 12 feet bgs. The surficial sand is well to poorly graded, fine grained, and has an in-situ moisture content of 21 percent. The median value of silt and clay is 27 percent. Underlying the surficial soil is the Holocene-aged upper clay unit. The upper clay unit is generally present from 12 to 42 feet bgs. The upper clay unit is soft to very soft, dark gray to green, moist to wet, high plasticity clay with traces of fine sand, shell, and wood fragments (URS 2005). The median in-situ moisture content is 54 percent and the median sand content is 5 percent. This unit is a partially confining aquifer.

Underlying the upper clay unit is the interbedded sandy clay to clayey sand unit of the Pleistocene-aged Terrace Deposit. This unit is generally present between 42 and 49 feet bgs. This unit is a confined aquifer with an average gradient of 0.002 feet/feet (ft/ft) to the northwest toward Bayou Casotte. The lower clay layer of the Pleistocene-aged Terrace Deposit is found between 49 and 107 feet bgs. The lower clay layer has a median sand content of 3 percent and a median in-situ moisture content of 57 percent. From 107 to 120 feet bgs is a layer of interbedded sands and clays underlying the Terrace Deposit in the Citronelle Formation, which dates from the Pliocene-Pleistocene Epochs of the Quaternary Period. The Citronelle Formation is a dense sand present from approximately 120 to 240 feet bgs. Underlying the Citronelle Formation is the Graham Ferry, a stiff clay layer that dates from the Miocene Epoch, found from 240 feet bgs to a depth of over 600 feet bgs.

The existing topography at the 259.4-acre LNG terminal site would be permanently changed by the excavation and dredging of an unloading slip for the marine terminal. The unloading slip, situated along Bayou Casotte, would be 900 feet wide by 1,450 to 2,150 feet long and 42 feet below MLLW. Additional land modification at the proposed LNG terminal site would include grading the remainder of the site to a finished elevation of approximately 11 feet NGVD and building an earthen hurricane levee 14 feet above grade around the LNG storage tanks. Topographic contours would also change at locations where materials dredged from the unloading slip are disposed. Details of these modifications, including volumes of material to be excavated and dredged, are discussed in Section 2.4.

Construction and operation of the proposed pipeline interconnects would not materially alter the geologic or natural topographic conditions in the pipeline interconnection Project areas. The natural topographic slope and contours would be temporarily altered along much of the pipeline route by grading and trenching activities. However, Bayou Casotte Energy would restore topographic contours and drainage conditions to the extent practicable to preconstruction conditions following installation of the pipeline interconnects, except at those locations where permanent changes in drainage would be required to prevent erosion, scour, and possible exposure of the pipeline interconnection.

4.1.2 Mineral Resources

Primary mineral resources that have been developed in Mississippi are sand and gravel, crushed stone, and portland cement for construction uses and petroleum.

An analysis of aerial photographs and topographic maps indicates that no sand or gravel mining operations are found near the proposed Project site. The only coal mine in Mississippi is located near the

middle of the state; therefore, the proposed terminal and pipeline interconnects are not expected to have an impact on future exploitation of these resources.

Oil refineries and the associated crude oil, product, and liquified petroleum gas pipelines are present in the vicinity of the proposed Project site. One abandoned oil well and two natural gas wells with expired permits are located in Jackson County, but are several miles from the proposed Project site (Mississippi State Oil and Gas Board 2005). Therefore, Project facilities are not expected to interfere with petroleum production in the area.

4.1.3 Geologic Hazards

Potential geologic hazards in the Project area consist of seismic-related hazards, soil liquifaction, landslides, and subsidence. Slope instability and inadequate load-bearing capacity of soils would also pose a hazard at the proposed LNG terminal. Conditions necessary for the development of other geologic hazards, including karst terrain, avalanches, and volcanism are not present in the proposed Project area.

In general, the potential for geologic hazards to significantly affect the construction or operation of the proposed Project is low. The risk of damage resulting from geologic hazards would be avoided or reduced by specific engineering design criteria, ground modification, other construction techniques, and operating procedures to be implemented by Bayou Casotte Energy. Geologic hazards, their potential to occur in the Project area, and proposed mitigation measures, where applicable, are discussed below.

4.1.3.1 Seismicity and Faulting

Potential seismic-related hazards include earthquakes, surface faulting, soil liquefaction, and related soil failures. The Gulf Coast region of the United States is tectonically stable and the likelihood of a major earthquake occurring in the Project area would be very low. Seismic risk can be quantified by the motions experienced by the ground surface or structures during a given earthquake, expressed in terms of the acceleration due to gravity (g). The USGS has developed a series of maps for the entire United States that describe the likelihood for shaking of varying degrees to occur in a given area (USGS 2002). According to the USGS maps, there is a 10 percent probability of an earthquake occurring in the next 50 years that would result in a peak ground acceleration rate of about 0.01 g in the Project area. A peak ground acceleration of 0.1 g is generally considered to be the minimum threshold for damage to older structures or structures not made to resist earthquakes (USGS 2004).

Although the number of earthquakes that have epicenters in Mississippi are few, the state has been affected by earthquakes in neighboring states, including a series of great earthquakes near New Madrid, Missouri in 1811 and 1812. The closest historical earthquake was located 36 miles west of the Project site and occurred February 1, 1955. The Pickens-Gilbertown and the Southern Arkansas fault zones occupy an area over 500 miles long and 25 miles wide, running from southwestern Alabama through west-central Mississippi to southern Arkansas and eastern Texas. The closest that the zones come to the Project site is 43 miles. The formations overlying the Pickens-Gilbertown fault zone are unfaulted indicating that the fault zones are no longer active. Deep exploration wells indicate that the Southern Arkansas fault zone has been inactive since the Miocene Epoch. These faults are not anticipated to have an impact on the proposed Casotte Landing Project.

4.1.3.2 Soil Liquefaction

Secondary seismic effects triggered by strong ground shaking are often more serious than the shaking itself. The most damaging secondary seismic effect is often soil liquefaction, a physical process in which saturated, non-cohesive soils temporarily lose their bearing strength when subjected to strong

and prolonged shaking. Soils most prone to liquefaction are poorly graded, or in other words, have a uniform grain size. Soil liquefaction can also lead to other ground failures, including settlement and lateral spreading.

A geotechnical survey was conducted to assess the potential for liquefaction at the proposed Project site. Boring logs and Cone Penetrometer Test (CPT) results were evaluated to identify layers that were susceptible to liquefaction. Although the CPT results found liquefiable layers at the proposed Project site, these thin sand layers were not laterally extensive enough to impact the Project. Earthquake stress potential and subsurface stress resistance were compared to develop a factor of safety values for the Project site. The factor of safety values were greater than or equal to one, which is satisfactory. Based on these facts, there is a relatively low potential for seismically-induced liquefaction to occur at the proposed Project site.

4.1.3.3 Landslides/Slope Stability

Landslides are a form of ground failure, involving the down-slope movement of earth materials under the force of gravity due to natural or artificial causes. The proposed Project area is located in a zone of low susceptibility and low incidence of natural landslides. Landslides from artificial causes due to construction of the proposed terminal have a low probability of occurring due to engineering and construction standards that would be applied at the site.

The geotechnical study indicated that the uppermost soils at the proposed LNG terminal site have very low load-bearing capacities due to the very soft and cohesive soils and loose granular soils occurring within the upper 35 to 55 feet. Therefore, soil improvements and engineering designs must be implemented to ensure the stability of the LNG storage tanks, process structures, and marine facilities. The proposed LNG tanks would be supported on mat foundations with a re-consolidation of the existing soils under the mat or pile-supported foundations. Pilings for any structures that would impose a significant foundation load (such as LNG storage tanks, vessel berth pilings) would be driven to depths ranging from 90 to 120 feet bgs. The foundations would be monitored to ensure that no ground failure under the LNG tanks is occurring.

The proposed process area would include excavations of the main and secondary impoundment sumps. Groundwater control would be necessary to prevent slope failure during the excavations.

Short and long-term stability of the sloped walls of the marine slip has been analyzed to determine if failure would occur. The structures associated with the marine facilities would be supported with both vertical and battered piles. A 5:1 slope would be created from the crest of the slope to the toe of the slope. According to the results of a slope stability analysis for the LNG terminal site, the proposed slope configuration would meet safety criteria. Provided that all engineering specifications are followed, the marine slip would not likely be affected by landslides or other slope failures.

4.1.3.4 Subsidence

Subsidence would be likely to occur at the site due to the settling of geologically recent alluvial material in low-lying coastal areas. The rate of subsidence at the proposed Project site is approximately 2 millimeters per year (Berger 2005). Because the structures at the proposed Project site would make use of pile-supported foundations, impacts from subsidence would unlikely affect the Project facilities.

Two public water supply wells are located within 1 mile of the proposed Project area. Based on current groundwater usage in the Project area, subsidence in the Project area resulting from groundwater extraction is minimal. No wells are planned for installation at the proposed site.

Due to limited production of oil and gas in Jackson County, subsidence associated with oil or gas production in the area is not anticipated.

4.1.3.5 Flooding/Storm Damage

The Mississippi Gulf Coast is susceptible to hurricanes and tropical storms, which may produce storm surge, flooding, and high winds. Storm surge, the abnormal rise in sea level due to the wind and pressure forces associated with hurricanes and other tropical storms, is often the most significant cause of damage to facilities and property in low-lying coastal areas. Freshwater flooding can occur along rivers, stream valleys, and adjacent, poorly-drained areas.

Flash Flooding

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps show the majority of the Project site is within the FEMA 100-year floodplain. Two areas on the north and western portion of the site are above the 100-year floodplain. The potential for flash flooding to significantly impact construction or operation of the proposed Project is low. The greatest potential for flash flooding to occur in the Project area is associated with tropical storms and hurricanes, which are usually accompanied by significant precipitation over a short period of time. Aside from temporary delays during the construction phase of the Project, the primary potential impact associated with flooding would be soil erosion.

The potential effects associated with high rainfall events during construction would be mitigated by implementing Bayou Casotte Energy's Upland Erosion Control, Revegetation, and Maintenance Plan (Plan), as modified in this EIS (Appendix B). After construction, the Project area would be stabilized with permanent erosion control measures such as berms and vegetative cover, including revegetation of disturbed soils. These measures would minimize the effects of high rainfall events during operation of the proposed LNG terminal and pipeline.

Hurricane Storm Surge

Bayou Casotte Energy used three models to assess future hurricane storm surge events: the FEMA Flood Insurance Study Model (FIS) from 1987; an analysis conducted by Chevron in 1998; and the COE Hurricane Surge Atlas in 1999. The FEMA FIS analyzes the effect of tropical storms and hurricanes from the storm of 1909 to Hurricane Frederic in 1987. The analysis had two parts: evaluation of the still water level and computation of the related wave set up. In the vicinity of the proposed terminal site, the 100-year still water elevation was found to be 9.0 feet NGVD and the wave crest elevation was 13.4 feet NGVD. The base flood elevation is from 9.0 to 13.0 feet NGVD.

The Chevron analysis was conducted after Hurricane Georges flooded the Pascagoula Refinery in 1998. The 100-year still water elevation at the Pascagoula Refinery was found to be 11.1 feet NGVD. The required levee crest elevation would be 18.1 feet NGVD for a 100-year storm and 22.8 feet NGVD for a 500-year storm, which is the design basis for the levees at the proposed Casotte Landing site.

The COE Hurricane Surge Atlas was developed to be used for evacuation applications and typically is more conservative. Storm surge elevations are calculated based on the maximum envelope of water (MEOW) from all storm surge models and is per the Safir-Simpson scale hurricane ranking. For a Category 5 storm, the MEOW is 22.2 feet, which is less than the design elevation of the levees at the proposed Project site.

Bayou Casotte Energy has collected historic oceanographic data on the effects of hurricanes in the Project area and currently collects data during hurricanes to update the analysis. With the recent strike of the Mississippi coast by Hurricane Katrina (August 2005), Bayou Casotte Energy was able to update its design basis for construction of the hurricane levee. Based on this data, wave and storm surge would be of concern at the proposed Project site.

In order to mitigate the potential hazards associated with storm-induced flooding and waves, Bayou Casotte Energy would construct a hurricane levee to surround the terminal process equipment and LNG storage tanks. The hurricane levee crest construction height is proposed at 24 feet NGVD to allow for an adequate margin of safety at the proposed Project site.

4.1.3.6 Shoreline Erosion

The shoreline along the Gulf Coast exists in various states of erosion, accretion, and equilibrium. These processes are dynamic and vary with time as well as location. The existing shoreline at the proposed LNG terminal has been significantly modified. The geotechnical study for the proposed Project presented aerial/satellite photographs over time that show shoreline erosion is removing significant coastal segments of the immediate coastal shoreline to the south and east of the proposed terminal facilities.

As discussed in Section 4.1.1, the shoreline would be altered at the proposed LNG marine terminal by construction of a marine unloading slip. The new shoreline would be protected from erosion by measures taken to stabilize the slope parallel to the shoreline to minimize scour potential within the berth area from LNG ship propeller wash. During the transit along the Bayou Casotte Channel, LNG marine traffic would be operating at low speeds and would not create wakes that would increase the potential for shoreline erosion in the Project area, or along the transit waterway between Horn Island and Petit Bois Island. The implementation of the shoreline scour protection in the berth area would minimize the potential for shoreline erosion associated with the Project.

4.1.4 Blasting

Based on the regional and local geology, no areas of shallow bedrock are present. As a result, no blasting is anticipated for development of the proposed Casotte Landing Project.

4.1.5 Paleontological Resources

Numerous fossils of marine origin are present in the coastal deposits of Mississippi. Most of these fossils originate from the Cenozoic Era. Principal deposits of buried reef shell occur in the Mississippi Sound. However, because of the relatively recent deposition of the surficial geology that would be encountered at the site, it is unlikely that fossils would be encountered at the site.

4.2 SOILS AND SEDIMENTS

4.2.1 Soil Resources

We reviewed information provided by Bayou Casotte Energy and contained in the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database for Jackson County, Mississippi (NRCS, USDA 2005a) to evaluate likely project-related impacts on soils within the proposed LNG terminal site as well as along the proposed pipeline interconnect routes and associated aboveground facilities. Soils at the proposed LNG terminal site would be disturbed by grading, excavation, heavy equipment traffic, and the construction

and operation of aboveground facilities. Soils at the proposed terminal site would also be physically removed to construct the marine terminal. Soils along the proposed pipeline interconnect routes would be disturbed by grading, excavation, and heavy equipment traffic. Issues to be addressed include permanent conversion of prime farmland to other uses, soil compaction, erosion and sediment control, and long-term soil productivity.

Bayou Casotte Energy's Plan and Procedures, as modified in this EIS, would be implemented to address potential impacts on soil resources in the Project area. Some of the relevant mitigation measures specified in Bayou Casotte Energy's Plan and Procedures include requirements to:

- segregate a maximum of 12 inches of topsoil in all actively cultivated or rotated croplands, pastures, residential areas, hayfields, and at other areas at the request of the landowner or land management agency;
- provide temporary erosion and sediment control measures such as silt fence, straw bales, slope breakers, seeding, mulch, and erosion control fabric to minimize any impacts related to soil erosion and sedimentation that may result from precipitation runoff;
- mitigate soil compaction following construction and right-of-way restoration activities;
- ensure revegetation of all areas disturbed by Project-related activities. Disturbed upland areas would be seeded in accordance with written recommendations from local conservation authorities or as requested by the landowner;
- provide post-construction monitoring of mitigation practices to ensure their success;
- implement the SPCC Plan if a spill or leak occurs during construction; and
- utilize at least one EI to ensure implementation of the practices outlined above.

In response to past concerns raised by federal, state, and local agencies, the FERC developed a Plan to provide baseline mitigation measures for minimizing erosion and enhancing revegetation during construction. The FERC's Plan includes requirements for pre-construction planning, environmental inspection, specific construction methods, sediment and erosion control, restoration, and post-construction maintenance. Bayou Casotte Energy has requested certain variances from the FERC's standard Plan. In the case of construction activities at the terminal site, uplands would not simply be crossed and then restored; rather they would be filled, graded, or otherwise completely removed. Because of the large-scale, permanent modification of the proposed terminal site, we recognize that certain construction activities would be required within and immediately adjacent to existing uplands. Due to this feature of the proposed Project, some of the standard measures in the FERC's Plan would not be applicable at the proposed LNG terminal site including restoration, revegetation, and post-construction monitoring and maintenance.

The FERC's acceptance of these requested variances applies only to the proposed LNG terminal site. Other areas that would be affected by construction of the proposed pipeline interconnects must comply with the FERC's standard Plan, regardless of whether access is obtained via easement agreement.

Additionally, Bayou Casotte Energy proposed several variances that are relatively minor modifications, reflect consideration of site conditions, and that offer similar levels of environmental protection as provided by the FERC's Plan. Those measures, which are approved, include:

- the nominal construction right-of-way of 110 feet in upland locations along the pipeline route. The expanded construction right-of-way is needed due to the containment of a dual pipeline configuration. We agree that the wider construction right-of-way for the collocation

of pipelines in uplands would accommodate the workspace requirements and safety considerations for construction personnel (Section IV.2);

- extending each temporary slope breaker marginally off the disturbed right-of-way so that the outfall exits onto stable, well vegetated areas. If a stable, well vegetated area does not exist, an energy dissipater would be constructed at the end of the slope breaker (Section IV.F.1.c); and
- openings would be left in sediment barriers to allow temporary and permanent slope breakers to exit the construction right-of-way (Section IV.F.2.c).

Additionally, Bayou Casotte Energy proposed numerous other variances from the FERC's Plan that either were not sufficiently supported or did not offer similar levels of environmental protection. These other proposed variances have been rejected. Therefore, **we recommend that:**

- **Except for the proposed variances specifically approved above, Bayou Casotte Energy should revise its proposed Plan to be consistent with the FERC's standard Plan, as modified in this EIS. The revised Plan should be filed with the Secretary for review and written approval by the Director of OEP prior to construction.**

4.2.1.1 Soil Characteristics

Soils in the proposed Project area are generally medium to fine textured and formed in alluvium. Major characteristics of soils associated with the proposed LNG terminal and proposed pipeline interconnects are presented in Table 4.2.1-1. The majority of the soils at the proposed terminal site consist of fill, or altered soils from previous dredge disposal operations and industrial uses. Most of the soils along the proposed pipeline interconnects and NGL pipeline are hydric and poorly drained, although there are small areas of well drained soils. Generally, the landscape is nearly level except near the shoreline. Soil erosion is not a major concern on the soils of the proposed Project area because the landscape is nearly level.

LNG Terminal Facilities

According to the current NRCS soil survey database, soils at the proposed LNG terminal site are comprised of the Udorthents and Axis soil series. Udorthents soils comprise 64 percent of the proposed terminal site. These soils are disturbed soils primarily consisting of fill material. This is verified by the very soft to soft clays and very loose to loose sands and silts encountered in the upper 35 to 55 feet of the geotechnical soil borings conducted throughout the proposed terminal site. The Axis soils formed in thick loamy marine sediments on coastal marshes.

The construction of the proposed LNG terminal facilities would involve removing the existing surface soils to expose the most stable subsoils. Fill would be used to raise the surface grade where the proposed LNG terminal would be constructed, with the exception of the LNG storage tank area, which would be lower in elevation for secondary containment purposes. Additional soil amendments would also be used to re-engineer the soils at the site to provide a stable land surface for construction. These activities would not have a significant impact on soils at the proposed LNG terminal site because these soils were already impacted by previous fill and industrial activities. Because the soils within the proposed LNG terminal would be permanently converted to an industrial use following construction, mitigation of compaction impacts on soils at the terminal would not be necessary.

TABLE 4.2.1-1
Major Characteristics of Soils Impacted by the Proposed Casotte Landing LNG Project

Soil Series	Acreage Impacted	Drainage Class	Prime Farmland	Hydric Soils	High Compaction Potential	Highly Erodable Soils	Poor Revegetation Potential
LNG Terminal							
Udorthents	164.9	Varies	No	Unranked	Varies	No	Yes
Axis Mucky Sandy Clay Loam, frequently flooded	69.0	Very poorly drained	No	Yes	No	No	No
Water	25.5	NA	NA	NA	NA	NA	NA
Pipeline Spur Interconnect							
Udorthents	2.1	Varies	No	Unranked	Varies	No	Yes
Axis Mucky Sand Clay Loam, frequently flooded	15.3	Very poorly drained	No	Yes	No	No	No
Nonjurisdictional Facilities							
Udorthents	23.9	Varies	No	Unranked	Varies	No	Yes
Axis Mucky Sand Clay Loam, frequently flooded	4.9	Very poorly drained	No	Yes	No	No	No
Bayou Sandy Loam, 0-1% slopes	7.4	Very poorly drained	No	Yes	No	No	No

Source: SSURGO database

Pipeline and Associated Aboveground Facilities

The proposed interconnect and NGL pipelines would cross the Udorthents, Axis, and Bayou soil series. Udorthents and Axis soils were described in the previous section. Bayou soils consist of sandy loam that is poorly drained and also formed on loamy sediments, such as Axis soils.

Pipeline construction activities such as clearing, grading, trench excavation, backfilling, and the movement of heavy construction equipment along the construction right-of-way would result in adverse impacts on soil resources. Clearing activities remove the protective cover and expose the soil to the effects of wind, sun, and precipitation. This exposure would lead to movement of sediment to sensitive areas. Grading and equipment traffic have the potential to compact soil, reducing porosity and infiltration rates, which would lead to increased runoff potential or difficulty in revegetating. Trench excavation and backfilling would lead to a mixing of the soil layers, bringing potentially less productive subsoil to the surface or introducing rocks from deeper horizons to the soil surface. The soils would also potentially be impacted due to contamination from spills or leaks of fuels, lubricants, and coolants from construction equipment.

4.2.1.2 Prime Farmland

As part of our review, we considered the effect of the proposed Project on prime farmland. Specifically, we evaluated the extent to which construction of aboveground facilities would result in the loss of prime farmland through permanent conversion to other uses. Prime farmland is designated by the NRCS and has the best combination of physical and chemical characteristics for producing agricultural crops with the minimum inputs of fuel, fertilizer, pesticides, and labor. Prime farmland typically:

- contains few or no rocks;
- is not subject to excessive erosion;
- is relatively permeable to air and water; and
- is not subject to prolonged periods of flooding during the growing season.

No prime farmland has been designated in the proposed Project area by the NRCS; therefore, the construction of the proposed LNG terminal and proposed pipeline interconnects would not impact prime farmland.

4.2.1.3 Hydric Soils

Hydric soils, as designated by the NRCS, are formed under saturated conditions and are a component in determining the presence of jurisdictional wetlands. A high incidence of hydric soils would suggest a high probability of potential impacts on wetlands. A review of NRCS data indicates that hydric soils comprise 88 percent of the pipeline spur interconnect route and 34 percent of the NGL pipeline route (see Table 4.2.1-1). Approximately 27 percent of the soils at the proposed LNG terminal site are classified as hydric.

The extent of hydric soils suggests that proposed Project-related impacts on wetlands would be extensive (see Section 4.4). In addition, high groundwater levels associated with hydric soils would create a buoyancy hazard for the pipeline interconnects. In accordance with its Procedures, Bayou Casotte Energy would minimize rutting of hydric soils by using construction mats where hydric soils cannot support equipment and/or employing low-ground-weight equipment. Special construction methods such as concrete coating of pipe and other weighting methods would be used to overcome buoyancy hazards during operation of the pipeline.

4.2.1.4 Compaction Potential

Soil compaction increases soil density, degrades soil structure, and reduces the permeability of the soil to air, water, and plant roots. The decreased permeability increases runoff and erosion and reduces overall productivity. Fine textured soils with poor internal drainage are the most susceptible to compaction by construction equipment and vehicles. Wet conditions at the time of construction increase the potential for compaction to occur.

The majority of the soils at the proposed LNG terminal and along the proposed pipeline interconnects do not have a high potential for compaction. Impacts from compaction would be minimized by implementing measures outlined in Bayou Casotte Energy's Plan and Procedures, as modified in this EIS, (for example, use of construction mats or low-ground-weight equipment) during construction in soft or wet soils. Additionally, the EI would restrict construction activities during unfavorable conditions (such as wet weather) to further reduce compaction. Compaction impacts would be mitigated through the use of deep-tillage implements during restoration activities.

4.2.1.5 Erosion

Soil that is disturbed by construction activities has an increased risk of erosion by wind and water. Erosion not only causes the loss of high quality topsoil, but generates sediment that can degrade wetlands or waterbodies. The Project area has very level topography, so according to SSURGO data, most of the soils have a low potential for erosion under normal land use. Construction activities cause more severe soil disturbance than normal land use, which in turn increases the erosion potential. Exposed soils coupled with heavy rainfalls that are common in the Project area would result in significant erosion and sedimentation if appropriate controls are not in place.

Bayou Casotte Energy's Plan contains a number of provisions to control erosion and sedimentation such as silt fence, straw bales, slope breakers, seeding, mulch, and erosion control fabric. Bayou Casotte Energy also indicates that sediment traps and physical barriers would be installed as needed. These techniques, when properly installed, inspected, and maintained, would minimize any impacts related to soil erosion and sedimentation that may result from precipitation runoff. Additionally, Bayou Casotte Energy has developed a site-specific SWPPP as a requirement of the general permit for construction stormwater discharge that details the Best Management Practices (BMP) to be used during construction (see Appendix C). Shoreline erosion at the LNG terminal site and along the waterway that would be used by the LNG marine traffic is addressed in Section 4.1.3.6.

As a requirement of coverage under the National Pollutant Discharge Elimination System (NPDES) Industrial Stormwater General Permit, an Industrial SWPPP would be required. The Industrial SWPPP would be submitted to the MDEQ, along with an application for coverage, at least 60 days before commencement of facility operations to allow for agency review. The Industrial SWPPP would, in part, identify areas with a high potential for soil erosion and specify prevention measures to limit erosion. This plan would be updated on an as-need basis, at least annually, in accordance with the terms of the general permit.

4.2.1.6 Revegetation

Successful revegetation is probably the most effective way to achieve permanent erosion control in areas that are not active cropland. The SSURGO database indicates that the Axis series soils have good revegetation potential, but that the Udorthents soils have a poor revegetation potential. Udorthents are soils that have been disturbed by human activity and can have widely varying properties. The majority of Udorthents soils are located on the proposed LNG terminal property.

Bayou Casotte Energy is proposing to revegetate only the areas that are covered under an easement agreement, which would exclude the proposed terminal property. Much of the proposed terminal site would be covered by gravel or crushed rock, or be paved. Some small areas would be covered with primarily ornamental/lawn vegetation. Therefore, the poor revegetation potential of Udorthents soils would not be an issue. On those areas covered under an easement agreement, Bayou Casotte Energy's proposed Plan and Procedures, as modified in this EIS, would be utilized to revegetate the land. The local soil conservation authority would be consulted to determine the appropriate soil additives and seeding requirements. Moreover, Bayou Casotte Energy's Plan and Procedures call for post-construction monitoring to assess the success of revegetation, as well as continued efforts until revegetation is successful.

4.2.1.7 Soil Contamination

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment would adversely affect soils. The effects of contamination are typically minor because of the low

frequency and volume of spills and leaks. Bayou Casotte Energy has developed a SPCC Plan for construction that specifies cleanup procedures in the event of soil contamination from spills or leaks of fuel, lubricants, coolants, or solvents. Bayou Casotte Energy would implement its SPCC Plan to prevent and contain, if necessary, accidental spills of any material that may contaminate soils, and to ensure that inadvertent spills of fuels, lubricants, or solvents are contained and cleaned in an appropriate manner (see Appendix D).

The proposed terminal site was owned and operated by Corning Glass Works (Corning), who subleased portions of the property to Cohart Refractory (Cohart). Cohart manufactured high-temperature brick created by using a magnesite refractory from 1955 through 1989. An unlined below-grade landfill was used to store furnace dust and discarded ore and two unlined lagoons were used to settle fines in wastewater effluent prior to discharge. The landfill was excavated and backfilled with soil and refractory brick debris in 1984. The lagoons were filled and capped in 1989. A "No Further Action" designation was issued for the Project site by the EPA. An Environmental Site Assessment conducted in 2005 found no significant exposure risk. Therefore, contaminated soils would be discovered during construction activities; however, the risk appears to be minimal. If contamination is encountered during construction activities, Bayou Casotte Energy would instruct the contractor to stop work at the contaminated location to allow for the evaluation of potential contamination and to develop a plan for the safe handling and disposal of the contaminated materials in accordance with applicable local, state, and federal regulations.

Bayou Casotte Energy is also in the process of developing a proposed SPCC Plan to cover the operational phase of the proposed Project that would include procedures to prevent and mitigate accidental releases of oil, gas, lubricants, or hazardous materials.

4.2.2 Sediments

Construction of the proposed LNG terminal would require the dredging of about 3.5 mcy of sediments to create the marine facilities associated with the proposed Project. The ship berth and maneuvering area would be dredged to an elevation of 42 feet below MLLW, with an additional 2 feet for advance maintenance and up to 2 feet of potential overdredge allowance. Maintenance dredging would require the removal of about 250,000 yd^3 on an annual basis. The dredged material is proposed for placement in a combination of offshore (EPA-designated ODMDS) and approved and available federal and state coastal or offshore BU project sites. Currently, no BU project sites have been identified as being available.

Projects involving the transportation of dredged material for the purpose of final placement in ocean waters outside the 3-mile-limit must be evaluated pursuant to Section 103 of the MPRSA to determine whether the proposed discharge would unreasonably degrade or endanger human health, welfare or amenities, or the marine environment, ecological systems, or economic potentialities. A summary of the physical, chemical, and biological testing that was conducted by Bayou Casotte Energy to assist the COE, EPA, and MDMR in evaluating the proposed dredged sediment relative to Section 103 of the MPRSA is provided below. Bayou Casotte Energy's Section 103 evaluation and DMMP is provided in Appendix E. Sampling and analysis of the sediments contained within the proposed dredge area at the LNG terminal site was conducted per standard guidelines for assessing dredged materials (EPA and COE 1991; EPA, Region 4 and COE-SAD 1993; and EPA and COE 1998).

On January 16, 2006, Bayou Casotte Energy initiated Suitability Testing Phase II based on consultations with the COE and EPA. Bayou Casotte Energy submitted the results from the Phase II sampling on July 27, 2006, as part of its Joint Permit Application to the COE. It is the responsibility of the EPA and COE under the MPRSSA to manage and monitor the ODMDS. The COE has not made its final determination on Bayou Casotte Energy's Section 103 evaluation, and therefore, a final management

and monitoring plan has not been prepared for the placement of sediments associated with the Bayou Casotte LNG Project.

4.2.2.1 Physical Characteristics of the Sediments

The sediments proposed dredged for the marine facilities consist of a sand-rich upper layer and a clay- and silt-rich lower layer. On average, there is a 56 percent sand content and a 44 percent silt and clay content. The potential for sediments to be resuspended during dredging and dredged material placement operations can be estimated from the percentage of silts and clays. The estimated levels of total suspended solids (TSS) associated with construction of the proposed Project would be similar to or below existing background levels for Bayou Casotte. Section 4.3.2.2 provides additional information on methods used and impacts to water quality during dredging and disposal of dredged material.

Following excavation of soils above the water table at the proposed terminal site, remaining soils and sediments (approximately 3.5 mcy) at the proposed terminal slip would be removed using mechanical clamshell or dragline dredges mounted on barges. The slip would be dredged to an initial depth of 46 feet MLLW, and the sides of the slip would be sloped at a 5:1 ratio, covered with geotextile fabric, and lined with protective stone riprap as construction proceeds. It is anticipated that dredging would occur on a continuous, 24-hour a day basis, except during brief periods of down time associated with equipment maintenance, weather, or other unplanned reasons. The duration of dredging operations is anticipated to last for approximately six months.

Under existing conditions, Bayou Casotte is a turbid estuary. Water quality data collected by MDEQ indicated that Bayou Casotte had a median TSS level of 36 mg/l and a mean TSS level of 55 mg/l. Bayou Casotte Energy modeled the potential for suspension of sediment associated with dredging of the slip using the COE's DREDGE model. The analysis indicated that maximum predicted levels of TSS would be 19.9 mg/l at a distance of approximately 30 feet from the dredging activity, with concentrations of TSS dropping at distances further away from the activity. Thus, the estimated levels of TSS associated with construction of the proposed Project would be similar to or below existing background levels for Bayou Casotte. Furthermore, as a federal navigation project, Bayou Casotte is already routinely subjected to periodic COE maintenance dredging and the associated suspension of sediments into the water column. Even though the anticipated impacts to marine water resources would be small, Bayou Casotte Energy is consulting with MDEQ, MDMR, COE, and NOAA Fisheries regarding the possible development of BMPs to further reduce sedimentation and turbidity during construction and maintenance dredging.

4.2.2.2 Chemical Characteristics of the Sediments

Metals, nonmetals, PAHs, pesticides, PCBs and TPH were analyzed in all of the sediment samples collected from the proposed dredge area. Analytical measurements for each sample were compared to sediment quality screening guidelines. Effect range low (ERL) values are defined as the lowest chemical concentration in which toxic effects are manifested in selected species (Buchman, 1999). All of the analytical results were below ERL values, suggesting no significant impacts would result from dredging activities.

Elutriate chemical testing of the sediments is important in determining whether dredged material is suitable for placement at an ODMS by simulating the potential transfer of chemicals from the dredged sediments into the water column during dredging activities. Analytical results from elutriate tests were compared to Mississippi State and Federal Water Quality Criteria (WQC). No PCBs or pesticides were detected above Mississippi State or Federal WQC. With the exception of phosphorous, nickel, and mercury; no metals or non-metals were detected above Mississippi State or Federal WQC. Phosphorous contained in the elutriate mixture for sample SB10U and nickel contained in the elutriate mixture for

sample SB10L were both in excess of the Mississippi State and Federal WQC by an approximate factor of two. Mercury contained in the elutriate mixture for SB11U was below the Federal WQC but above the Mississippi State WQC by an approximate factor of 16. Since the ODMDS is located in federal waters, the analytical results for mercury are in an acceptable range for dredge disposal in federal waters. Therefore, dredged material placement at the ODMDS could result in water quality impacts on the receiving waters at the site as a result of phosphorus and nickel. We note, however, that elutriate testing yields conservative estimates of potential water quality impacts because the tests simulate a greater level of sediment mixing and aeration than actually created by mechanical dredging. This is supported by a study conducted by the COE to evaluate the release of chemical constituents at the point of dredging, which found elutriate test results are a conservative predictor of chemical concentrations within the water column (COE 1988). Actual water quality impacts are better evaluated based on biotoxicity and bioaccumulation testing as discussed in more detail below.

4.2.2.3 Biological Testing of the Sediments

Biological testing was implemented to evaluate any potential effects of open water placement of the dredged materials on benthic biota. This testing involved both bioassesment and bioaccumulation testing including 10-day whole sediment bioassays using the crustacean *Americamysis bahia* and the crustacean amphipod *Leptocheirus plumulosus*; 96-hour elutriate bioassays with *Americamysis bahia*, *Menidia beryllima*, and *Arbacia punctylata*; and 28-day bioaccumulation tests with *Macoma nasuta* and *Nereis verens*. The results of each of these stages of toxicity testing are described below.

Whole-sediment Bioassay Summary

Dredging activities could potentially affect organisms living and feeding within the sediment matrix. To determine the potential for toxicity, and if dredging activities would effect the organisms within the sediment matrix, whole sediment bioassays were conducted on sediments collected from the dredge area using the crustacean *Americamysis bahia* and the crustacean amphipod *Leptocheirus plumulosus*. These species were selected to help determine if dredging is anticipated to effect species of different feeding strategies. *Americamysis bahia* is a filter and deposit feeder and *L. plumulosus* is a burrowing filter and deposit feeder. For each species, five replicates were run on a laboratory control sediment; a reference sediment; and each of the 14 sediment samples collected from the area proposed for dredging. Average percent survival was calculated after 10 days of exposure. Mean percent survival for *A. bahia* in test sediments was not statistically decreased or different by 10 percent when compared to the reference sediment. *Leptocheirus plumulosus* exhibited significant mortality due to exposure to the test sediments; however, significant mortality was also observed in the reference sediment. It has been demonstrated that without sufficient organic carbon as a food source, organism mortality can occur (Word et al. 2005). To determine if the survival rates were attributable to the toxicity of the sediments or the lack of a source of adequate nutrients (i.e., organic carbon), three follow-up experimental treatments were conducted:

- Treatment I – Archived site sediments and freshly collected Grand Bay reference sediment were tested with a new batch of test organisms.
- Treatment II – Archived site sediments were conditioned, or "acclimated" to establish a marine sediment microbial assemblage. In some cases, samples used for the 28-day bioaccumulation test were re-used as it was acknowledged that their conditioning would be complete. In other cases, untested archived sediments were conditioned prior to testing. For these sediments, ammonia levels were measured during the conditioning process to monitor microbial activity.

- Treatment III – Previously conditioned sediment was supplemented with TetraMin™ in a manner similar to the EPA protocol for the chronic test with the amphipod, *L. Plumulosus* (USEPA 2001). The food ration was set at two feedings in 10 days to minimize the amount of food in the test system.

Treatment III toxicity bioassays (i.e., acclimation and TetraMin™) did not reveal significant mortality in any of the 14 test sediments when compared to reference or control sediments. Mean percent survival was not statistically decreased or different by 20 percent when compared to the reference sediment. The original *A. bahia* investigation and Treatment III *L. plumulosus* investigation demonstrated that sediments are not toxic to marine organisms and would be considered suitable for open ocean placement.

Elutriate Bioassay Summary

Elutriate tests were proposed to simulate the conditions that would exist during dredging operations. *Americamysis bahia*, *Menidia beryllima*, and *Arbacia punctylata* were tested by exposing each species to various concentrations of the 14 different sediment elutriates taken at the proposed dredge area for 96 hours. *Menidia beryllina* did not show significant mortality in any of the elutriate concentrations. No toxicity was observed for *A. bahia* with the exception of one sample (SB7L); however, the documented toxicity for that sample was negligible (less than 1 percent). Minor toxicity was observed for *A. punctulata* in two except in samples (SB4U2 and SB7U2); however, it was not determined to be significant. The results indicate that there would be no significant mortality among the test species and the sediments would comply with the criteria for open ocean placement of dredged material.

Bioaccumulation potential

Bioaccumulation potential tests were conducted to see if there was a risk of species tissues accumulating toxic materials. Sediments were evaluated for heavy metal bioaccumulation potential by exposing Macoma nasuta and Nereis verens to material from the proposed dredged area for 28 days. After 28-day exposures to the sediments, M. nasuta and N. verens did not demonstrate any toxic effects above the control samples. Tissue chemistry data were then compared to FDA action limits for the compounds that have established limits. In this case, Mercury is the only compound with established limits. Tissue chemistry data for mercury was well below that of the upper confidence limit (UCL) set by the FDA. The results indicate that there would be no significant bioaccumulation potential for any of the heavy metals detected in the proposed dredged sediments.

4.3 WATER RESOURCES

4.3.1 Groundwater

4.3.1.1 Hydrogeologic Setting

The proposed Casotte Landing Project is located within the East Gulf Coast Plain Physiographic Region, specifically the Coastal Zone, which is a low-lying 5- to 30-mile wide region of slight relief (Renken 1998). The regional aquifer underlying the proposed Project is the Coastal Lowlands Aquifer System. This aquifer underlies portions of southern Mississippi, Alabama, and Louisiana as well as portions of Florida and Texas. The aquifer system extends offshore to the edge of the continental shelf of the Gulf of Mexico, but becomes saline in offshore areas. The Coastal Lowlands Aquifer System becomes thicker nearer the Gulf of Mexico, is heterogeneous, and generally contains beds of sand, silt, and clay.

The region overlying the Coastal Lowlands Aquifer System receives ample rainfall, including approximately 68 inches annually in southeastern Mississippi (Renken 1998). The Mississippi, Pearl, and Red River drainages cross the aquifer system. The groundwater is potable, and is used to supply agricultural, public water, domestic, commercial, and industrial wells. In the vicinity of the proposed Project, the Coastal Lowlands Aquifer System may occur at approximately 500 feet below sea level (Renken 1998).

According to an environmental site assessment performed for Bayou Casotte Energy in 2005, the proposed LNG terminal site is underlain by an upper unconfined, unconsolidated sand unit (Upper Sand unit) extending from at or near the ground surface to approximately 23 feet bgs. A lower confined, unconsolidated sand unit (Lower Sand unit) occurs below the Upper Sand unit at depths of approximately 35 to 55 feet bgs. The Upper Clay unit separates the Upper Sand and Lower Sand units. Neither unit is used for drinking water. Groundwater flow in the Upper Sand unit is controlled by geology and topography and has been affected by past industrial uses at the site. As such, groundwater flow varies at the proposed terminal site, with no definitive directional flow for the unit as a whole. Depth to groundwater in the Upper Sand unit also is highly variable, with reported depths ranging from 2 to 20 feet. Groundwater flow in the Lower Sand unit appears to be to the west toward Bayou Casotte.

4.3.1.2 Public Water Supply and Wells

Groundwater in the Coastal Lowlands Aquifer System is potable, although depth to freshwater is typically deeper than the proposed Project would impact. Two public water supply wells are located within a 1-mile radius of the proposed terminal site, but they are located to the north along Bayou Casotte, upstream and up-gradient from the proposed Project. No Sole-Source Aquifers, as designated by EPA Region IV, are located within the vicinity of the proposed Project. Potable water at the proposed LNG terminal would be supplied by an existing well at the Chevron Pascagoula Refinery, and utility water would be supplied via municipal mains.

4.3.1.3 Groundwater Quality

Screening level samples collected within the area of proposed excavation (defined as 200 feet from the edge of the proposed terminal slip) from both the Upper and Lower Sand units contained concentrations of constituents that were either above the MDEQ Tier 1 Target Remediation Goals or EPA Maximum Contaminant Levels. Constituents detected include several metals and semi-volatile organic compounds. These samples were collected as part of the environmental site assessment performed in 2005. Temporary well points were installed in the Upper Sand unit and permanent wells were installed in the Lower Sand unit. Because the samples in the Upper Sand unit were collected from undeveloped wells, it is possible that the levels of analytes detected, particularly metals, could have resulted from high turbidity. One sample collected from outside of the area proposed for excavation of the new slip contained volatile organic compounds and semi-volatile organic compounds at levels exceeding regulatory targets. However, this contaminated area, which is located near the west-central boundary of the proposed terminal site, appears to be relatively small as other samples collected in the immediate vicinity were not contaminated.

4.3.1.4 Impacts and Mitigation

Impacts to groundwater resources could result from construction and operations at the proposed LNG terminal site, as well as installation of the proposed pipeline interconnects. These potential impacts are discussed below.

Impacts Associated with Proposed Terminal Construction and Operations

The Upper and Lower Sand units at the proposed LNG terminal site would be permanently affected by construction of the proposed LNG terminal. Site grading, excavation, and dredging activities associated with the proposed terminal site and slip would encounter groundwater in the Upper and Lower Sand units. Construction and installation of proposed infrastructure, such as sumps and the proposed LNG spill impoundment basin, would require dewatering throughout construction activities. The use of Bayou Casotte Energy's Plan and Procedures, as modified in this EIS, would limit impacts associated with dewatering. Those measures would include dewatering in a manner that does not cause erosion nor result in heavily silt-laden water flowing into any waterbody. Additionally, Bayou Casotte Energy would have to comply with any additional measures prescribed by MDEQ in association with the NPDES permit that might be granted for the proposed Project.

As part of the construction of the proposed terminal, existing wetlands and waterbodies would be converted to uplands, which would affect recharge for the underlying aquifers, as would the removal of vegetation. Since existing vegetation at the proposed terminal site is fragmented, of generally low quality (see Section 4.4.1), and part of the terminal site would be re-vegetated after construction, recharge would be only temporarily affected in some areas. Permanent effects would occur to groundwater recharge as a result from the proposed development of impervious surfaces and structures in some areas of the proposed terminal site, but these impacts would be relatively minor overall.

Chemical analytes, such as volatile and semi-volatile organic compounds and metals have been detected at the proposed terminal site in soils and groundwater. Bayou Casotte Energy proposes to remove contaminated soils through focused excavations, prior to the start of overall construction, thereby preventing chemical mobilization to groundwater or other media. According to the environmental site assessment performed for Bayou Casotte Energy, contaminated groundwater was detected at multiple locations. Bayou Casotte Energy indicated that if contaminated groundwater was encountered during construction or dewatering, that it would be collected in holding tanks or vacuum trucks and disposed of offsite in a permitted facility. However, Bayou Casotte Energy has not fully explained how monitoring and assessment of groundwater would be achieved during construction or dewatering activities, and therefore **we recommend that:**

- **Bayou Casotte Energy develop a plan in consultation with the MDEQ and EPA regarding assessment, containment, and disposal of contaminated groundwater that might be encountered during any construction activities and file a copy with the Secretary prior to the start of construction.**

Pilings for any structures that would impose a significant foundation load (for example, LNG storage tanks and vessel berth pilings, etc.) would be driven to depths ranging from 90 to 120 feet bgs. These pilings would perforate the clay unit that separates the Upper and Lower Sand units, creating the potential for cross-contamination. However, given the limited amount of documented contamination onsite, and our recommendation for development of a plan to detect, contain, and remove contaminated groundwater during construction, the potential for cross-contamination effects would be low.

Construction and operation at the proposed terminal site is not expected to result in impacts to drinking water wells. The nearest production well is located approximately 0.7 miles north of the proposed terminal site. Wells and wellhead protection areas are located up-gradient from the proposed terminal site to the north and northeast. Given their distance and location relative to the terminal site and plans to prevent mobilization of contaminants to groundwater, impacts to drinking water wells are not anticipated.

Bayou Casotte Energy has developed a SPCC Plan for the management of hazardous materials, such as fuels, lubricants, and coolants that would be used during construction (see Appendix D). Measures identified in the SPCC Plan to prevent or minimize the effects of accidental spills during construction include provision of adequate primary and secondary containment features, availability of spill kits, inspection of drainage from storage areas, and corrosion protection for buried piping. Programmatic guidelines in the SPCC Plan include spill reporting, notification of spills to relevant agencies, periodic review and evaluation of the plan, inspections, specified hazardous materials storage methods, established refueling procedures, and training for both prevention and response. Bayou Casotte Energy is also in the process of developing a proposed SPCC Plan to cover the operational phase of the proposed Project, and in Section 4.2.1 we have included a recommendation that Bayou Casotte Energy finalize and submit that plan prior to the start of construction.

The proposed Project would include construction of drainage ditches, impoundment basins, and sumps for equipment associated with offloading, handling, and storage of LNG at the proposed terminal site. These measures would limit the spread and release of LNG that could be inadvertently spilled during operations. Any spilled LNG would be covered with high expansion foam, thereby reducing evaporation and the potential for ignition. In the unlikely event that LNG is spilled into the water, the cryogenic liquid would vaporize rapidly upon contact with the warmer 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 any LNG would completely vaporize shortly after being spilled, there would be no liquid left that could mix with and/or contaminate the water. Given the measures proposed by Bayou Casotte Energy and our recommendation above, we conclude that the potential for effects to groundwater resulting from accidental spills would be effectively minimized.

Although the proposed Project is located near the Gulf of Mexico, saltwater intrusion would not be expected to occur as a result of construction and operation of the proposed Project. The regional freshwater-saltwater interface at the proposed LNG terminal site is expected to be located at least 120 feet below sea level. Additionally, fresh groundwater tends to bulge out under the sea near the coast. As dredging at the site would not extend deeper than about 46 feet below MLLW, it is unlikely that saltwater intrusion would occur at the site.

Impacts Associated with Pipeline Interconnects

Groundwater could be impacted by installation of the proposed pipeline interconnects due to open-cut trenching through waterbodies and wetlands, which can affect groundwater recharge, and by accidental spills, which are discussed above. As described in Bayou Casotte Energy's Plan and Procedures, as modified in this EIS, measures would be implemented to minimize impacts to wetlands during construction. Those measures include use of trench breakers and bottom seals to prevent dewatering of wetlands and waterbodies. Trench dewatering would be accomplished so as to avoid erosion or discharge of excessively turbid water to any waterbody or wetland, and dewatering structures would be removed as soon as possible after the activity is completed. The potential for impacts to onshore waterbodies is discussed in greater detail in Section 4.3.2, and wetland impacts are discussed in more detail in Section 4.4. Impacts to waterbodies and wetlands that could affect groundwater would also be minimized through NPDES and wetlands permit conditions required by MDEQ and the COE, respectively. Given that the proposed measures and permit conditions would serve to prevent or minimize impacts, we conclude that effects to groundwater resulting from the proposed Project would be temporary and minor.

4.3.2 Surface Water

4.3.2.1 Environmental Setting

As proposed, the Casotte Landing Project would be located on Bayou Casotte, a turbid estuary with ambient turbidity levels of approximately 15 to 20 Nephelometric Turbidity Units (NTUs), that empties into the Pascagoula Bay/Mississippi Sound portion of the Gulf of Mexico. Bayou Casotte and the Gulf of Mexico are the only estuarine or marine waterbodies that would be affected by the proposed Casotte Landing Project. The watershed for Bayou Casotte drains approximately 8.4 square miles of predominately urbanized and forested area (MDEQ 2002) and is located in the Mississippi Coastal Streams River Basin. Bayou Casotte is approximately 1,100 feet wide with a depth of up to 42 feet, which is controlled by routine dredging to maintain an actively used shipping channel. The proposed Project would be located within a previously altered and existing industrialized area along Bayou Casotte.

The State of Mississippi assigned Bayou Casotte a state fishery classification of "marine" and a designated use of "fish and wildlife." There are no officially designated recreational, commercial, or shellfish resources in Bayou Casotte, although some private recreational fishing does occur there and the area is a launching and access point for chartered fishing boats. Designated critical habitat for the federally threatened Gulf sturgeon (Unit 8, Mississippi Sound in Jackson County, Mississippi) is located at and immediately adjacent to the southwest corner of the proposed LNG terminal site. Gulf sturgeon habitat is discussed in more detail in Section 4.6. Bayou Casotte is listed as an impaired waterbody (impaired aquatic life support) by the MDEQ due to the presence of total toxics and unionized ammonia (MDEQ 2005).

Numerous cold fronts, in addition to more rare tropical cyclones, occur each year and affect wind and wave patterns in the vicinity of the proposed Project (Keen et al. 2003). Winds in the vicinity of Bayou Casotte tend to focus wave energy from the southwest toward the northeast, with the potential to cause shoreline erosion and mobilize sediments. Keen et al. (2003) indicated that the wave climate in Mississippi Sound was generally moderate, with wave heights typically less than 3 feet, and also suggested that currents in Mississippi Sound were dominated by tidal flow. The average difference in range of tides at Pascagoula, Mississippi is 1.5 feet (USM 2005). Coastal Mississippi is subject to impacts from major hurricanes that affect rainfall, wind, waves, and tides, as evidenced by the landfall of Hurricane Katrina near the Louisiana and Mississippi border on August 29, 2005 (Knabb et al. 2005). Hurricane Katrina made landfall as a strong Category 3 storm with winds exceeding 110 miles per hour and a storm surge of up to 27 feet (Knabb et al. 2005) after weakening from a Category 5 storm while in the Gulf of Mexico.

The onshore waterbodies that would be affected by the proposed Project range from freshwater to brackish in character, and additional information regarding their characteristics is provided in Table 4.3.2-1. Construction of the proposed terminal site would affect 14 onshore surface waterbodies, comprised of 10 ditches, two ponds, and two canals. The terminal site is located in an existing industrial area, and the site previously contained a refractory brick manufacturing plant that was closed and remediated in 1989. Two canals would be affected by construction of the proposed pipeline interconnects. Additionally, the nonjurisdictional NGL pipeline would affect five perennial ditches and one perennial canal.

TABLE 4.3.2-1 Onshore Waterbodies Affected by the Proposed Casotte Landing Project					
Feature ID / Facility	**Description**	**Type**	**Bank Width (feet)**	**Water Width (feet)**	**Water Depth (feet)**
S1AJA001/Terminal	Ditch	Intermittent	4	1	1.0
S1AJA002/Terminal	Canal	Perennial	40	40	2.0
S1AJA003/Terminal	Canal	Perennial	60	40	2.0
S1AJA004/Terminal	Pond (2.5 acre)	Perennial	440	430	4.0
S1AJA005/Terminal	Ditch	Perennial	20	8	0.5
S1AJA006/Terminal	Pond (0.1 acre)	Perennial	50	40	4.0
S1AJA007/Terminal	Ditch	Perennial	20	10	2.0
S1AJA008/Terminal	Ditch	Intermittent	20	10	0.5
S1AJA009/Terminal	Ditch	Intermittent	15	4	0.5
S1AJA010/Terminal	Ditch	Perennial	varied	varied	1.5
S1AJA011/Terminal	Ditch	Intermittent	25	8	1.0
S1AJA012/Terminal	Ditch	Intermittent	30	8	1.0
S1AJA013/Terminal	Ditch	Intermittent	40	6	1.0
S1AJA014/Interconnects	Canal	Perennial	45	12	0.5
S1AJA015/Terminal	Ditch	Intermittent	15	6	1.0
S1AJA015/NGL	Ditch	Perennial	15	15	1.5
S1AJA016/NGL	Ditch	Perennial	15	15	1.5
S1AJA017/NGL	Ditch	Perennial	15	15	1.5
S1AJA018/NGL	Ditch	Perennial	15	15	1.5
S1AJA019/NGL	Ditch	Perennial	15	15	1.5
S1AJA020/NGL	Canal	Perennial	70	40	1.5
S1AJA021/Interconnects	Canal	Perennial	85	60	4.0

Virtually all of the onshore waterbodies that would be affected by the proposed Project are artificially constructed canals, ditches, or ponds. Bayou Casotte Energy qualitatively characterized all of the affected onshore waterbodies as of "low quality," indicating that there were significant disturbances associated with the channels and riparian areas and that available aquatic habitat was marginal or generally unsuitable. All of the waterbodies have sandy substrates, carry a "warmwater" State fisheries designation, and have a designated use of "fish and wildlife." None of the onshore waterbodies are designated as sensitive resources or as sources for public surface water intakes.

4.3.2.2 Impact and Mitigation

Construction

The proposed Project could affect the quality of surface water resources in the proposed Project vicinity in several ways. Potential impacts to surface waters related to construction include runoff from the terminal site during excavation and construction, sedimentation, turbidity, accidental spills, and

possible mobilization of contaminants associated with dredging of the terminal's slip. Marine water quality in the Gulf of Mexico could also potentially be affected by the proposed disposal of dredged sediments at the Pascagoula Ocean Dredged Material Disposal Site (ODMDS), which is located approximately 11 nautical miles offshore. Hydrostatic testing of the LNG storage tanks and pipeline interconnects could also result in potential effects, which are discussed below.

Impacts Associated with Terminal Construction Excavation

The proposed Project would involve the excavation and removal of approximately 1.0 mcy of soil located at or above the water table from the proposed terminal slip. The excavation would be accomplished with standard earthmoving equipment and the excavated material would be stockpiled on-site and used for fill, leveling, and construction of the proposed LNG terminal.

Impacts to the 14 onshore waterbodies associated with the proposed terminal site would be permanent. All onshore waterbodies at the terminal site would be filled, graded, or otherwise altered during site preparation and excavation, and each would be permanently converted to uplands. However, given that the onshore waterbodies at the proposed terminal site are located in a previously disturbed, heavily impacted industrial area, are wholly man-made, and are of low quality, we conclude that construction of the proposed LNG terminal would not result in a significant adverse effect to surface freshwater resources. Rather, existing drainage patterns including artificial onshore waterbodies that were created and modified to meet the needs of past industrial development would be altered to meet the needs of the proposed industrial development. Drainage at the proposed terminal site following construction would be controlled during operations through a new stormwater management system, as discussed below. Mitigation for permanent impacts to existing onshore waterbodies at the terminal site may be required as part of the permitting required by agencies including the COE, MDMR, and MDEQ.

Runoff

Runoff from the terminal site to Bayou Casotte during construction would be controlled and minimized through implementation of Bayou Casotte Energy's Plan, as modified in this EIS (see below), which includes installation of temporary and permanent erosion control measures such as silt fencing, straw bales, slope breakers, sediment barriers, mulch, trench breakers, re-vegetation, daily inspection of cleared areas, and monitoring and maintenance of previously disturbed areas. Additionally, and as a requirement of the general permit for construction stormwater discharge that might be issued by the MDEQ, Bayou Casotte Energy has developed a site-specific SWPPP that details the BMPs to be used during construction (see Appendix C).

Dredging

Following excavation of soils above the water table at the terminal site, remaining soils and sediments (approximately 3.5 mcy) at the proposed terminal slip would be removed using mechanical clamshell or dragline dredges mounted on barges. The slip would be dredged to an initial depth of 46 feet MLLW, and the sides of the slip would be sloped at a 5:1 ratio, covered with geotextile fabric, and lined with protective stone riprap as construction proceeds. It is anticipated that dredging would occur on a continuous, 24-hour a day basis, except during brief periods of down time associated with equipment maintenance, weather, or other unplanned reasons. Dredging operations would last for approximately six months.

Under existing conditions, Bayou Casotte is a turbid estuary. Water quality data collected by MDEQ indicated that Bayou Casotte had a median TSS level of 36 mg/l and a mean TSS level of 55 mg/l. Bayou Casotte Energy modeled the potential for suspension of sediment associated with dredging of the

slip using the COE's DREDGE model. The analysis indicated that maximum predicted levels of total suspended solids (TSS) would be 19.9 mg/l at a distance of approximately 30 feet from the dredging activity, with concentrations of TSS dropping at distances further away from the activity. Thus, the estimated levels of TSS associated with construction of the proposed Project would be similar to or below existing background levels for Bayou Casotte. Furthermore, as a federal navigation project, Bayou Casotte is already routinely subjected to periodic COE maintenance dredging and the associated suspension of sediments into the water column. Even though the anticipated impacts to marine water resources would be small, Bayou Casotte Energy is consulting with MDEQ, MDMR, COE, and NOAA Fisheries regarding the possible development of BMPs to further reduce sedimentation and turbidity during construction and maintenance dredging. In addition, Bayou Casotte Energy would be required to conduct water quality monitoring as a condition of its Section 401 Water Quality Certification. Based on the results of water quality monitoring, Bayou Casotte Energy could adjust the rate of dredging to reduce impacts resulting from elevated TSS levels. Based on the existing TSS levels and the implementation of Bayou Casotte Energy's mitigation measures, as well as those developed in consultation with the applicable agencies, we believe that potential impacts on water quality associated with the proposed dredging activities would be sufficiently minimized.

Disposal of Dredged Material

Bayou Casotte Energy has developed a DMMP that describes the dredging and material placement operations that would be needed for construction and operation of the proposed Project. In the DMMP, Bayou Casotte Energy proposes to place sediments dredged from the terminal slip into bottom dump scows for disposal at the EPA's permitted Pascagoula ODMDS, which is located in the Gulf of Mexico south of Horn Island. Assuming an average scow capacity of approximately 3,000 yd^3 and Bayou Casotte Energy's estimate that up to 10 scow loads per day would place dredged spoils at the Pascagoula ODMDS, it would take approximately six months to complete dredging operations.

Bayou Casotte Energy developed an agency-approved plan to test sediments prior to final selection of disposal methods and sites. Results of this plan were submitted to the COE on July 27, 2006 as part of Bayou Casotte Energy's Joint Permit (see Section 4.2.2 and Appendix E). Furthermore, and if approved for use, Bayou Casotte Energy would perform a bathymetry survey of the ODMDS following disposal, and EPA would conduct sediment mapping.

The Pascagoula ODMDS routinely accepts spoils from Bayou Casotte, and the site was designed for use by multiple entities, including the adjacent Chevron Pascagoula Refinery (EPA 1991). The disposal of dredged sediments at the ODMDS was evaluated in an EIS prepared by the EPA (1991), in coordination with the U.S. Navy and COE as cooperating agencies. At that time, the COE required a disposal site for spoils resulting from maintenance dredging within the federal shipping channel extending from the Gulf of Mexico to Mississippi Sound, the Pascagoula River, and Bayou Casotte. The EPA concluded that impacts associated with placement of the dredged materials in the ODMDS would be localized to the vicinity of the disposal site and that they "would not significantly alter the long-term productivity of the site."

For the reasons outlined above, we do not anticipate that disposal of sediments excavated from the proposed LNG terminal slip would result in significant adverse effects to marine surface waters. The Commission and Bayou Casotte Energy are proceeding under the assumption that sediments would be suitable for placement in the ODMDS. However, the final agency approvals required pursuant to Section 103 of the MPRSA have not yet been obtained (see Section 4.2.2).

Waterbody Crossings Associated with Pipeline Facilities

Bayou Casotte Energy proposes to use open-cut construction techniques to cross all of the affected waterbodies during installation of the proposed pipeline interconnects and the nonjurisdictional NGL pipeline. In order to minimize potential environmental impacts, the NGL pipeline would be completely collocated with the proposed interconnect spur, the existing Gulfstream pipeline, and the existing MPC electric transmission line right-of-way.

The greatest potential impact of the open-cut construction method on surface waters would be turbidity and sedimentation caused by instream construction or by erosion of cleared waterbody banks. The FWS also commented that it was concerned that open-cut trenching might lead to head cutting that could result in bank sloughing and channel erosion. The extent of the impact would depend on existing sediment loads, stream velocity, turbulence, waterbody bank composition, sediment particle size, and the extent of the disturbance to the channel. To minimize the potential for impacts to water quality, open-cut crossings would be accomplished in accordance with Bayou Casotte Energy's Procedures, as modified in this EIS (see below), which include measures to: (1) limit clearing of vegetation adjacent to waterbodies, (2) maintain adequate flow rates, (3) install equipment bridges, (4) complete instream construction activities, including restoration of the streambed contours, within 48 hours, (5) install and maintain sediment barriers, (6) stabilize waterbody banks within 24 hours of completion of instream construction, and (7) revegetate disturbed riparian areas. Given the anticipated rapid restoration of the streambed contours and the relatively flat topography and channel gradients in the area, we do not anticipate that head cutting in waterbodies crossed by the proposed pipeline interconnects would be likely to occur or result in significant impacts. Additionally, Bayou Casotte Energy would comply with any waterbody permit and mitigation requirements specified by the COE, MDMR, and MDEQ. Given the relative low quality of the onshore waterbodies crossed by the proposed pipeline interconnects and NGL pipeline, as well as required measures to prevent or minimize impacts, we conclude that the crossings would not result in more than a temporary adverse effect to fresh water resources.

Bayou Casotte Energy's Proposed Variances to the FERC's Procedures

In response to past concerns raised by federal, state, and local agencies, the FERC developed Procedures to provide a baseline level of protection for surface waterbodies and wetlands crossed during pipeline construction. The FERC's Procedures include requirements for pre-construction planning, environmental inspection, specific construction methods, sediment and erosion control, restoration, and post-construction maintenance. Bayou Casotte Energy has requested certain variances from the FERC's standard Procedures. In the case of construction activities at the terminal site, waterbodies and wetlands would not simply be crossed and then restored, rather they would be filled, graded, or otherwise completely removed. Because of the large-scale, permanent modification of the proposed terminal site, we recognize that certain construction activities would be required within, and immediately adjacent to, existing waterbodies and wetlands. Due to this feature of the proposed Project, some of the standard measures in the FERC's Procedures would not be applicable at the proposed LNG terminal site including:

- restriction of extra workspace within 50 feet of a waterbody or wetland (Sections V.B.2.a, V.B.2.b, VI.B.1.a, VI.B.1.b);
- marking of waterbody and wetland boundaries and buffers (Sections V.B.3.f, VI.A.4);
- restriction of placement of spoil within 10 feet of the water's edge (Sections V.B.4.a); and
- limitation of vegetation maintenance along waterbodies to allow a riparian strip 25 feet wide (Section V.D.1).

The FERC's acceptance of these requested variances applies only to the proposed LNG terminal site. Other areas that would be affected by construction of the proposed pipeline interconnects must comply with the FERC's standard Procedures, regardless of whether access is obtained via easement agreement.

Additionally, Bayou Casotte Energy proposed several variances that are relatively minor modifications, reflect consideration of site conditions, and that offer similar levels of environmental protection as provided by the FERC's Procedures. Those measures, which are approved, include:

- use of salvaged flat bed rail cars or equivalent in addition to flexi-float or portable bridges (Section V.B.5.b) ;
- that sediment barriers would allow for ingress and egress to any equipment bridges present (Section V.B.10.a); and
- use of flexible channel liners in addition to seeding and erosion control fabric as vegetative stabilization techniques (Section V.C.5).

Any proposed expansion of the construction right-of-way associated with waterbodies or wetlands must be approved in writing by the Commission on a site-specific basis prior to construction. Although the FERC would consider site-specific requests for a variance based on conditions that may be encountered during construction, the FERC does not expect that this variance would be required for all wetland crossings. Additionally, Bayou Casotte Energy proposed numerous other variances from the FERC's Procedures that either were not sufficiently supported or did not offer similar levels of environmental protection. These other proposed variances have been rejected.

Therefore, **we recommend that:**

- **Except for the proposed variances specifically approved above, Bayou Casotte Energy should revise its proposed Procedures to be consistent with the FERC's standard Procedures, as modified in this EIS. The revised Procedures should be filed with the Secretary for review and written approval by the Director of OEP prior to construction.**

Hydrostatic Testing

Bayou Casotte Energy would perform a hydrostatic test for structural integrity of the LNG transfer lines, storage tanks, and all pipelines prior to operation. The hydrostatic testing would be conducted in accordance with the DOT's specifications (49 CFR 192). Pending completion of water suitability and compatibility analyses and MEDQ approval, Bayou Casotte Energy proposes to withdraw approximately 28 million gallons of test water at a rate of approximately 264,000 gallons per hour from Bayou Casotte. Test water would be sequentially re-used for hydrostatic testing of each LNG storage tank, being transferred through the LNG transfer lines to each of the three tanks, thereby minimizing water withdrawals to the extent possible. The same test water, albeit a smaller amount (approximately 450,000 gallons) would also be re-used for hydrostatic testing of the pipeline interconnects. Additionally, it is anticipated that a separate 135,000 gallons of test water would be used to test the nonjurisdictional NGL pipeline.

Following completion of hydrostatic testing, the water would be analyzed to determine whether treatment is required prior to discharge. Treatment measures could include filtration, oil/water separation, clarification, carbon adsorption, and chemical injection. After determination that the water is suitable for discharge or sufficiently treated, it would then be discharged back to Bayou Casotte at the completed terminal slip at a rate of approximately 60,000 to 120,000 gallons per hour. To prevent erosion, energy

dissipation devices and erosion control techniques such as hay bales and silt fencing would be used during discharge of hydrostatic test water. Bayou Casotte Energy anticipates hydrostatic testing for the LNG tanks and pipeline interconnects would take approximately 16 and two weeks to complete, respectively. Given its anticipated schedule, Bayou Casotte Energy estimates that hydrostatic testing would occur in the spring or summer seasons.

If required as a result of suitability analyses that would be performed prior to the start of hydrostatic testing, additives could be combined with the hydrostatic test water. These additives could include biocides that prevent corrosion caused by bacteria, other corrosion inhibitors, oxygen scavengers, and leak detection tracers. All of the potential additives except leak detection tracers are considered potentially toxic in the aquatic environment. Bayou Casotte Energy is in the process of consulting with MDEQ regarding the hydrostatic test water and the use of such additives, should they become necessary. To minimize the potential for impacts to water quality from hydrostatic testing, **we recommend that:**

- **Bayou Casotte Energy submit the results of consultations with MDEQ regarding the use of hydrostatic test water additives to the Commission prior to the start of construction, and not use corrosion inhibitors, biocides, oxygen scavengers, or other hydrostatic test water additives that exhibit toxicity to aquatic organisms without prior written approval by the Director of OEP.**

Bayou Casotte Energy has proposed several measures to minimize impacts to water quality resulting from hydrostatic testing. These measures include:

- withdrawal from and discharge to water sources in compliance with agency requirements in consideration of the protection of fishery resources on a case-by-case basis;
- compliance with all permit requirements; and
- screening of intakes to avoid entrainment and impingement of fish and other aquatic organisms.

Additional discussion regarding hydrostatic testing and potential effects to fishery resources is included in Section 4.5. Given the proposed minimization of water withdrawals to the extent possible, Bayou Casotte Energy's measures to prevent or minimize impacts, ongoing consultations with MDEQ and NOAA Fisheries that may result in additional protective measures, and the FERC's recommendation regarding the use of hydrostatic test water additives, we conclude that hydrostatic testing of the proposed Project would not result in more than a temporary adverse effect to water resources.

Mobilization of Contaminants

Potentially contaminated soils and sediments at the terminal site have been largely identified and delineated during previous environmental site assessments. These contaminated sediments are located at or near the ground surface and they would be removed by focused excavation activities prior to the start of generalized excavation or dredging at the terminal site. Additionally, the suitability of the dredged material from the proposed terminal slip for placement at the ODMDS has not yet been approved by the COE and EPA. All contaminated soils and sediments would be properly disposed of off-site at permitted landfills in compliance with EPA's guidelines and solid waste management procedures (40 CFR 260-265). Given that contaminated soils and sediments have been delineated and would be removed through focused excavations prior to the start of general excavation and dredging, the risk of mobilization of contaminants to Bayou Casotte or other areas is small.

Accidental Spills

Surface waters could potentially be impacted from the inadvertent release of fuel, oil, or other hazardous fluids during transfer (e.g., refueling) or storage of these materials near surface waterbodies. Water quality in the vicinity of the spill would be impaired and acute, and chronic toxic effects to aquatic organisms could occur. Impacts from fuel spills would be avoided or minimized through implementation of guidelines presented in Bayou Casotte Energy's Plan and Procedures, as modified in this EIS, and Bayou Casotte Energy's SPCC Plan. As discussed in Sections 4.2.1 and 4.3.1, Bayou Casotte Energy has developed a SPCC Plan for construction activities (see Appendix D). In Section 4.2.1 we have recommended that Bayou Casotte Energy submit an operational SPCC Plan prior to the start of construction.

Operation

Potential impacts related to operation of the proposed Project include stormwater runoff; accidental spills; bank erosion caused by waves or vessel propeller wash; intake and discharge of ballast water and cooling water by LNG marine traffic and other vessels visiting the terminal; effects of the terminal slip on water quality; and maintenance dredging. Because the primary LNG vaporization system would operate in a closed loop using waste heat from the Chevron Pascagoula Refinery, significant volumes of cooled waters would not be discharged as a result of operation of the proposed Project.

Stormwater Runoff

Storm water at the proposed terminal site would be routed by surface ditches and swales adjacent to roads and the hurricane levee before collection in catch basins. Storm water collected inside of the hurricane levee would be pumped over the levee to the storm sewer systems outside of the levee. Areas subject to spills of oil and lubricants would be drained to a separate collection area and oil separator. Recovered oil would be transported off-site for recycling or disposal and treated oily water would be pumped to the sanitary system for treatment and disposal. Curbed areas would be used to contain spills and prevent contamination of storm water. Storm water would collect in four basins and would ultimately be discharged via two new outfalls into Bayou Casotte. Bayou Casotte Energy would employ general BMPs including good housekeeping, preventative maintenance, visual inspections, spill prevention and response, and management of runoff. The specific measures that would be implemented by Bayou Casotte Energy during operations would be identified in an Industrial SWPPP, which would be required to comply with the provisions of a NPDES Industrial Stormwater Permit, if issued by MDEQ. In Section 4.2.1, we have included a recommendation for Bayou Casotte Energy to finalize the Industrial SWPPP in consultation with MDEQ prior to the start of construction.

Accidental Spills

Measures to prevent or minimize the effects of accidental spills, including spills of LNG, during construction are discussed in Sections 4.2.1 and 4.3.1. Additionally, in Section 4.2.1, we have included a recommendation that Bayou Casotte Energy develop and finalize an operational SPCC Plan prior to the start of construction. The measures identified in the operational SPCC Plan would prevent or minimize the effects of any accidental spills during operation.

The LNG terminal was designed to account for an accidental spill of LNG during operation of the facility and to prevent any LNG from entering Bayou Casotte. In the unlikely event that LNG is spilled into the water either from the LNG terminal itself or from an LNG carrier during transit to the LNG terminal, 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 would completely vaporize shortly after being spilled, the LNG could not mix with or contaminate the water. Additional information on the environmental impacts resulting from LNG ships and transit is provided in Section 4.12.5.3.

Bank Erosion

Bank erosion could reduce bank stability and result in increased turbidity and suspended sediments in Bayou Casotte and adjacent areas. However, it does not appear that the location, size, and shape of the proposed terminal slip would result in significantly modified flow velocities or wave action that could promote increased erosion of the channel banks. The proposed slip would have only very localized effects on velocities and the area proposed for dredging is small compared to the much larger open-water area where waves develop. Additionally, the movement of large vessels, such as LNG carriers or crude oil tankers, has the potential to result in bank erosion and associated turbidity through creation of waves or wakes caused by propeller wash. However, the proposed terminal site is located near the downstream end of an existing shipping channel and erosion within the proposed slip would be limited by the use of rock riprap overlaid on a geotextile fabric. Bank erosion could occur as a result of the LNG vessel passage between Petit Bois and Horn Islands, and when vessels operate near and/or at the facility's berthing area. Because of the anticipated speed of the LNG vessels transiting the waterway and the distance from Petit Bois and Horn Islands to the transit channel, bank erosion would not be significant. Given these factors, potential effects to water quality from bank erosion would be small.

Intake of Ballast Water and Cooling Water by LNG Carriers

LNG carriers would take on ballast water to maintain stability and use seawater to cool engines during offloading of LNG at the proposed terminal. These activities have the potential to use large quantities of water from Bayou Casotte. A single LNG carrier could take on approximately 15 million gallons of ballast water during each offloading operation, and given that approximately 170 vessels may visit the proposed terminal each year, up to 2.5 billion gallons of ballast water could be withdrawn from Bayou Casotte on an annual basis. Additionally, LNG carriers use seawater to cool their engines during LNG offloading operations. This process could use approximately 15 to 42 million gallons of seawater per offloading event (depending on whether the carrier is steam or electric powered), and could result in the use of approximately 4.8 billion gallons of seawater on an average annual basis.

Given the location of the proposed terminal site near the mouth of Bayou Casotte, adjacent to Mississippi Sound and the Gulf of Mexico, sufficient water is available to provide the quantities necessary for ballast and engine cooling operations. Because the LNG ships would be fully loaded with LNG when transiting to and arriving at the proposed terminal, no ballast water would be discharged along the waterway in the Mississippi Sound. It is anticipated that ballast water would be taken on and retained during LNG offloading operations and no ballast water would be discharged in Bayou Casotte. There is potential for harm to the marine environment through introduction of exotic and invasive marine organisms from ballast operations, and these potential impacts are discussed in Section 4.5.2. Additionally, the transited waterway is an active commercial shipping channel already subject to the withdrawal and discharge of vessel engine cooling water, and that activity would not substantially affect water quality in the proposed Project area. Furthermore, heavy shipping traffic augments the mixing and circulation of water in the waterway, thus reducing impacts from ballast water and cooling water intake.

Effects of Slip Creation on Water Quality

Impacts could occur to water quality within the proposed terminal slip and adjacent Bayou Casotte due to the recessed nature of the slip and the potential for stagnation. However, the potential for these impacts would be eliminated or effectively minimized through tidal flushing and regular LNG

carrier, crude oil tanker, and tug traffic. Also, the generally shallow nature of the slip would reduce the potential for adverse impacts. However, Bayou Casotte Energy is in the process of consulting further with MDMR and MDEQ regarding the proposed slip and potential effects on water quality, and therefore **we recommend that:**

- **Bayou Casotte Energy complete consultations with MDMR and MDEQ regarding potential impacts to water quality within or adjacent to the proposed terminal slip and file a report documenting the findings of those consultations and any required mitigation or monitoring measures with the Secretary prior to the start of construction.**

Maintenance Dredging

According to preliminary modeling, Bayou Casotte Energy estimates that maintenance dredging of the proposed terminal slip could generate up to about 250,000 yd^3 of material per year during operations, as described in Section 2.7.1. In the DMMP, Bayou Casotte Energy has identified placement of maintenance dredge materials at the Pascagoula ODMDS as its primary disposal option. Bayou Casotte Energy has also indicated that it would consider placement of maintenance dredge materials at beneficial use sites, as well as coordination of maintenance dredging with the COE's routine maintenance dredging of the Bayou Casotte channel.

As discussed previously in relation to initial dredging associated with construction of the proposed terminal slip, Bayou Casotte is an industrialized shipping channel that is already subject to routine maintenance dredging by the COE. Additionally, Bayou Casotte Energy is in the process of consulting with MDEQ, MDMR, COE, and NOAA Fisheries regarding the development of dredging BMPs and possible monitoring measures. Furthermore, Bayou Casotte Energy has filed its dredge material suitability testing results and evaluations pursuant to Section 103 of the MPRSA (see Appendix E). Final approvals from EPA and COE regarding selection of the Pascagoula ODMDS as the dredge material placement site have not been made. With implementation of the measures and recommendations, it is not anticipated that maintenance dredging would result in significant effects to marine surface waters, especially given the existing turbid nature of Bayou Casotte.

4.4 VEGETATION AND WETLANDS

4.4.1 Habitat/Community Types

The Casotte Landing LNG Project is located in a coastal setting comprised of the marine environment of the waterway and berthing facility transitioning to estuarine and upland communities farther inland. Dominant vegetation types of the proposed Project were identified during field evaluations performed by the Bayou Casotte Energy in April 2005 and December 2005. Hurricane Katrina is likely to have had a short-term impact on upland vegetation communities in the Project area. Salt stress associated with the storm surge may have resulted in temporary die-off of some plant species, but not to the extent that the communities mapped and characterized prior to the hurricane are invalid. Additionally, some of the field evaluations performed for the proposed Project were conducted following the hurricane.

Vegetation in the Project area includes upland and wetland communities as described below. Two general categories of upland vegetation were identified: commercial/industrial associated vegetation and right-of-way associated vegetation. Wetlands identified by Bayou Casotte Energy were classified as palustrine emergent, palustrine scrub-shrub, palustrine forested, estuarine emergent, or estuarine scrub-shrub. The wetland communities potentially affected by the Project are discussed in Section 4.4.3. Submerged aquatic vegetation does not occur in the immediate vicinity of the proposed Casotte Landing Project. The nearest submerged aquatic vegetation community is located approximately 4 miles east of

the proposed terminal site. The LNG marine traffic, however, would transit confined areas between the barrier islands and the mainland, where submerged aquatic vegetation could be present. Beach dunes also exist on Petit Bois and Horn Islands along the LNG ship transit route.

Submerged aquatic vegetation, or seagrass, occurs in relatively shallow coastal waters of the Mississippi Sound as a result of depth-limited penetration of sunlight associated with the relatively turbid waters of the coast. Seagrass occurs in open waters from 1 to 9 feet deep, typically in a sandy substrate with various amounts of shells and shell fragments (MDMR 1998a). Seagrass beds commonly consist of turtle grass (*Thalassia testudinum*), shoal grass (*Halodule wrightii*), and manatee grass (*Syringodium filiforme*). Submerged vegetation near the mainland is dominated by two species; widgeon grass (*Ruppia maritime*) and to a lesser extent tape grass (*Vallisneria americana*).

The beach dune community on both Petit Bois and Horn Islands consists of two distinct plant associations. The hardy pioneer plants colonize the foredune and are dominated by sea oats, which are able to survive both partial burial by sand and exposure of the root system when sand is blown away. The extensive root system of this plant aids in dune stabilization. On the protected lee side of the dune a large variety of plants occur, including beach grass, bunch grass, prickly-pear cactus, and golden aster (National Park Service 2006).

4.4.1.1 LNG Terminal Facilities

The terminal site is a heavily disturbed and previously developed area within an industrial port setting. The commercial/industrial associated vegetation present at the site is representative of this disturbance, and is generally sparse, fragmented and of low quality. About 115 acres of commercial/industrial land-associated vegetation would be impacted by the construction of the proposed terminal. No upland forested areas occur at the proposed terminal site. Field surveys found that the commercial/industrial associated vegetation at the terminal site was dominated by herbaceous species such as blackberry (*Rubus argutus)*, dogfennel (*Eupatorium capillifolium)*, broomsedge (*Andropogon virginicus*), and invasive, exotic species, which are discussed further below.

Following construction, the entire terminal site would be permanently converted to industrial use. Although operation of the proposed LNG terminal facilities would permanently remove native vegetation, these impacts are not expected to be significant on a regional scale because areas with similar vegetation characteristics are common in surrounding areas. Additional information on the environmental impacts resulting from the transit of the LNG ships is provided in Section 4.12.5.3.

Additional impacts on vegetation could occur as a result of construction and operation of the nonjurisdictional electrical transmission facilities associated with the LNG terminal. However, the final route for these facilities has not been determined.

4.4.1.2 Interconnect Pipeline and Associated Aboveground Facilities

The proposed interconnect pipeline would traverse existing rights-of-way along Ranson Road and West Hardee Road. The nonjurisdictional NGL pipeline and the pipelines associated with the nonjurisdictional water circulation system would traverse areas of upland vegetation associated with the Chevron Pascagoula Refinery perimeter. The upland vegetation associated with these areas is similar in composition to that identified at the proposed terminal site and is frequently disturbed by routine maintenance activities. No upland forested areas occur along the proposed pipeline interconnect route.

Construction of the proposed interconnect pipeline would temporarily affect 2.1 acres of upland herbaceous vegetation associated with existing rights-of-way. The proposed nonjurisdictional NGL

pipeline and circulation water system would affect 16 and 7.9 acres, respectively, of similar commercial/industrial land associated vegetation.

During construction, existing vegetation including herbaceous and shrub species would be temporarily removed from within the pipeline construction right-of-way and other workspaces as necessary. The impacts of clearing vegetation generally include the loss of habitat, habitat fragmentation, increased absorption of solar radiation into affected soils, and a greater potential for surface water movement/erosion.

To minimize impacts on vegetation, Bayou Casotte Energy has routed the proposed interconnect pipeline and nonjurisdictional facilities so that they would be collocated with existing facilities to the maximum extent possible. Additionally, Bayou Casotte Energy would restore the construction right-of-way in accordance with its Plan and Procedures, as modified in this EIS. Implementation of the measures provided in its modified Plan and Procedures would minimize potential long-term impacts on vegetation by allowing annual maintenance of only a 10-foot-wide strip centered over the pipeline. Additionally, routine vegetation maintenance across the entire permanent right-of-way could occur only once every three years in uplands and would be restricted in wetlands to the periodic clearing of trees greater than 15 feet in height that are within 15 feet of the pipeline centerline. Therefore, we believe that impacts resulting from construction and operation of the proposed pipeline and aboveground facilities would not significantly affect vegetative resources.

4.4.2 Invasive Plant Species

Upland areas at the proposed terminal site and along the proposed pipeline interconnects provide habitat conducive to the propagation of invasive exotic weeds and nuisance vegetation. Invasive plant species observed during field surveys of the terminal site and along the proposed pipeline routes include Chinese tallow (*Sapium sebiferum*), Chinese privet (*Ligustrum sinense*), cogongrass (*Imperata cylindrica*), and Japanese honeysuckle (*Lonicera japonica*). Invasive exotic and nuisance plants are typically fast growing hardy species that out-compete native species for nutrients, sunlight, and space. These species may be difficult to control due to aggressive and efficient reproduction patterns, as well as a lack of natural controls, such as insects and herbivores.

4.4.3 Wetlands

Section 404 of the CWA protects the jurisdictional waters of the United States, including wetlands. “Wetlands” is a collective term for swamps, marshes, bogs, wet meadows, and similar areas that are often located between open water and dry land. A wetland is defined as an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation (COE 1987).

Bayou Casotte Energy identified wetland areas using desktop evaluation of National Wetland Inventory Maps, United Stated Geologic Survey 7.5 Minute Quadrangle Topographic Maps, and aerial photography, followed by field delineations at the terminal site in April 2005 and along the proposed pipeline interconnects and NGL pipeline route in April and December 2005. Field delineations were performed according to the COE Wetland Delineation Manual (COE 1987). Wetland boundaries were surveyed and the linear distance and acreage of impact to wetlands in the Project area were calculated by overlaying the proposed terminal and aboveground facility boundaries and construction rights-of-way on the surveyed wetland boundaries. Wetland jurisdictional determinations are usually valid for at least five years unless the land is altered. The COE is responsible for approving wetland delineations and permitting all wetland impacts. COE staff and Bayou Casotte Energy completed field verification of the

wetlands and waterbodies that would be affected by the proposed Project in January 2006. Though Hurricane Katrina is likely to have had a short-term impact on freshwater wetlands in the Project area, additional surveys, as well as field verification efforts, were completed following the effects of that storm.

All wetlands that would be impacted by the proposed terminal and pipeline facilities were described using the Classification of Wetland and Deepwater Habitats of the United States (Cowardin et al. 1979). Wetlands identified by Bayou Casotte Energy were classified as palustrine emergent (PEM), palustrine scrub-shrub (PSS), palustrine forested (PFO), estuarine emergent (EEM), or estuarine scrub-shrub (ESS) based on their primary vegetative stratum. Descriptions of these classifications are summarized below.

Freshwater wetlands dominated by erect, herbaceous vegetation (e.g., grasslands or stands of reedy growth) are classified as PEM wetlands. This wetland type generally has less than 20 percent coverage by shrubs or trees. Freshwater wetlands with extensive woody vegetation less than 20 feet tall are classified as PSS wetlands. PSS wetlands generally have greater than 60 percent coverage by shrubs and less than 20 percent coverage by trees. Freshwater wetlands with greater than 50 percent coverage by trees greater than 20 feet in height are classified as PFO wetlands. PFO wetlands often consist of an overstory dominated by deciduous, broad-leaved tree species and an assortment of herbaceous plants and vines that occur as ground cover and in the forest subcanopy.

EEM wetlands are semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean. Salinity in EEM wetlands may be periodically increased above levels found in the ocean due to evaporation, but they are typically diluted by freshwater runoff from the associated watershed. EEM wetlands are dominated by herbaceous vegetation and have less than 20 percent coverage by shrubs or trees, while ESS wetlands are dominated by woody vegetation less than 20 feet tall.

4.4.3.1 LNG Terminal Facilities

Twelve wetlands occur at the proposed terminal site (Table 4.4.3-1). These include eight freshwater wetlands, which are classified as PSS, PEM, PSS/PEM, or PFO wetlands, and four estuarine wetlands, which are classified as ESS and EEM wetlands. The freshwater wetlands total approximately 66.2 acres. In general, all of these wetlands are of relatively low to medium quality due to the effects of prior disturbance at the site and prevalence of exotic and nuisance vegetation. The PSS wetlands at the terminal site contain a scrub-shrub layer dominated by Chinese tallow and black willow (*Salix nigra*) with an understory of spikerush (*Eleocharis spp.*) and cattail (*Typha spp.*), which is considered a nuisance species. Spikerush and cattail were the most common vegetative species in PEM wetlands.

Approximately 45 percent, about 53.1 acres, of the wetlands that occur at the proposed terminal site are classified as ESS, with a much smaller amount of EEM and mixed ESS/EEM wetlands. These estuarine wetlands, which are located along the southern portion of the proposed terminal site, are considered to be of low to moderate quality. Vegetation in the EEM wetlands that occur at the terminal site is comprised mostly of panic grass (*Panicum spp.*), bulrush (*Scirpus spp.*), cogongrass, and black needlerush (*Juncus romerianus*). The ESS wetlands also contain these species, as well as shrubs such as Chinese tallow, wax myrtle (*Myrica cerifera*), common reed (*Phragmites australis*), and black willow.

TABLE 4.4.3-1
Wetlands Affected by Construction and Operation of the Proposed Casotte Landing Project

Wetland Identification Number	Wetland Classification	Area Affected During Construction (acres)[a]	Area Affected During Operation (acres)[b]
Terminal Site			
W1AJA001	PSS	7.8	7.8
W1AJA002	PSS/PEM	10.0	10.0
W1AJA003	PSS	18.7	18.7
W1AJA004	PSS/PEM	2.5	2.5
W1AJA005	PSS	0.2	0.2
W1AJA006	PEM	0.1	0.1
W1AJA007A	PSS	20.4	20.4
W1AJA007B	PSS	6.5	6.5
W1AJA007C (non-tidal)	ESS (non-tidal)	46.3	46.3
W1AJA007C (tidal)	ESS (tidal)	4.2	4.2
W1AJA007D	EEM (*Spartina patens*) (non-tidal)	2.4	2.4
W1AJA007E	EEM (*Juncus roemerianus*) (non-tidal)	0.2	0.2
Pipeline Interconnects			
W1AJA009	PSS/EEM	0.5	0
W1AJA010	EEM	12.0	0
Meter Station (Interconnect Laterals)			
W1AJA010	EEM	1.5	0.9
Meter Station (Interconnect Spur)			
W1AJA010	EEM	1.3	0.9
NGL Pipeline[c]			
W1AJA015	PFO/PEM/PSS	2.1	0.2
W1AJA014	EEM	3.7	0
W1AJA013	PEM/PSS	0.6	0
W1AJA011	PEM/PSS	2.3	0
W1AJA012	PEM/PSS	2.4	0

TABLE 4.4.3-1 (continued) Wetlands Affected by Construction and Operation of the Proposed Casotte Landing Project			
Wetland Identification Number	**Wetland Classification**	**Area Affected During Construction (acres)[a]**	**Area Affected During Operation (acres)[b]**
Meter Station (NGL Pipeline)[c]			
W1AJA012	PEM/PSS	1.2	0.7
	Totals	**146.9**	**122.0**

Notes:

[a] Includes the terminal site and the temporary and permanent construction rights-of-way and extra workspaces.

[b] Operational impacts for the LNG terminal and meter stations include the permanent loss of wetlands within the footprint of those facilities. Operational impacts for the pipeline facilities would only result where a 10-foot wide strip (centered over the pipeline) maintained as herbaceous wetland resulted in a conversion of forested wetlands.

[c] The NGL pipeline and meter station are nonjurisdictional facilities.

PSS – Palustrine Scrub-Shrub

PEM – Palustrine Emergent

PFO – Palustrine Forested

ESS – Estuarine Scrub-Shrub

EEM – Estuarine Emergent

4.4.3.2 Interconnect Pipeline Route

The proposed jurisdictional pipeline interconnects and meter stations would affect a total of two wetlands comprising 15.3 acres (Table 4.4.3-1), although one wetland (W1AJA010) would be separately affected by the interconnects and both meter stations. These wetlands are classified primarily as EEM, with a minor PEM component, and all are considered to be of medium quality. As these wetlands occur in low areas between or adjacent to roadways, hurricane levees, and spoil piles, they have been subjected to previous disturbance. Dominant plant species present at these EEM wetlands include black needlerush (*Juncus roemerianus*), cordgrass (*Spartina spp.*), and panic grass. The PEM are dominated by cattails and soft rush (*Juncus effusus*).

4.4.3.3 Nonjurisdictional Facilities

The nonjurisdictional NGL pipeline and associated meter station would affect five wetlands, totaling approximately 12.3 acres (Table 4.4.3-1), although one wetland (W1AJA012) would be separately affected by both of these facilities. These wetlands are mostly classified as PEM/PSS, with smaller EEM and PFO components. In general, these wetlands are of medium quality, but one EEM wetland (W1AJA014) was determined to be relatively undisturbed and of higher quality. The plant species present in these wetlands include panic grass, cordgrass, cattails, black needlerush, and loblolly pine (*Pinus taeda*).

4.4.4 Impact and Mitigation

The primary impact on vegetation from construction and operation of the proposed Project would be the temporary removal of vegetation from construction work areas and permanent alteration of vegetative cover at the proposed terminal site. Bayou Casotte Energy would use open-cut construction

techniques to install the entire length of the proposed pipeline interconnects and linear, nonjurisdictional facilities. However, Bayou Casotte Energy proposes to limit impacts to vegetation and wetlands by siting the LNG terminal in an existing, disturbed industrial site and overlapping or co-locating the nonjurisdictional linear facilities with existing rights-of-way through primarily industrialized areas.

4.4.4.1 Upland Vegetation

Approximately 117.1 acres of low quality vegetation would be affected by construction of the jurisdictional Project facilities associated with the proposed terminal site and pipeline interconnects. Most of this impact would be permanent, as development and operation of the terminal site would result in a permanent conversion of vegetative cover. The area at the proposed LNG terminal site would be completely graded, excavated, or otherwise modified to accommodate the proposed vessel slip and LNG terminal facilities. Following construction, upland areas not containing new infrastructure would be landscaped with gravel or turf grass. Although existing vegetation at the terminal site would be permanently impacted by the proposed Project, the vegetation is sparse, fragmented, and contains numerous exotic and invasive species.

Construction of the pipeline interconnects would affect 2.1 acres of low quality vegetation associated with existing rights-of-way. Additionally, construction of the nonjurisdictional NGL pipeline and water circulation system would temporarily affect an additional 23.9 acres of low quality upland vegetation associated with the Chevron Pascagoula Refinery perimeter. Impacts to vegetation along the construction rights-of-way for these facilities would be temporary, as disturbed upland areas would be restored, with little or no expected loss of cover type due to maintenance of the permanent rights-of-way. During the initial phases of upland construction, the construction right-of-way would be cleared and graded where necessary to provide a sufficiently wide and relatively level surface for the passage of heavy construction equipment (typically a minimum of 25 feet wide). Vegetation would be removed either by mechanical cutting or by hand. Trees and shrubs would be cut only where necessary to accomplish the installation of the pipeline and other facilities, and in accordance with state and local regulations and permitting.

To ensure successful restoration and revegetation, Bayou Casotte Energy would adhere to its Plan, as modified in this EIS (see Section 4.2.1), which includes installation of temporary erosion controls, permanent erosion control devices, soil compaction mitigation, soil additives, seeding, follow-up inspections, and monitoring. Revegetation would be considered successful if the density and cover of non-nuisance vegetation within areas disturbed by construction is similar to the density and cover in adjacent undisturbed areas.

During operation, normal maintenance procedures along the pipeline interconnect right-of-way would include regular mowing and periodic removal of woody shrubs (frequency cannot be more than once every three years). Turf grasses at the terminal site would be maintained by regular mowing. This landscaping and maintenance program would also control the presence and spread of exotic and invasive plant species.

Given the measures outlined above, the general low quality of the vegetation resources that would be affected by the proposed Project, and because this Project involves re-development of an existing disturbed industrial site for a new industrial use, we conclude that impacts to upland vegetation resources would not be significant.

4.4.4.2 Wetlands

Bayou Casotte Energy would limit wetland impacts by reducing the proposed terminal footprint to the minimum size practicable and by positioning the reduced footprint within the previously disturbed areas or lower quality wetland zones, as described in Section 3.4. Construction at the proposed terminal site and the jurisdictional and nonjurisdictional meter stations would result in a permanent conversion of affected wetland areas to maintained upland areas (Table 4.4.3-1). These wetlands include approximately 122.0 acres of palustrine and estuarine wetlands. Some wetland functions and wildlife habitat would be lost in the permanent conversion of wetland areas to uplands. Wetland loss could also affect water retention and recharge for the underlying aquifers, as would the removal of existing vegetation. However, the affected wetlands are of low to moderate quality and have limited functional value. Additionally, higher quality wetlands in surrounding areas would continue to provide functional benefits and wildlife habitat, such that permanent impacts would be relatively minor overall.

The impact of pipeline construction activities on wetlands could include the permanent and temporary alteration of wetland vegetation. Bayou Casotte Energy proposes to use open cut construction techniques to install the jurisdictional pipeline interconnects and the nonjurisdictional NGL. These activities would temporarily affect approximately 23.6 acres of predominantly moderate quality, estuarine and palustrine wetlands during construction (Table 4.4.3-1). The lone high quality EEM wetland (W1AJA014) that would be affected by construction of the nonjurisdictional NGL pipeline would not be permanently affected by operations, but construction of that facility would result in the permanent conversion of 0.2 acres of forested wetland (W1AJA015). Thus, the impact of proposed pipeline construction activities on wetlands would include the permanent and temporary alteration of wetland vegetation. Other impacts associated with construction of the proposed pipeline could include temporary changes to wetland hydrology, water quality (e.g., hazardous materials spills), and erosion/sedimentation. Effects typically would be greatest during and immediately following construction.

Construction and restoration of wetlands for the pipeline interconnects would be conducted in accordance with the Bayou Casotte Energy's Procedures, as modified in this EIS (see Section 4.3.2). Although the Bayou Casotte Energy requested expansion of the construction right-of-way in wetlands to 110 feet, the construction right-of-way in wetlands would be limited to 75 feet or less, unless site-specific approval for exceptions were granted by the Commission. During construction, protective measures would include, but not be limited to: marking of wetland buffers, location of all extra work areas at least 50 feet from wetlands, limitation of vegetative clearing, limitation of equipment operating in the wetland, and installation of temporary sediment controls.

Prior to construction, Bayou Casotte Energy would develop a Project-specific restoration plan in consultation with the COE and MDMR. Restored wetlands would be monitored by a qualified biologist annually for three years, followed by submittal of a report regarding the success of restoration to the Commission. If after two years of monitoring, the vegetation did not consist of at least 80 percent wetland species, appropriate native wetland species would be planted. If restoration is not considered successful after three years, monitoring would continue annually and a remedial revegetation plan would be developed. Bayou Casotte Energy's proposed Procedures, as modified in this EIS, would restrict maintenance activities in wetlands to a 10-foot-wide corridor centered on the pipeline, which could include regular mowing and periodic removal of woody shrub and tree species at a frequency not exceeding once every three years.

4.4.5 Compensatory Mitigation

For projects where wetland impacts are proposed, the COE requires that all appropriate and practicable actions be taken to avoid or minimize those impacts, pursuant to its Section 404(b)(1)

guidelines that restrict discharges of dredged or fill material where a less environmentally damaging and practicable alternative exists. All wetland crossings would be subject to review by the COE and MDMR under the Joint Section 404 permitting process. Bayou Casotte Energy submitted its Joint Permit Application with the COE on July 27, 2006.

To mitigate for unavoidable loss of wetland function if the proposed Project were approved, Bayou Casotte Energy proposed a wetland mitigation plan in its Joint Permit Application following consultation with the FWS, COE, and MDMR. Bayou Casotte Energy is considering several mitigation options, including restoration and enhancement of a local site and the purchase of mitigation credits from various mitigation banks and restoration projects. These options include Moss Point Mitigation Bank, Old Fort Bayou Mitigation Bank, and Round Island, Greenwood Island and Deer Island restoration projects. Mitigation banking is an approved alternative to on-site mitigation and often provides for greater likelihood of success in replacement of wetland function and long-term management of restored wetland areas. The proposed mitigation ratios are 1:1 for temporary construction-related impacts, 2:1 for permanent impacts, and 4:1 for permanent high-saltmarsh impacts.

Given the previously disturbed nature and relatively low quality of the wetlands that would be affected by the proposed Project, the measures that would be used to prevent or minimize effects, including Bayou Casotte Energy's Procedures, as modified in this EIS, and the requirement that Bayou Casotte Energy complete permitting and develop an agency approved wetland mitigation plan prior to construction, we conclude that impacts to wetland resources associated with construction and operation of the proposed Project would not be significant.

4.5 WILDLIFE AND AQUATIC RESOURCES

This section describes the terrestrial, fresh water, estuarine, and marine wildlife species and habitats that occur or could potentially occur in the area that would be affected by construction and operation of the proposed Project, including the waterway used by the LNG marine traffic to transit from the territorial sea to the berthing facility, and describes the potential effects on those species.

4.5.1 Terrestrial Wildlife

4.5.1.1 Existing Terrestrial Wildlife Habitats

The proposed Casotte Landing Project is located in the Coastal Plain region of southern Mississippi. The onshore habitats supporting terrestrial wildlife in the vicinity of the proposed Project have been extensively modified by past development and industrial uses. The proposed Project would re-develop these previously disturbed lands. Onshore habitats supporting terrestrial wildlife include upland habitats, open water habitats, and wetlands, as described in Sections 4.3 and 4.4. LNG marine traffic would also transit confined areas between the barrier islands and the mainland where submerged aquatic vegetation and beach dunes occur. The wildlife and aquatic resources associated with submerged aquatic vegetation is discussed in Section 4.5.2.1. Additional information on the environmental impacts resulting from the transit of the LNG ships is provided in Section 4.12.5.3.

Upland Habitats

Two categories of upland habitat occur at the proposed terminal site and along the proposed pipeline interconnects: right-of-way associated vegetation (2.1 acres) and commercial/industrial associated vegetation (115.0 acres, with an additional 23.9 acres affected by nonjurisdictional facilities). The proposed terminal site and upland areas located at the pipeline interconnects are heavily disturbed and are located in a previously developed area in an industrial setting. The vegetation types and habitats

present are representative of this disturbance and as such are sparse, fragmented, and of generally low quality. No forested upland areas occur at the proposed terminal site or along the proposed pipeline interconnects, and those upland areas that are present offer little to no habitat for wildlife foraging, resting, or nesting. Species that may occur at the proposed Project site are typical of disturbed or developed areas in the Coastal Plain, and a list of representative species is included in Table 4.5.1-1.

TABLE 4.5.1-1
Typical Wildlife Species that Occur in the Vicinity of the Proposed Casotte Landing Project

Common Name	Scientific Name
Opossum	*Dildelphis virginiana*
Raccoon	*Procyon lotor*
Red shouldered hawk	*Buteo lineatus*
Great blue heron	*Ardea herodias*
Turkey vulture	*Cathartes aura*
Bullfrog	*Rana catesbiana*
American alligator	*Alligator mississippiensis*
Five-lined skink	*Eumeces fasciatus*
Gray rat snake	*Elaphe obsoleta*

Open Water

Fourteen onshore waterbodies occur at the proposed terminal site, and two onshore canals would be traversed by the pipeline interconnects. Additionally, the nonjurisdictional NGL pipeline would cross five perennial ditches and one perennial canal.

Virtually all of the onshore waterbodies that would be affected by the proposed Project are artificially constructed canals, ditches, or ponds that offer minimal habitat for aquatic species. Only one onshore waterbody (S1AJA020), a tidally influenced creek that would be affected by the nonjurisdictional NGL pipeline, was identified as a natural waterbody. The only fish species observed by Bayou Casotte Energy during field surveys and known to occur in the onshore waterbodies and wetlands at the proposed terminal site is the striped mullet (*Mugil cephalus*). Additionally, blue crabs (*Callinectes sapidus*) and fiddler crabs (*Uca pugnax*) were observed in onshore waterbodies during field surveys. These waterbodies (and wetlands) also undoubtedly provide habitat to migratory birds and waterfowl such as ducks and geese, but the habitat is of relatively low quality. Onshore waterbodies are discussed in more detail in Section 4.3.2, and potential impacts to these habitats are discussed below.

Wetlands

A variety of wetlands and wetland types occur at the proposed terminal site and along the proposed pipeline interconnects. The quality of wetlands at the proposed terminal site, considering such factors as the potential for wildlife utilization, has been compromised by extensive alteration and historic disturbance that has occurred at the site. Intertidal estuarine emergent or estuarine scrub-shrub wetlands of low to medium quality comprise 53.1 acres at the proposed terminal site. Other wetlands at the terminal site (approximately 66.2 acres) are classified as palustrine scrub-shrub or palustrine emergent, and are also considered to be of low to medium quality. Wildlife typical of wetlands found onsite are listed in Table 4.5.1-1.

Jurisdictional facilities associated with the proposed pipeline interconnect routes and meter stations would traverse wetland areas classified as estuarine emergent (15.0 acres) and palustrine scrub-shrub (0.3 acres). Nonjurisdictional facilities, such as the NGL pipeline and associated NGL pipeline meter station, would traverse wetlands classified as palustrine emergent (4.3 acres), palustrine scrub-shrub (4.1 acres), estuarine emergent (3.7 acres), and palustrine forested (0.2 acres). Additional information regarding these wetlands is provided in Section 4.4 and potential impacts to these habitats are discussed below.

Beach Dunes

Beach dunes occur on Petit Bois and Horn Islands along the LNG ship transit route of the proposed project. Beach dunes provide foraging and resting habitats for various migratory and resident species of birds throughout the year, including brown pelican, great blue heron, gulls, terns, and osprey (*Pandion haliaetus*). In addition, marsh rabbit (*Sylvilagus palustrus*), cottontail rabbit, Norway rat, black rat (*Rattus rattus*), river otter (*Lutra canadensis*), and raccoon occur in the beach dune habitat.

4.5.1.2 Unique or Sensitive Wildlife Habitats

The proposed pipeline interconnect spur would approach, but not cross, the boundary of the Grand Bay Reserve, an 18,400 acre tract preserved and managed by NOAA Fisheries and the MDMR. The Reserve contains numerous habitats for wildlife including coastal bay, saltwater marshes, pine forest, pine savannas, and pitcher plant bogs (NOAA 2006a). The Grand Bay Reserve is located approximately 1.0 mile east of the proposed terminal site. No other unique or sensitive habitats occur in the vicinity of the proposed Project.

4.5.1.3 Impacts and Mitigation

Upland Habitats

Construction and operation of the proposed Project could result in relatively minor direct and indirect effects on wildlife and their habitats. Additional discussion regarding potential impacts to vegetated areas is provided in Section 4.4. Upland habitats include vegetation associated with existing commercial/industrial land, and to a much smaller extent, existing rights-of-way. However, more suitable and higher quality habitats are located adjacent to the proposed Project, particularly at the Grand Bay Reserve.

Direct effects to marginal and fragmented wildlife habitats would include temporary effects along the proposed interconnects and permanent alteration of habitats at the terminal site; displacement or mortality during construction; and disturbance, alteration, and loss of habitat from maintenance activities once construction is completed. Clearing of vegetation for construction and operation could reduce cover, nesting, and foraging habitat for wildlife. During construction, mobile species would be displaced from the construction right-of-way while less mobile species, such as small mammals, reptiles, and amphibians could be injured or killed. Routine operation activities, such as maintenance of the proposed pipeline interconnects, could result in similar but less extensive effects on wildlife species. Indirect effects to wildlife species may include disturbance from noise and human activity during construction and temporary impacts to water quality. Bayou Casotte Energy has proposed to contract licensed wildlife specialists to remove and relocate any large specimens of wildlife, such as alligators, that presently occur at the proposed terminal site prior to excavation. Fencing or other barriers would be used to keep wildlife from re-entering the site after removal.

The proposed Project is located in an area traversed by migratory birds as they move between northern breeding grounds and southern wintering grounds. Given the location of the proposed Project, migrating birds could encounter the proposed terminal facilities immediately before or just after crossing the Gulf of Mexico. Many of the birds that cross the Gulf of Mexico are nocturnal migrants and these species can become disoriented by lights at various facilities, especially towers. During an interagency scoping meeting for the project, the FWS expressed concerns that migratory birds could be adversely impacted by lighting at the proposed LNG terminal. The FWS has developed lighting guidelines for the siting, construction, operation, and decommissioning of communication towers that specifically recommend the number and intensity of facility lighting be minimized and that security lighting be down-shielded to keep light within the boundaries of the site. To address potential impacts from terminal lighting on migratory birds, **we recommend that:**

- **Bayou Casotte Energy should develop a lighting plan consistent with the lighting guidelines developed by the FWS for siting, construction, operation, and decommissioning of communication towers, to the extent that those guidelines are consistent with applicable safety regulations and requirements, and file that plan with the Secretary for review and written approval by the Director or OEP prior to construction.**

Open Water

All onshore waterbodies at the proposed terminal site would be filled, graded, or otherwise removed during site preparation and excavation and permanently converted to uplands. This impact would result in a loss of low quality aquatic habitat for striped mullet, blue and fiddler crabs, water birds, and some upland species. Fish, other aquatic life, and less mobile species could suffer mortality during construction. However, these impacts are considered relatively minor as more suitable and higher quality habitats, and greater wildlife species diversity and abundance are located in close proximity to the proposed terminal site, particularly at the Grand Bay Reserve.

Bayou Casotte Energy proposes to use open-cut techniques to accomplish installation of the jurisdictional pipeline interconnects across two waterbodies. Additionally, open-cut methods would be used to install the nonjurisdictional NGL pipeline across six perennial waterbodies. In order to minimize potential environmental impacts, the NGL pipeline would be completely co-located with the proposed interconnect spur, the existing Gulfstream pipeline, and the existing MPC electric transmission line right-of-way. Virtually all of the waterbodies affected by the proposed pipeline interconnect and NGL pipeline represent man-made features located in a previously disturbed, heavily impacted area, and are generally of low quality. Additionally, all impacts to those features would be temporary, as the waterbody crossings would be restored in accordance with Bayou Casotte Energy's Procedures, as modified in this EIS (see Section 4.3.2), following pipeline installation. Additional measures to limit impacts and mitigate for permanent impacts to existing onshore waterbodies and aquatic species may also be required as conditions of the permits that may be granted by other agencies including the COE, MDMR, and MDEQ. Given the relative low quality of the onshore waterbodies crossed by the proposed pipeline interconnects and NGL pipeline, as well as required measures to prevent or minimize impacts, we conclude that the crossings would not result in more than a temporary, relatively minor negative effect to onshore, fresh water habitats.

Wetlands

Construction at the proposed terminal site would result in a permanent conversion of all wetland areas to maintained upland areas, as these areas would be filled or otherwise removed as described in Section 4.4.3. These areas include approximately 119.3 acres of low to medium quality palustrine and

estuarine wetlands. Bayou Casotte Energy also proposes to use open-cut construction techniques to cross two medium quality, palustrine emergent and estuarine emergent wetlands associated with the installation of the pipeline interconnects. These activities would affect approximately 12.5 acres of wetlands. The impacts associated with the pipeline interconnects would all be temporary, as the emergent wetlands would be restored following construction and the removal of any woody vegetation during operations would focus on a 10-foot-wide right-of-way centered directly over the pipeline. Construction of the two jurisdictional meter stations would also affect 2.8 acres of estuarine emergent wetlands, and 1.8 of those acres would be permanently converted to uplands. Additionally, construction of the nonjurisdictional NGL pipeline and associated meter station would affect 12.3 acres of mostly palustrine emergent and palustrine scrub-shrub, medium quality wetlands. Operations would affect only 0.9 acres.

The impact of the proposed pipeline construction activities on wetland wildlife habitats could include the permanent and temporary alteration of wetland vegetation, temporary changes to wetland hydrology, and erosion/sedimentation. Loss of wetland habitat could result in displacement of species dependent on these habitats, such as wading birds, waterfowl, and amphibians. Less mobile species could suffer mortality during construction activities. Effects typically would be greatest during and immediately following construction. Construction through and restoration of wetlands for the pipeline interconnects and nonjurisdictional NGL pipeline would be conducted in accordance with Bayou Casotte Energy's Procedures, as modified in this EIS (see Section 4.3.2). These measures would limit the potential for impacts to wetlands and aquatic species associated with installation of the pipeline interconnects.

In general, the marginal onshore habitats that would be affected by the proposed Project are highly disturbed, industrialized, and support limited amounts of wildlife. However, more suitable and higher quality habitats are located adjacent to the site, particularly at the Grand Bay Reserve. All construction would be conducted in accordance with the mitigation and restoration requirements described in Bayou Casotte Energy's Plan and Procedures, as modified in this EIS (see Sections 4.2.1 and 4.3.2), and impacts to onshore wildlife habitat would be minimal. Given these measures, the extremely limited amounts of available upland habitats available, and the limited number and low abundance of species present, we conclude that the proposed Project would not result in a significant effect to any terrestrial or freshwater wildlife resources.

Additional information on the environmental impacts resulting from LNG ships and transit is provided in Section 4.12.5.3.

4.5.2 Estuarine and Marine Resources

The proposed Casotte Landing Project would be located on Bayou Casotte, an estuary emptying into the Pascagoula Bay/Mississippi Sound portion of the Gulf of Mexico. The open waters of the estuarine area provide wintering habitat for a wide variety of bird species, including brown pelican (*Pelecanus occidentalis*), American white pelican (*Pelecanus erythrorhynchos*), loons, grebes, and ducks. Bottlenose dolphins (*Tursiops truncatus*) and Atlantic spotted dolphins (*Stenella frontalis*) may also occur in the marine habitat along the proposed LNG marine traffic route.

Fish communities occupying the nearshore areas consist of species found in both estuarine and offshore marine habitats. Distribution and abundance of fish species and communities within these habitats vary greatly with time and place, depending on factors such as temperature, salinity, and predictable cycles directly related to reproduction.

Life histories of many fish species in the Gulf of Mexico can be characterized as estuarine-dependent. These species typically spawn in the Gulf, while the juvenile fish generally remain in the

estuarine nurseries for about a year, taking advantage of the greater availability of food and protection that estuarine habitats afford. Upon reaching maturity, estuarine fish either remain in the estuary, migrate to sea to spawn (returning to the estuary between spawnings), or migrate from the shallow estuaries to spend the rest of their lives in deeper offshore waters. Non-estuarine fish, including coastal pelagic marine fish and freshwater fish, will also forage in estuaries when conditions are favorable.

4.5.2.1 Existing Estuarine and Marine Resource Habitats

The proposed Casotte Landing Project would potentially impact three estuarine and marine habitats: estuarine soft bottom and its overlying water column, marine soft bottom and its overlying water column, and submerged aquatic vegetation. Other estuarine and marine habitats exist in the Bayou Casotte and Mississippi Sound area that are not expected to be affected by the proposed action. These habitats include coastal marshes and oyster reefs.

Estuarine Soft Bottom and Water Column Habitats

The benthic habitat of Bayou Casotte is comprised of marine silts combined with fine to very fine sands. Bayou Casotte is an existing, industrialized shipping channel already subject to routine maintenance dredging, which is performed approximately every three years by the COE. Therefore, the estuarine benthic habitat in this area is already frequently disturbed. The fauna associated with this benthic habitat is reflective of periodic disturbance and is primarily comprised of opportunistic and colonizing invertebrate species. Typical benthic species associated with this habitat type are listed in Table 4.5.2-1.

TABLE 4.5.2-1
Typical Estuarine Benthic Species that Occur in the Vicinity of the Proposed Casotte Landing Project

Group	Scientific Name
Hemichordate	Balanoglossus cf. aurantiacus
Mollusk	*Mulinia lateralis*
	Nassarius acutus
	Utriculastra canaliculata
Polychaete	*Armandia maculata*
	Capitella capitata
	Heteromastis filiformis
	Magelona sp. H
	Mediomastus sp.
	Owenia fusiformis
	Paraprionospio pinnata

The aquatic habitat occurring in the Bayou Casotte water column is also reflective of a developed and previously disturbed setting. Bayou Casotte is listed as an impaired waterbody (i.e., impaired ability to support aquatic life) by the MDEQ due to the presence of total toxics and unionized ammonia (MDEQ 2005). The estuary is turbid, with typical turbidity levels of 15 NTUs or greater, and with levels of TSS present averaging 55 mg/l. Fertilizer manufacturers located within the Bayou Casotte watershed contribute nitrogen and phosphorus, which are sources of nutrient enrichment, and Mississippi Sound,

including Bayou Casotte, is subject to periodic episodes of reduced dissolved oxygen levels. The water resources of Bayou Casotte are discussed in more detail in Section 4.3.2.

Marine Soft Bottom and Water Column Habitats

Bayou Casotte Energy proposes to dispose of sediments dredged from the proposed terminal slip at the EPA's permitted Pascagoula ODMDS, which is located approximately 11 nautical miles offshore in the Gulf of Mexico south of Horn Island. The disposal of dredged sediments at the Pascagoula ODMDS was evaluated in an EIS prepared by the EPA (1991), in coordination with the U.S. Navy and COE as cooperating agencies. According to the EPA (1991), sediments at the ODMDS were highly variable and range from mostly sand to a silt-clay mixture. In general, sediment quality in this area was relatively good. Laboratory analyses of sediment samples collected in the vicinity of the ODMDS indicated that chemical constituents either were not detected or were found in concentrations similar to other locations typical of the Gulf of Mexico. Water quality in this area is variable, with issues including seasonally low levels of dissolved oxygen, but levels of contaminants were generally found to be lower in waters at the ODMDS than in other offshore waters in the vicinity. The benthic community at the ODMDS is dominated by polychaetes (including several of the species listed in Table 4.5.2-1), nemertean worms, sipunculid worms, and small crustaceans (EPA 1991). Common fish species found at the ODMDS include those listed in Table 4.5.2-2. The EPA (1991) concluded that disposal of dredged sediments would not significantly affect the long-term productivity of the ODMDS site and mandated monitoring and management programs to prevent impacts.

Submerged Aquatic Vegetation

LNG marine traffic would transit confined areas between the barrier islands and the mainland, where submerged aquatic vegetation and beach dunes occur. Submerged aquatic vegetation, or seagrass, occurs in relatively shallow coastal waters of the Mississippi Sound as a result of depth-limited penetration of sunlight associated with the relatively turbid waters of the coast. These communities provide food for the marine ecosystem. In addition, they provide cover for many young fish. Although the seagrass beds make up only a small percentage of the total submerged lands, the fauna observed in association with them, especially the invertebrates, appears far greater than the more extensive sandy areas. Typical motile benthic species utilizing seagrass habitat includes gastropods such as the convex slippershell (*Crepidula convexa*). Seagrass beds provide habitat and protection for a wide variety of larval and juvenile species such as bay scallops (*Argopecten irradians*), gray snapper (*Lutjanus griseus*), black drum (*Pogonias cromis*), and code goby (*Gobiosoma robustum*) that feed on the smaller animals also utilizing the beds (Nelson 1992). In addition, green sea turtles (*Chelonia mydas*), Kemp's ridley sea turtles (*Lepidochelys kempii*), and smalltooth sawfish (*Pristis pecinata*) are known to occur in seagrass beds.

Fisheries of Special Concern

Fish species of special concern that occur in the vicinity of the proposed project include federal and state listed threatened and endangered species, those with EFH designations in the Mississippi Sound estuary, and those of commercial and recreational value. Threatened and endangered fish species are discussed in Section 4.6. Species having EFH designations, as well as commercial and recreational fish species, are discussed below.

TABLE 4.5.2-2 Managed Fish and Shellfish Resources with Potential for EFH in the Casotte Landing Project Area	
Common Name (applicable to all life stages unless otherwise noted)	**Scientific Name**
Brown shrimp	*Farfantepenaeus aztecus*
White shrimp	*Litopenaeus setiferus*
Pink shrimp	*Farfantepenaeus duorarum*
Red drum	*Sciaenops ocellatus*
Gag grouper	*Mycteroperca microlepis*
Gray snapper (juveniles and adults only)	*Lutjanus griseus*
Red snapper (juveniles only)	*Lopholatilus chamaeleonticeps*
Lane snapper (juveniles only)	*Lutjanus synagris*
King mackerel (juveniles only)	*Scomberomorus cavalla*
Spanish mackerel (juveniles and adults only)	*Scomberomorus maculatus*
Cobia (juveniles and adults)	*Rachycentron canadum*
Stone Crab (all stages but rarely found)	*Menippe mercenaria*
Gulf Stone Crab	*Menippe adina*
Scalloped hammerhead shark (rarely found, late juvenile/subadult)	*Sphyrna lewini*
Blacktip shark (rarely found, late juveniles)	*Carcharhinus limbatus*
Tiger shark (rarely found, juveniles only)	*Galeocerdo cuvieri*
Bonnethead shark	*Sphyrna tiburo*
Atlantic sharpnose shark (all stages, but rarely found)	*Rhizoprionodon terraenovae*

Commercial and Recreational Fisheries

A variety of fish and shellfish species occur in the Gulf of Mexico. A list of the representative species managed by NOAA Fisheries that may occur in the estuarine and marine waters of Bayou Casotte, the Mississippi Sound, and the Gulf of Mexico are included in Table 4.5.2-2. Although Bayou Casotte serves as a launching point for recreational fishing charters, most fishing activity in the area is conducted outside of Bayou Casotte. There are no commercially harvested fish or shellfish populations in Bayou Casotte. The oyster fisheries nearest the proposed Project are located in Point-aux-Chenes Bay

(approximately 0.5 miles southeast of the proposed terminal site) and at Bangs Lake (approximately 1.7 northeast of the proposed terminal site).

4.5.2.2 Impacts and Mitigation

Short-term and permanent impacts to estuarine and marine habitats resulting from construction and operation of the proposed Project are discussed below.

Impacts to Estuarine Soft Bottom and Water Column Habitats

Potential impacts related to construction at the proposed terminal site that could affect the estuarine water column and soft bottom habitat include runoff from the terminal site during excavation and construction; sedimentation, turbidity, and possible mobilization of contaminants associated with dredging of the terminal slip; accidental spills; and withdrawal and discharge of hydrostatic test water. These impacts are discussed below and also in Section 4.3.2.

Impacts Resulting from Construction

Excavation and Runoff

Construction of the proposed terminal slip would require the excavation and removal of approximately 1.0 mcy of soil located at or above the water table. Some of the excavated material would be stockpiled on-site and used for fill, leveling, and construction of the proposed LNG terminal. Significant stormwater runoff resulting from excavation activities could result in re-suspension of soil particles into the water column and settling of these particles over existing estuarine soft bottom habitats. In addition, stormwater runoff could result in increased nutrient loads or contamination to aquatic systems, dependent on the types and concentrations of constituents associated with the suspended materials. Significant concentrations of nutrients or contaminants could cause decreases in survival, growth and reproduction of aquatic organisms receiving sufficient exposure. In addition, re-suspension of soil particles could increase turbidity, resulting in impacts to both sessile and mobile aquatic species. Increases in turbidity physiologically affect aquatic resources (e.g., fish) through mechanical abrasion of surface membranes, delayed larval and embryonic development, reduced bivalve pumping rates, or interference with respiratory functions. In addition, fish could be affected behaviorally through interference with feeding for sight-foraging fish and area avoidance. Reduced visibility of predatory fish could also lower vulnerability to predation for prey species. Settling of soil particles over existing bottom sediments (if significant) could result in loss of habitat for sessile species of invertebrates and plants and could also disrupt oxygen transport mechanisms for many species.

In order to control and minimize runoff from the terminal site to Bayou Casotte during construction, Bayou Casotte Energy would implement its Plan, as modified in this EIS, and its SWPPP (see Appendix C). Bayou Casotte Energy's Plan provides for installation of temporary and permanent erosion control measures such as silt fencing/straw bales, slope breakers, sediment barriers, interceptor dikes, mulch, and trench breakers; re-vegetation; daily inspection of cleared areas; and monitoring and maintenance of previously disturbed areas. Additionally, Bayou Casotte Energy would have to comply with any other erosion control and BMP provisions that may result from ongoing consultations with MDMR, COE, and NOAA Fisheries.

Dredging

Following excavation of soils above the water table, approximately 3.5 mcy of sediments would be removed from the proposed terminal slip using a mechanical dredge. This activity would disturb

approximately 6.3 acres of unvegetated, soft bottom habitat, although construction of the proposed slip would result in the creation of approximately 49 acres of new, soft bottom habitat. In addition to directly removing benthic substrate and sessile organisms inhabiting the substrate, dredging would also temporarily increase turbidity and sedimentation in the area surrounding dredging operations. Sedimentation could result in injury or mortality to benthic organisms through burial or smothering, but it is anticipated that these organisms would re-colonize the area soon after cessation of the dredging activity. However, suspended sediments would likely settle relatively quickly. As described above, increases in turbidity, if significant, could result in physiological effects and/or behavioral modifications by aquatic organisms. Any turbidity effects would be limited to the dredging period as suspended sediments would likely return to background levels relatively quickly.

Bayou Casotte Energy modeled the potential for suspension of sediments associated with dredging of the slip using the COE's DREDGE model. The resulting analysis indicated that TSS levels generated by dredging would be similar to or lower than ambient levels occurring in Bayou Casotte. Potential impacts to marine water resources associated with the proposed dredging activities would be small given the relatively low levels of TSS that would be generated and considering that the area is already routinely subjected to periodic COE maintenance dredging (and suspension of sediments into the water column) for the federal Bayou Casotte shipping channel.

Bayou Casotte Energy is consulting with MDEQ, MDMR, COE, and NOAA FISHERIES regarding the development of BMPs to reduce sedimentation and turbidity during dredging, as well as the need for and requirements of any monitoring programs. In Section 4.3.2, we have recommended that Bayou Casotte Energy complete these ongoing consultations and finalize any needed measures to prevent or minimize impacts prior to construction. Bayou Casotte Energy consulted with NOAA Fisheries regarding seasonal construction windows which are sometimes implemented to reduce impacts to aquatic species, including managed species. It was determined that NOAA Fisheries would not require seasonal construction windows. Bayou Casotte Energy has also consulted with the MDMR regarding the need for a pre-construction and post-construction project trawl and benthic sampling plan; however, MDMR has not yet reached a conclusion on a benthic sampling plan. Because these consultations are not yet complete, **we recommend that:**

- **Bayou Casotte Energy should complete consultations with MDMR regarding the need for a pre-construction and post-construction project trawl and benthic sampling plan and, if required, file the agency approved plan with the Secretary prior to construction.**

Mobilization of Contaminants

Potentially contaminated soils and sediments at the terminal site have been identified and delineated during previous environmental site assessments. As previously discussed, excavation and dredging activities, and the associated stormwater runoff, have the potential to re-introduce deleterious compounds currently in the bottom sediments and surface soils into open water habitats surrounding the proposed terminal site. Certain chemical contaminants could cause various acute or chronic growth and physiological effects on a wide variety of species including fish, birds, mammal, reptiles, and amphibians. For this particular site, the known contaminated sediments are located at or near the ground surface, and Bayou Casotte Energy has proposed to remove them by focused excavation activities prior to any other grading or site preparation activities. Any contaminated sediments would be properly disposed of off-site in permitted landfills, thus removing the possibility of impacts to surface waters and associated fish and wildlife resources.

Accidental Spills

Bayou Casotte Energy would use training and engineering controls to minimize the potential for, and effect of, any inadvertent spills at the proposed terminal site. Depending on the location, magnitude and type of spill, potential terrestrial and aquatic resources could be at risk. Most fuel related compounds have the ability to cause acute and chronic mortality on all levels of aquatic and terrestrial biota. In the event that significant volumes of material were spilled into surrounding waters, vegetation and other aquatic resources could be potentially affected.

Bayou Casotte Energy has developed a SPCC Plan for construction activities (see Appendix D). Measures to prevent or minimize the effects of accidental spills during construction include adequate primary and secondary containment features, availability of spill kits, inspection of drainage from storage areas, and corrosion protection for buried piping. Programmatic guidelines in the SPCC Plan include spill reporting, notification of spills to relevant agencies, periodic review and evaluation of the plan, inspections, and training, and these measures are also discussed in Sections 4.2.1 and 4.3.1. Additionally, in Section 4.2.1, we have included a recommendation that Bayou Casotte Energy develop and finalize an operational SPCC Plan prior to the start of construction.

Pile Driving

Bayou Casotte Energy proposes to install approximately 265 pilings during construction of the marine berthing and unloading facilities. The piles would be approximately 100 to 140 feet long, with a diameter of 16 to 48 inches. They would be installed using a barge-mounted crane and various methods, including impact driving.

In some cases, driving steel piles can generate intense underwater sound pressure waves that can adversely affect nearby marine organisms. Although the effects of pile driving are poorly studied and there appears to be substantial variation in a species' response to sound, intense sound pressure waves can change fish behavior or injure/kill fish by 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 at a reference pressure of 1 micropascal (re: 1 μPa) can illicit avoidance behaviors or stun small fish (NOAA 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 produces 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 because 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 (2003a) 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).

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 at the proposed LNG terminal could generate underwater sound levels great enough to injure, stun, or illicit avoidance responses (i.e., 155 decibels (re: 1 μPa)) in fish in the vicinity of the pile driving activities. 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 over 1,800 feet from a steel pile while piles for some of the mooring dolphins are being driven. Because dredging and other construction activities would be occurring both before and during pile installation, it seems likely many fish would avoid the area where the most intense sound levels would be generated.

Based on consultations with NOAA Fisheries, Bayou Casotte Energy will adopt NOAA Fisheries' *Pile-Driving Harm Avoidance and Listed Species / Critical Habitat and Vessel Impacts* guidelines. These guidelines include alternative options to reduce potential impacts resulting from sound waves caused by pile driving. These options consist of reduction of sound waves by use of a bubble curtain, use of a smaller hammer type, or observation of a defined zone to monitor for sensitive species and adjustment of pile driving activity, as prescribed in the guidelines.

Increased Noise

Construction of the proposed LNG terminal slip would result in increased noise in Bayou Casotte. The noise would result from increased vessel traffic associated with construction, dredging, pile driving (see above), pumping, and other incidental sounds. Noise can affect fish behavior, including feeding, habitat selection, and reproduction. However, given that these impacts would be temporary and that Bayou Casotte is an existing shipping channel that already is dredged every three years to maintain the channel by the COE, we conclude that impacts would be minor and fish and other mobile species would relocate to adjacent, unaffected areas for the duration of the disturbance.

Hydrostatic Testing

Bayou Casotte Energy would perform a hydrostatic test for structural integrity of the LNG transfer lines, storage tanks, and all pipelines prior to operation as described in Section 4.3.2. Hydrostatic test water would be withdrawn from Bayou Casotte and, after testing to assess suitability and need for treatment, it would be discharged back to Bayou Casotte at a rate and in a manner not causing erosion. Given its anticipated schedule, Bayou Casotte Energy estimates that hydrostatic testing would occur in the spring or summer seasons. Intake of water for hydrostatic testing could result in impingement and entrainment of fish and other aquatic biota. Impingement and entrainment has the potential to cause mortality, particularly to larval and other early life stages of aquatic species. Depending on factors such as the location of the intakes and timing, impingement and entrainment could cause significant reductions in recruitment and year class strength. In this section we have recommended that Bayou Casotte Energy complete consultations with NOAA Fisheries regarding seasonal construction windows to minimize the potential for adverse effects to aquatic species. During hydrostatic testing, Bayou Casotte Energy would comply with its proposed Procedures, as modified in this EIS, including provisions to screen water intakes to minimize impingement and entrainment of fish and other aquatic organisms.

Bayou Casotte Energy would also comply with the conditions of any NPDES permit that may be required by MDEQ in association with hydrostatic test water withdrawals. As certain hydrostatic test water additives may be toxic to aquatic life, Bayou Casotte Energy is in the process of consulting with MDEQ regarding the use of additives in hydrostatic test water, should their use become necessary. However, these consultations are not yet complete. Therefore, we have included a recommendation in Section 4.3.2 that requires Bayou Casotte Energy to consult with MDEQ and gain Commission approval before using any test water additives that could result in toxicity to aquatic organisms.

Impacts Resulting from Operations

Stormwater Runoff

Untreated and/or increased stormwater runoff can adversely affect the systems in which it discharges. Increased surface flows due to disturbance at the proposed terminal site could result in flooding and erosion. In addition, increased flows could result in increased turbidity and contaminant and nutrient loadings to surface water systems. In turn, this could result in acute and chronic toxicity to aquatic biota if not managed properly.

Stormwater at the proposed terminal site would be routed by surface ditches and swales located adjacent to roads and the hurricane levee before collection in catch basins. Curbed areas would be used to contain spills and prevent contamination of storm water. Stormwater would collect in four basins and would ultimately be discharged via two new outfalls into Bayou Casotte. Bayou Casotte Energy would employ general stormwater BMPs including good housekeeping, preventative maintenance, visual inspections, spill prevention and response, and management of runoff. Specific measures would be included in the Industrial SWPPP for operations that is being prepared by Bayou Casotte Energy. In Section 4.2.1, we have included a recommendation for Bayou Casotte Energy to finalize the Industrial SWPPP in consultation with MDEQ prior to the start of construction. Bayou Casotte Energy would also be required to comply with the provisions of a NPDES Industrial Stormwater Permit, if issued by MDEQ, during operations at the proposed LNG terminal site.

Bank Erosion

Bank erosion could occur along the waterway between Petit Bois and Horn Islands used by LNG vessels as well as near and within the proposed terminal slip. Bank erosion could reduce bank stability and result in suspension of sediments, nutrients and contaminated media in Bayou Casotte and adjacent areas. Bank erosion could also directly result in a loss of habitat for vegetative species and some sessile organisms. In addition, bank erosion could result in localized increases in water column turbidity and associated potential impacts to fish and benthic species, as noted above. However, the potential for these effects should be limited since bank erosion is a relatively slow process and would therefore be unlikely to result in high turbidity loads. Because of the anticipated slow speed of the LNG marine traffic transiting the waterway and the distance from Petit Bois and Horn Islands to the transit channel, bank erosion from this source would not be considered to be significant. Further, it does not appear that the location, size, and shape of the proposed terminal slip would result in significantly modified flow velocities or cause increased erosion of adjacent channel banks.

Propeller Wash

The movement of large vessels (i.e., LNG carriers or crude oil tankers) has the potential to result in additional bank erosion, associated turbidity, and bottom substrate scour through creation of waves or wakes caused by propeller wash. The resulting turbidity and potential movement of bottom sediments could affect both fish and more sessile aquatic invertebrates. As described above, excessive turbidity can

result in both physiological and behavioral effects in fishes. In addition, movement of sediments due to propeller wash could result in shifting and covering of benthic habitats. Although temporary, movement of sediments along the bottom could result in more sessile organisms being covered. The potential for propeller wash induced Erosion within the proposed terminal slip would be minimized by armoring the walls and slopes of the slip with rock riprap overlaid on a geotextile fabric. Additionally, the proposed terminal site is located near the downstream end of an existing shipping channel that is already subject to the frequent passage of large vessels. The potential for excessive bank erosion induced by Project operations should therefore be minimal.

Unanticipated Spills

As discussed above, terrestrial and aquatic resources could be injured or suffer mortality due to accidental or intentional (i.e., terrorist activity) spills of fuel or other toxic substances. Bayou Casotte Energy would use training and engineering controls to minimize the potential for, and effect of, any inadvertent spills at the proposed terminal site during operations. Bayou Casotte Energy has already developed a SPCC Plan (see Appendix D). In Section 4.2.1, we have included a recommendation that Bayou Casotte Energy develop and finalize an operational SPCC Plan prior to the start of construction. This plan would identify measures to prevent and mitigated the effects of accidental spills during operations. Additional information on accidental spill prevention during operations is provided in Sections 4.2.1 and 4.3.1.

Intake of Ballast Water and Cooling Water by LNG Vessels

LNG carriers would take on ballast water to maintain stability (up to 15 million gallons per vessel offloading event) and use seawater for engine cooling (up to 42 million gallons per vessel offloading event) during berthing and while transiting the entire waterway from the territorial seas to the berthing facility. Given the location of the proposed terminal site near the mouth of Bayou Casotte, and the adjacent areas traversed including Mississippi Sound and the Gulf of Mexico, sufficient water is available to provide the quantities necessary for ballast and engine cooling operations. Ballast water would be taken on and retained during LNG offloading operations, but no ballast water would be discharged in Bayou Casotte, thereby preventing the potential discharge of exotic and invasive organisms. Water used for engine cooling would be quickly discharged, and the resulting increase in water temperature is expected to be minor. Further, Bayou Casotte and the entire transit waterway are active commercial shipping channels already subject to the withdrawal and discharge of vessel engine cooling water as discussed in Section 4.3.2, and that activity would not substantially affect water quality in the proposed Project area.

There is potential for the entrainment of ichthyoplankton, including the larvae of managed species, from Bayou Casotte and the entire transit waterway associated with LNG carrier engine cooling water withdrawals. Entrainment of ichthyoplankton could result in mortality and reduced recruitment for fish and other aquatic species. Bayou Casotte Energy is currently in the process of consulting with NOAA Fisheries regarding the potential for ichthyoplankton impacts, but because these consultations are not yet complete, **we recommend that:**

- **Bayou Casotte Energy should complete consultations with NOAA Fisheries and MDMR regarding potential impacts to ichthyoplankton and aquatic resources resulting from the intake of ballast and engine cooling water, the discharge of cooling water, and all other activities that could result in withdrawal of marine surface waters (e.g., hydrostatic testing and maintenance dredging), and file the findings of these consultations with the Secretary, including any required or recommended measures to prevent or reduce impacts, prior to construction.**

Invasive, Exotic Species

In order to maintain a constant draft during the unloading operation, LNG carriers berthed at the proposed terminal slip would bring on ballast water during transfer of its LNG cargo and retain this ballast water until after the LNG ship departs Bayou Casotte. Although ballast water has been identified as a major pathway for the introduction and spread of exotic species, the absence of ballast water discharges while moored at the proposed terminal slip would limit the potential for import of exotic species.

In addition to ballast water, there is a potential that exotic species could be imported on the hulls and exterior equipment of LNG carriers. If successful in establishing in the surrounding environment, exotic species can successfully out-compete native species, causing native species to decline. To combat this issue, the Coast Guard has developed responses to exotic/invasive organisms associated with foreign vessels. The Coast Guard 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 remove fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, state, and federal regulations. Any LNG carriers visiting the proposed Project would comply with these practices. Therefore, we conclude that the introduction of non-indigenous attached organisms via ship hulls or ballast water would be unlikely to result in a significant alteration of the local biotic community.

Effects of Slip Creation on Water Quality

The recessed nature of the proposed terminal slip could cause stagnation, resulting in potential impacts to water quality within the slip and adjacent Bayou Casotte. These effects of stagnation could include increases in water temperature during warmer months and decreases in overall water quality (e.g., reduced dissolved oxygen levels). Fish and aquatic invertebrates typically have relatively rigid tolerances to fluctuations in temperature and dissolved oxygen. As oxygen levels begin to deplete in stagnant waters, organisms that are not able to relocate can suffer diminished survival, growth, and reproduction, or suffer mortality. If such localized water quality effects did occur, aquatic organisms capable of avoiding such conditions would do so; however, more sessile organisms could be affected by fluctuations in temperature and overall water quality. However, the potential for water quality impacts at the proposed terminal slip would be eliminated or effectively minimized through tidal flushing, regular LNG carrier, crude oil tanker, and tugboat traffic, and the generally shallow nature of the slip itself. Bayou Casotte Energy is in the process of consulting further with MDMR and MDEQ regarding the proposed slip design and potential effects on water quality. In Section 4.3.2 we have included a recommendation that Bayou Casotte Energy file the results of those consultations with the Commission prior to the start of construction**.**

Maintenance Dredging

According to preliminary modeling, Bayou Casotte Energy estimates that maintenance dredging of the proposed terminal slip could generate up to 250,000 yd^3 of material per year during operations, as described in Section 2.7.1. Potential impacts to habitats and aquatic species due to dredging have been discussed in Section 4.5.2.2 above. In the DMMP, Bayou Casotte Energy has identified placement of maintenance dredge materials at the Pascagoula ODMDS as its primary disposal option. Bayou Casotte Energy has also indicated that it would consider placement of maintenance dredge materials at beneficial use sites, as well as coordination of maintenance dredging with the COE's routine maintenance dredging of the Bayou Casotte channel.

As discussed previously in relation to initial dredging associated with construction of the proposed terminal slip, Bayou Casotte is an industrialized shipping channel that is already subject to routine maintenance dredging by the COE. Additionally, Bayou Casotte Energy is in the process of consulting with MDEQ, MDMR, COE, and NOAA Fisheries regarding the development of dredging BMPs and possible monitoring measures. Bayou Casotte Energy has also filed its Section 103 evaluation with the COE and is awaiting approval of its dredge disposal plan. With implementation of these measures and recommendations, it is not anticipated that maintenance dredging would result in significant effects to marine and estuarine habitats or species, especially given the existing turbid nature of Bayou Casotte.

Increased Noise

Increased vessel traffic would occur during operation of the proposed Project, resulting in additional noise in Bayou Casotte as well as the approaches to Bayou Casotte in the Gulf of Mexico. Traffic would increase from tug boats using the new slip and an estimated 170 LNG carrier vessels that would use the proposed LNG terminal annually. Although noise can affect fish behavior, it is difficult to determine the impact of anthropogenic noise in the marine environment (Stocker 2002). Altered behavior due to noise effects could change feeding habits and movement patterns, cause stress, and otherwise interfere with the normal physiology of fishes and aquatic organisms, thereby potentially reducing growth, reproduction, and survival. However, Bayou Casotte is an existing shipping channel already subject to maintenance dredging every three years by the COE, we conclude that fish and other mobile species would relocate to adjacent, unaffected areas for the duration of the disturbance.

Impacts to Marine Soft Bottom and Water Column Habitats

Bayou Casotte Energy proposes to dispose of sediments dredged from the slip during construction at the EPA's permitted Pascagoula ODMDS. Bayou Casotte Energy's results of its sampling analysis, filed with the COE, indicate that the chemical parameters are within acceptable limits for sediment disposal at the Pascagoula ODMDS or other beneficial use sites.

The disposal of dredged sediments at the Pascagoula ODMDS was evaluated in an EIS prepared by the EPA (1991), in coordination with the U.S. Navy and COE as cooperating agencies. The EPA concluded that impacts associated with placement of the dredged materials in the ODMDS would be localized to the vicinity of the disposal site and that they "would not significantly alter the long-term productivity of the site." Following disposal, monitoring of the ODMDS would include a bathymetric survey performed by Bayou Casotte Energy and sediment mapping conducted by EPA. The ODMDS site routinely accepts spoils from Bayou Casotte, and the site was designed for use by multiple entities including the adjacent Chevron Pascagoula Refinery (EPA 1991).

For the reasons outlined above, we do not anticipate that disposal of sediments excavated from the proposed LNG terminal slip would result in significant adverse effects to marine soft bottom and water column habitats or species associated with those habitats. The Commission and Bayou Casotte Energy are proceeding under the assumption that sediments would be suitable for placement in the ODMDS. However, final agency approvals required pursuant to Section 103 of the MPRSA have not yet been obtained (see Section 4.2.2).

4.5.3 Freshwater Resources

Potential habitat for freshwater fisheries in the vicinity of the Casotte Landing Project includes several emergent wetlands and man-made ponds, drainage canals, and ditches. The vegetation within the emergent wetlands that would be affected in the project area is discussed in Section 4.4. Surface water is

generally only present for brief periods during the growing season in these wetlands and the water table usually lies well below the soil surface. Therefore, emergent wetlands in the project area are not anticipated to support freshwater fisheries.

The proposed terminal site would impact two ponds, two canals, and 10 ditches; while the pipeline interconnects and nonjurisdictional facilities would cross three canals and five ditches (see Table 4.3.2-1). All of the onshore waterbodies contain water year-round with the exception of five ditches. Bayou Casotte Energy reported that only the striped mullet was identified within the waterbodies located at the proposed terminal site. Bayou Casotte Energy would implement its Procedures, as modified in this EIS, to minimize construction-related impacts on these waterbodies.

4.5.4 Essential Fish Habitat

The MSA requires that EFH be designated for species managed by NOAA Fisheries or regional Fishery Management Councils (FMC). EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 USC 1802(10)). EFH may include both water column and benthic habitats that support the different life stages of managed fishery resources. According to the Gulf of Mexico FMC, all estuarine and marine waters and substrates within the northern Gulf of Mexico, extending from the shoreline to the exclusive economic zone boundary, are considered EFH (GMFMC 1998). A variety of managed fish and shellfish species occur within this region, but EFH for 18 individual species and the "billfish and highly migratory species group" has the potential to occur within the proposed Project area. These species are listed in Table 4.5.2-2.

The MSA requires NOAA Fisheries to minimize effects to EFH and managed species to the extent practicable and it requires federal agencies to consult with NOAA Fisheries regarding potential impacts resulting from projects under federal purview (NOAA 2006b). The FERC is the lead federal agency for the purposes of evaluating the proposed Project under NEPA. Therefore, the FERC requests that NOAA Fisheries consider the draft EIS as notification of the initiation of EFH consultation.

Generally, the EFH consultation process includes the following steps:

1. **Notification** – The action agency should clearly state the process being used for EFH consultations, such as incorporation of EFH consultation into the EIS, as is the case with the proposed Casotte Landing Project;
2. **EFH Assessment** – The action agency should prepare an EFH Assessment that includes both identification of affected EFH and an assessment of potential impacts. Specifically, the EFH Assessment should include: a) a description of the proposed action; 2) an analysis of the effects, including cumulative effects, of the proposed action on EFH, the managed fish species, and major prey species; 3) the federal agency's views regarding the effects of the action on EFH; and 4) proposed mitigation, if applicable;
3. **EFH Conservation Recommendations** – After review of the EFH Assessment, NOAA Fisheries would provide recommendations to the action agency regarding measures that can be taken by that agency to conserve EFH; and
4. **Agency Response** – The action agency must respond to NOAA Fisheries within 30 days of receiving NOAA Fisheries' recommendations or the action agency may notify NOAA Fisheries that a full response to the conservation recommendations will be provided by a specified completion date agreeable to all parties. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH.

On our behalf, Bayou Casotte Energy is in the process of consulting with NOAA Fisheries regarding conservation measures that would avoid, minimize, or mitigate for potential Project related impacts to EFH and managed species. As part of those consultations, representatives of Bayou Casotte Energy compiled baseline data on existing EFH resources that occur within the proposed project area. That information is provided in the EFH Assessment for the Casotte Landing Project, which is included as Appendix F of this EIS. An analysis of the cumulative impacts of the project on aquatic resources (including EFH) is presented in Section 4.13, and our assessment of the potential for Project effects on EFH is provided below.

4.5.4.1 Conclusions of EFH Assessment

The proposed Project was sited and designed to avoid and minimize potential impacts to EFH and other fish and wildlife resources. Additionally, Bayou Casotte Energy has proposed specific measures, as discussed in this section, to further minimize or mitigate for potential impacts. Impacts to onshore waterbodies and wetlands at the proposed terminal site would be permanent, but would be mitigated in consultation with the COE during the permitting process. Impacts to waterbodies and wetlands affected by the interconnects would be temporary, and wetlands would be restored in accordance with Bayou Casotte Energy's Procedures, as modified in this EIS (see Section 4.3.2). Additional measures to minimize or mitigate for temporary wetland impacts may be required by the COE or MDMR during permitting. Soft bottom and water column habitats, in both the estuarine and marine environment, including the waterway transited by LNG vessels from the territorial seas to the berthing facility, would be disturbed by construction and operation of the proposed Project. However, these impacts would be minor and largely temporary.

We conclude that the proposed Project would not result in significant adverse effects to EFH or managed species based on:

- the previously disturbed and modified character of the potentially affected onshore waterbodies and wetlands, estuarine habitats of Bayou Casotte, and the Pascagoula ODMDS;
- the measures to avoid and/or minimize impacts that have been proposed by Bayou Casotte Energy;
- the conditions that the FERC has recommended in this EIS; and
- the impact avoidance and minimization requirements that would be implemented as a result of other permitting and regulatory approvals that would be required for authorization of the proposed Project.

However, because EFH consultations are not yet complete and because mitigation for those permanent impacts to EFH that would occur as a result of the proposed Project has not yet been agreed upon, **we recommend that:**

- **Bayou Casotte Energy should finalize consultations with NOAA Fisheries, MDMR, and the COE to develop a plan for quantifying, if appropriate, and mitigating impacts to EFH and file that plan with the Secretary for review and written approval of the Director of OEP prior to construction.**

4.6 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

4.6.1 Federally Listed Threatened and Endangered Species

Section 7 of the Endangered Species Act (ESA) requires each Federal agency to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of federally listed endangered or threatened species, or result in the destruction or adverse modification of the designated critical habitat for any federally listed species. The FERC, as lead agency in the review of the proposed Project, is required to consult with the FWS and/or NOAA Fisheries to determine whether federally listed or proposed species, or their designated critical habitat, may occur in the Project area, and to determine the proposed action's potential effects on these species and critical habitats. For actions involving major construction activities with the potential to affect listed species or designated critical habitats, the FERC must report its findings to FWS and NOAA Fisheries in a Biological Assessment (BA).

To assist the FERC in meeting our Section 7 requirements, Bayou Casotte Energy as a non-federal representative, conducted informal consultation with the FWS, NOAA Fisheries, MDMR, and Mississippi Museum of Natural Science-Natural Heritage Program (MMNS-NHP). In addition, Bayou Casotte Energy reviewed endangered and threatened species related databases maintained by the FWS, MMNS-NHP, and NatureServe Explorer. Bayou Casotte Energy conducted field surveys of the proposed LNG terminal site and proposed pipeline interconnect routes in April 2005 and December 2005. No threatened or endangered species were observed during the surveys.

We have reviewed the information submitted by Bayou Casotte Energy, and our analysis of the potential for Project-related effects to federally listed species and their designated critical habitats is provided in this EIS. To comply with Section 7 of the ESA, we request that NOAA Fisheries and FWS consider this EIS as our BA for the proposed Project and concur with the determinations provided herein.

Habitats that occur in the proposed Project area include shallow marine environments, wetlands, onshore waterbodies, and uplands (see Sections 4.3, 4.4, and 4.5). Most of the proposed LNG terminal site and proposed pipeline interconnect routes are generally highly disturbed and industrialized. These areas would provide limited or no habitat for federally listed species. Bayou Casotte is an active shipping channel, and the estuarine habitats at the proposed terminal site are periodically disturbed by routine maintenance dredging performed by the COE. Offshore environments that would be affected during construction and operation have the potential to support transient endangered and threatened species.

Based on consultation with the FWS, NOAA Fisheries, MMNS-NHP, and MDMR and review of existing records, 26 federally listed endangered and threatened species were identified that could potentially occur in the vicinity of the proposed Project or along the LNG ship transit route within the waters of the Gulf of Mexico. We conclude that 11 of these species do not occur in the Project area or would not be affected by construction and operation of the proposed Project based on the results of field surveys, initial agency consultations, and review of existing information. These include several terrestrial and avian species, which clearly lack suitable habitat or a significant potential for negative interaction with the proposed Project. These species, their status, preferred habitats, potential for occurrence, and our assessment of potential Project effects are discussed in Table 4.6.1-1. Because these species would not be adversely affected by the proposed Project, they have been eliminated from further consideration in our analysis.

Surveys performed by Bayou Casotte Energy did not identify any high quality habitat for federal or state protected species at the proposed terminal site or along the proposed pipeline interconnect routes. However, consultations with the FWS and NOAA Fisheries indicate that the proposed Project could

TABLE 4.6.1-1
Federally Listed Species Eliminated From Further Consideration for the Casotte Landing LNG Project Area

Species	Federal/ State Status	Project Effect	Habitat	Potential for Occurrence / Interaction
Plants				
Louisiana quillwort *(Isoetes louisianensis)*	T/S2	No effect.	Sand and gravel bars on small- to medium-sized streams.	Suitable freshwater habitat not found on site.
Reptiles				
Alabama redbelly turtle *(Pseudemys alabamensis)*	E/S1	No effect.	Quiet backwaters with dense submerged vegetation, in water 3 – 6 feet deep. Also found in river channels. Uses sand spoil banks and natural levees for nesting.	Occurs in brackish water and salt marsh areas only as a straggler. Per the Mississippi Natural Heritage Program, the proposed Project occurs in an apparent gap in the range of the species. The species was not observed during field surveys.
Eastern indigo snake *(Drymarchon corais couperi)*	T/S1	No effect.	Xeric sandhills, cabbage palm hammocks, and near ponds, streams, and swamps often associated with gopher tortoise burrows. Requires large areas of habitat.	Suitable habitat does not occur at the proposed Project site.
Gopher tortoise *(Gopherus polyphemus)*	T/S2	No effect.	Well-drained, sandy soils in transitional areas with a pine overstory, an open understory, and a grass and forb groundcover.	Suitable habitat does not occur at the proposed Project site.
Yellow-blotched map turtle (*Graptemys flavimaculata*)	T/S2	No effect.	Riverine habitat with moderate current, sand, clay, or rocky bottom, sand bars, limestone ledges, tangled tree roots, and logs. Also utilizes ponds and oxbow lakes.	Suitable habitat does not occur at the proposed Project site. The species was not observed during field surveys.
Birds				
Piping plover *(Charadrius melodus)*	T/SZN	No effect.	Sandy upper beaches with grass tufts, lightly vegetated shores, and islands of shallow lakes, ponds, and rivers. Non-breeding habitat includes algal flats, sand flats, and mud flats.	Suitable, high quality habitat does not occur in the Project area. FWS indicated that no critical habitat occurs within or adjacent to the proposed Project site.

TABLE 4.6.1-1 (continued)
Federally Listed Species Eliminated From Further Consideration for the Casotte Landing LNG Project Area

Species	Federal/ State Status	Project Effect	Habitat	Potential for Occurrence / Interaction
Birds (continued)				
Mississippi sandhill crane *(Grus canadensis pulla)*	E/S1	No effect.	Wetlands bordering pine forests, swamp edges, and open savannas.	Suitable nesting habitat does not occur at the proposed Project site. Low quality foraging habitat may be present, but the species was not observed during field surveys.
Red-cockaded woodpecker (*Picoides borealis*)	E/S1	No effect.	Savanna with scattered overstory of large pines and dense groundcover of grass, forb, and shrub. Also inhabits open, mature pine woodlands.	Suitable habitat does not occur at the proposed Project site.
Mammals				
Louisiana black bear (*Ursus americanus luteolus*)	T/S1	No effect.	Bottomland forests with diverse food resources; hollow trees and brush piles. Prefers remote areas with little or no human contact.	Suitable habitat does not occur at the proposed Project site.
Invertebrates				
Fat pocketbook (*Potamilus capax*)	E/S1	No effect.	Slow-flowing portions of large, freshwater rivers. Sand, mud, and fine gravel substrates.	Suitable freshwater habitat does not occur at the proposed Project site.

TABLE 4.6.1-1 (continued)
Federally Listed Species Eliminated From Further Consideration for the Casotte Landing LNG Project Area

Species	Federal/ State Status	Project Effect	Habitat	Potential for Occurrence / Interaction
Fish				
Smalltooth sawfish (Pristis pectinata)	E/NS	No effect.	Shallow coastal and estuarine waters, often near river mouths and large embayments.	According to NOAA Fisheries, breeding and juvenile habitats do not occur in the Project area, and abundances are so low, that the risk of harm is considered discountable.

Notes:

E = Endangered

T = Threatened

S1 — Critically imperiled in Mississippi because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it vulnerable to extirpation.

S2 — Imperiled in Mississippi because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it vulnerable to extirpation.

SZ — Zero occurrences in the state. Not of practical conservation concern in the state, because there are no definable occurrences, although the taxon is native and appears regularly in the state.

Breeding Status: (Applicable to migratory species, mainly birds, but also includes sea turtles, some fish, and some insects).

B — Breeding Status

N — Non-breeding Status

Sources: Mississippi Museum of Natural Science – Natural Heritage Program (including letter dated March 31, 2005)

NOAA Fisheries (including letter dated June 8, 2005)

encompass habitat for or involve interaction with 15 federally listed endangered or threatened species. These species include seven mammals (sperm whale, blue whale, sei whale, fin whale, humpback whale, North Atlantic right whale, and the Florida manatee); one fish (Gulf sturgeon); five reptiles (hawksbill sea turtle, green sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle); and two birds (bald eagle and brown pelican). These species, their status, habitat, potential for occurrence, and our assessment of potential Project effects are listed in Table 4.6.1-2 and discussed in more detail below. Additional information regarding LNG shipping incidents and their potential impacts along the transit corridor is provided in Section 4.12.5.3

4.6.1.1 Mammals

Whales

Offshore environments that would be traversed by LNG marine traffic associated with operation of the proposed LNG terminal may provide potential movement corridors for the blue, fin, humpback, North Atlantic right, sei, and sperm whales. Whales are highly transient in deep, offshore waters. It is unlikely that LNG carrier traffic in offshore areas would affect such highly mobile species. Furthermore, existing shipping traffic already uses these shipping corridors. Bayou Casotte Energy has agreed to adopt and comply with NOAA Fisheries' *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* policy to minimize the risk to whales from contact with shipping. These procedures include:

- use of 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 one species of manatee that might be encountered in the Gulf of Mexico Outer Continental Shelf;
- maintain a vigilant watch for marine mammals and sea turtles and slow down or stop their vessel to avoid striking protected species;
- maintain a distance of 300 feet or greater between the vessel and whales;
- attempt to maintain a distance of 150 feet or greater between the vessel and sea turtles or small cetaceans;
- attempt to remain parallel to the animal's course and avoid excessive speed or abrupt changes in direction when protected species are sighted in the area;
- reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel;
- reduce speed and shift the engine to neutral when protected species are sighted in the vessel's path or in close proximity to a moving vessel; and
- report sightings of any injured or dead protected species (marine mammals and sea turtles) immediately to the Marine Mammal and Sea Turtle Stranding Hotline or the Marine Mammal Stranding Network.

Of the federally listed whale species considered in our analysis, no resident stock for five of these species (blue, sei, fin, humpback, and North Atlantic right whales) occurs in the Gulf of Mexico. NOAA Fisheries indicated in its letter dated June 8, 2005, that the "potential for interaction between any of the proposed Project's activities and these whale species is extremely low." We concur with this assessment and conclude that the proposed Project would have no effect on these species. The sperm whale is the only whale species that occurs in the Gulf of Mexico with enough frequency to be potentially affected by

TABLE 4.6.1-2
Federally Listed Species Potentially Affected in the Casotte Landing LNG Project Area

Species	Federal/ State Status	Project Effect	Habitat	Potential for Occurrence
Mammals				
Blue whale (*Balaenoptera musculus*)	E/NS	No effect.	Open ocean; cold, mostly pelagic waters. Calves are born in warmer waters of lower latitudes.	According to NOAA Fisheries, there is no resident stock in the Gulf of Mexico so the potential for interaction with the proposed Project is extremely low.
Fin whale (*Balaenoptera physalus*)	E/NS	No effect.	Pelagic water, usually 25 miles or more from shore.	According to NOAA Fisheries, there is no resident stock in the Gulf of Mexico so the potential for interaction with the proposed Project is extremely low.
Humpback whale (*Megaptera novaengliae*)	E/NS	No effect.	Pelagic and coastal waters	According to NOAA Fisheries, there is no resident stock in the Gulf of Mexico so the potential for interaction with the proposed Project is extremely low.
North Atlantic right whale (*Eubalaena glacialis*)	E/NS	No effect.	Pelagic and coastal waters	According to NOAA Fisheries, there is no resident stock in the Gulf of Mexico so the potential for interaction with the proposed Project is extremely low.
Sei whale (*Balaenoptera borealis*)	E/NS	No effect.	Offshore waters in deep water.	According to NOAA Fisheries, there is no resident stock in the Gulf of Mexico so the potential for interaction with the proposed Project is extremely low.
Sperm whale (*Physeter macrocephalus*)	E/NS	Not likely to adversely effect.	Pelagic offshore, deep waters	More common in the Gulf of Mexico than other whale species but, according to NOAA Fisheries, the potential for interaction with the proposed Project is extremely low.
Florida manatee (*Trichechus manatus*)	E/SZ	Not likely to adversely affect.	Shallow coastal waters, estuaries, bays, rivers, and lakes. Usually associated with freshwater sources.	May occur in estuarine and shallow coastal areas adjacent to the proposed Project site.

TABLE 4.6.1-2 (continued)
Federally Listed Species Potentially Affected in the Casotte Landing LNG Project Area

Species	Federal/ State Status	Project Effect	Habitat	Potential for Occurrence
Fish				
Gulf sturgeon (*Acipenser oxyrinchus desotoi*)	T/S1	Not likely to adversely affect.	Marine and estuarine in fall and winter, migrates to upper rivers to spawn in spring and summer. Riverine habitat includes hard clay bottom, rubble, gravel, and rock ledges and shelves.	May occur in estuarine and shallow coastal areas adjacent to the proposed Project site.
Reptiles				
Green sea turtle (*Chelonia mydas*)	T/SZN	Not likely to adversely affect.	Feeds in shallow, low-energy water with abundant submerged vegetation. Rests on rocky outcrops and coral reefs. Nests on coarse- to fine-sand beaches; prefers high energy beaches with deep sand.	May occur in estuarine, shallow coastal, and sand beach areas adjacent to the proposed Project site.
Hawksbill sea turtle *(Eretmochelys imbricata)*	E/NS	Not likely to adversely affect.	Shallow coastal waters with rocky bottoms, coral reefs, and mangrove-bordered bays and estuaries. Nests on undisturbed, low-energy, deep-sand beaches.	May occur in estuarine, shallow coastal, and sand beach areas adjacent to the proposed Project site.
Kemp's ridleys sea turtle (*Lepidochelys kempii*)	E/S1N	Not likely to adversely affect.	Shallow coastal and estuarine waters. Nests on elevated dunes.	May occur in estuarine, shallow coastal, and sand beach areas adjacent to the proposed Project site.
Leatherback sea turtle (*Dermochelys coriacea*)	E/NS	Not likely to adversely affect.	Open ocean, as well as gulfs, bays, and estuaries. Nests on sandy beaches near deep, open ocean with no fringing reef.	May occur in estuarine, shallow coastal, and sand beach areas adjacent to the proposed Project site.
Loggerhead sea turtle (*Caretta caretta*)	T/S1B, SZN	Not likely to adversely affect.	Open ocean, as well as bays, estuaries, lagoons, creaks, and mouths of rivers. Nests on sandy, high-energy, steeply sloped beaches on barrier islands.	May occur in estuarine, shallow coastal, and sand beach areas adjacent to the proposed Project site.

TABLE 4.6.1-2 (continued)
Federally Listed Species Potentially Affected in the Casotte Landing LNG Project Area

Species	Federal/ State Status	Project Effect	Habitat	Potential for Occurrence
Birds				
Bald eagle (*Haliaeetus leucocephalus*)	T/S1B, S2N	Not likely to adversely affect.	Areas within 2.5 miles of coastal areas, bays, rivers, lakes, or other bodies of water with food sources including fish, waterfowl, and seabirds.	Suitable nesting habitat does not occur at the proposed Project site, but Bayou Casotte may provide some foraging habitat. The species was not observed during field surveys.
Brown pelican (*Pelecanus occidentalis*)	T/S1N	Not likely to adversely affect.	Coastal shallow estuaries, sand spits, offshore sand bars, and islets. Requires dry roosting sites.	Marginal, low quality habitat may occur at the proposed Project site, but the species was not observed during field surveys.

Notes:

E = Endangered

T = Threatened

S1 — Critically imperiled in Mississippi because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it vulnerable to extirpation.

S2 — Imperiled in Mississippi because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it vulnerable to extirpation.

SZ — Zero occurrences in the state. Not of practical conservation concern in the state, because there are no definable occurrences, although the taxon is native and appears regularly in the state.

Breeding Status: (Applicable to migratory species, mainly birds, but also includes sea turtles, some fish, and some insects).

B — Breeding Status

N — Non-breeding Status

Sources: Mississippi Museum of Natural Science – Natural Heritage Program (including letter dated March 31, 2005)

NOAA Fisheries (including letter dated June 8, 2005)

the proposed Project. Even so, the probability of whales encountering LNG marine traffic in the open ocean is inherently low due to the species' ability to avoid on-coming vessels coupled with their overall rarity.

For LNG ship operation in the open Gulf of Mexico there is a possibility that fuel used for vessel propulsion or auxiliary/emergency generators could spill or leak. Each vessel would maintain a Shipboard Oil Pollution Emergency Plan as required by international convention. Additional information regarding LNG shipping incidents and their potential impacts along the transit corridor is provided in Section 4.12.5.3.

Given the low potential for interaction with the proposed Project and the measures that would be implemented to avoid or minimize impacts, as described above, we conclude that the proposed Project would not be likely to adversely affect sperm whales.

Florida Manatee

The Florida manatee is a large, slow-moving marine mammal found in lagoons, rivers, estuaries, and coastal areas along the east and west coasts of Florida. It feeds primarily on submergent, emergent, and floating vegetation. During colder winter months, manatees move south, and during warmer summer months they move north and west in the Gulf of Mexico. Its range extends as far west on the Gulf of Mexico coast as Louisiana.

Collisions with powerboats or outboard propellers pose a significant threat to manatees. Watercraft collisions account for approximately 25 percent of all manatee deaths (FWS 2006e). Boats traveling faster than 15 mph are capable of injuring or killing a manatee. Manatees can also be injured or entangled in locks, flood control structures, and fishing nets. Construction of the proposed LNG terminal and the LNG carrier traffic associated with its operation has the potential to affect the Florida manatee. However, Bayou Casotte Energy has agreed to adopt and comply with NOAA Fisheries' *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* policy and station a wildlife observer to watch for manatees and other sensitive species during construction activities, including dredging operations, to minimize the risk to manatees. Given these measures, and considering that submerged aquatic vegetation, a preferred food source, is not found in the immediate vicinity of the proposed Project, we conclude that the proposed Project would be not likely to adversely affect the Florida manatee. Potential cryogenic and thermal impacts along the waterway are discussed in greater detail in Section 4.12.5.

4.6.1.2 Fish

Gulf sturgeon

The Gulf sturgeon is a large anadromous fish that occurs in the Gulf of Mexico and several river systems of southeastern United States. Its habitat includes riverine, estuarine, and nearshore marine environments. Juvenile Gulf sturgeon typically spend their first two years in the riverine environment before migrating to the ocean. Almost all feeding and growth occurs during winter months spent in estuarine and nearshore marine environments. In March and April, mature Gulf sturgeon migrate upriver, often over 100 miles, to freshwater spawning sites. After spawning, they return to the Gulf of Mexico in late fall to spend the winter feeding on benthic invertebrates and small fishes.

<u>Critical Habitat</u>

The Gulf sturgeon was federally listed as threatened in 1991, and critical habitat was designated in 2003. The southwest corner of the proposed LNG terminal site overlaps a portion of this designated

critical habitat (Critical Habitat Unit 8) which includes several areas in the northern Gulf of Mexico including Mississippi Sound adjacent to Jackson County, Mississippi and the proposed Project. The FWS and NOAA Fisheries identified seven primary constituent elements, defined as those physical and biological features that are essential to the conversation of the species and that may require special management considerations or protection, for the critical habitat of Gulf sturgeon. These primary constituent elements include:

- abundant food items for juvenile and adult life stages, primarily including detritus, aquatic insects, worms, mollusks, polychaetes, and other benthic organisms in riverine, estuarine, and marine environments;
- riverine spawning sites with suitable substrates for egg deposition and development, mostly hard substrates;
- riverine aggregation areas, typically in deep holes used for resting, holding, or staging;
- an adequate flow regime to provide a suitable environment for all life stages in the riverine environment;
- water quality, including turbidity, dissolved oxygen, and other parameters;
- sediment quality, including texture and other characteristics; and
- safe and unobstructed migratory pathways.

Potential Impacts to Primary Constituent Elements of Critical Habitat

The proposed Project would not affect any known Gulf sturgeon spawning sites or riverine resting, holding, or staging areas, nor would freshwater flow regimes be affected. Additionally, neither construction nor operation of the proposed Project would result in obstruction of migratory pathways, should they occur in the vicinity of Bayou Casotte. There is potential for impacts to abundant food items, water quality, and sediment quality resulting from construction and operations of the proposed Project and these primary constituent elements are discussed in more detail below.

The proposed Project would affect approximately 6.3 acres of non-vegetated, estuarine soft sediments during construction dredging. Maintenance dredging of sediments within the newly constructed slip would also be required during operations. Dredging and excavation of the proposed marine slip would create approximately 49 acres of additional soft-bottom benthic habitat that could also potentially be used for foraging. As discussed in Section 4.5.2 numerous species of mollusks, polychaetes, and other benthic organisms, which could serve as prey items for juvenile and adult Gulf sturgeon, occur in this area and could be affected by the proposed Project. However, this area is already routinely dredged approximately every three years by the COE, resulting in a benthic community conditioned to periodic disturbance and largely comprised of opportunistic species that would soon re-colonize disturbed habitats.

Similarly, sediment texture and quality in Bayou Casotte would not be appreciably altered by dredging during construction or operations because it is already routinely disturbed. Contaminated soils and sediments would be identified and removed from the terminal site prior to excavation and dredging, thereby preventing the potential mobilization of toxic constituents into the estuary. Construction and maintenance dredging would be performed with clamshell or dragline dredges to minimize the risk to Gulf sturgeon, rather than hopper dredges, which are known to injure Gulf sturgeon. Additionally, Bayou Casotte Energy proposes to dispose of all non-contaminated, dredged sediments at the existing Pascagoula ODMDS, which is located outside of designated Gulf sturgeon critical habitat. That site has

already been approved for disposal of dredge spoils from Bayou Casotte channel (USEPA 1991), and no significant adverse effects would be anticipated with its use as proposed.

Given the condition of the estuarine sediments, the benthic community at Bayou Casotte, and the availability of expansive, less disturbed estuarine habitat in Mississippi Sound, we conclude that any impacts resulting from the proposed Project would be temporary and minor and would not result in significant impacts to Gulf sturgeon food availability or sediment quality or texture.

The proposed Project could potentially affect water quality in Bayou Casotte in a number of ways, as discussed in Section 4.3.2. Potential effects could result from stormwater runoff from the terminal site during construction and operations, hydrostatic testing, accidental spills, bank erosion caused by waves or vessel propeller wash, and intake/discharge of ballast water and cooling water by vessels at the terminal and along the entire transit waterway. The potential for effects to water quality within Gulf sturgeon critical habitat from these activities or sources is low, given the measures and plans that would be implemented by Bayou Casotte Energy, ongoing Agency consultations and resulting permit requirements, and the conditions that Commission staff have recommended in Section 4.3.2. Two other potential causes of effects to water quality, operation of the proposed slip and sedimentation and turbidity during construction and maintenance dredging, have relatively greater potential to affect Gulf sturgeon critical habitat and are discussed in more detail below.

Impacts to water quality such as depressed levels of dissolved oxygen could occur within the proposed terminal slip and adjacent Bayou Casotte due to the recessed nature of the slip and the potential for stagnation. However, the potential for these impacts would be eliminated or effectively minimized through tidal flushing, regular ingress and egress of LNG carrier and tug traffic, and the generally shallow nature of the slip itself. Additionally, Bayou Casotte Energy is in the process of consulting with MDMR and MDEQ regarding the proposed slip and its possible effects on water quality. In order that these consultations may be completed in a timely manner, we have included a recommendation in Section 4.3.2 that Bayou Casotte Energy complete the consultations and report on any required mitigation or monitoring measures prior to the start of construction.

Bayou Casotte Energy modeled the potential for suspension of sediment associated with dredging of the slip using the COE's DREDGE model. The analysis indicated that maximum predicted levels of TSS would be 19.9 mg/l at a distance of approximately 30 feet from the dredging activity, with concentrations of TSS dropping at distances further away from the activity. The estimated levels of TSS associated with the proposed Project are similar to or below existing, background levels for Bayou Casotte. Bayou Casotte is a turbid estuary under existing conditions, with ambient TSS levels of approximately 36 mg/l to 55 mg/l and turbidity levels of approximately 15 to 20 NTUs. Potential impacts to water quality within Gulf sturgeon critical habitat would be small given the relatively low levels of TSS that would be generated and in consideration that the area is already routinely subjected to periodic maintenance dredging (and suspension of sediments into the water column) for the shipping channel. Bayou Casotte Energy has included BMPs for dredging in its Joint Application to the COE (July 27, 2006) which included a dredging monitoring plan (see Appendix E). Final agency approval for the plan has not been received.

Conclusions Regarding Gulf Sturgeon

Given the existing industrial character of Bayou Casotte, the anticipated effects of the proposed Project, including the mitigation measures proposed by Bayou Casotte Energy, we conclude that construction and operation of the proposed Project would not be likely to adversely affect Gulf sturgeon or the primary constituent elements of its designated critical habitat.

4.6.1.3 Reptiles

Marine Sea Turtles

Sea turtles occupy a variety of habitats, including open ocean, estuarine areas, and coral reefs. Nesting typically occurs on high-energy sand beaches, and sea turtles are not known to nest at Bayou Casotte or in the immediate vicinity of the proposed Project. Human development and artificial illumination can deter or disorient nesting sea turtles and hatchlings. As the MMNS-NHP indicated in its letter dated March 31, 2005, collision and propeller injuries from commercial fishing, recreational boating, and shipping are common. As described previously, Bayou Casotte Energy has agreed to adopt and comply with NOAA Fisheries' *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* policy to minimize the risk to sea turtles from collisions with vessels.

The green and loggerhead sea turtles are federally listed as threatened by the FWS. The hawksbill, Kemp's ridley, and leatherback sea turtles are federally listed as endangered by the FWS. The MMNR-MNHP stated in their Project correspondence dated March 31, 2006 that the green, hawksbill, and leatherback sea turtles should not be affected by the proposed Project in inshore waters due to the rarity of their occurrence in the vicinity of the terminal site. The Kemp's ridley sea turtle, however, regularly uses shallow nearshore waters during certain seasons. The loggerhead sea turtle may also occasionally use shallow nearshore waters. Increased vessel traffic associated with the proposed LNG terminal may affect the leatherback, Kemp's ridley, and loggerhead sea turtles farther offshore, as they regularly occur in the inter-island channels that would be traversed by LNG marine traffic. However, impacts from Project related vessel traffic would be minimized through implementation of NOAA Fisheries' *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* policy. Bayou Casotte Energy would also station a wildlife observer to watch for sea turtles during construction activities, including all dredging operations, further reducing the potential for impacts from vessels or mechanical dredging.

As discussed in detail in Section 4.5.2, Bayou Casotte Energy proposes to install approximately 265 pilings during construction of the marine berthing and unloading facilities. The piles would be approximately 100 to 140 feet long, with a diameter of 16 to 48 inches. They would be installed using a barge-mounted crane and various methods, including impact driving. In some cases, driving steel piles can generate noise and intense underwater sound pressure waves that can adversely affect nearby marine organisms. Based on consultations with NOAA Fisheries, Bayou Casotte Energy will adopt NOAA Fisheries *Pile-Driving Harm Avoidance and Listed Species / Critical Habitat and Vessel Impacts* guidelines (November 7, 2005). These guidelines would constitute Bayou Casotte Energy's pile driving plan.

For LNG ship operation in the open Gulf of Mexico there is a possibility that fuel used for vessel propulsion or auxiliary/emergency generators could spill or leak. Each vessel would maintain a Shipboard Oil Pollution Emergency Plan as required by international convention. In addition, should this project be approved, Bayou Casotte Energy would prepare an SPCC Plan for operation of the project that would include procedures to prevent and mitigate accidental releases of oil, gas, lubricants, or hazardous materials (see Sections 4.2.1.7 and 4.3.1.4). Additional information regarding LNG shipping incidents and their potential impacts along the transit corridor is provided in Section 4.12.5.3. With the implementation of these measures, the low likelihood and limited volume of fuel spills in the vicinity of the transit route, coupled with the overall rarity of sea turtles, minimizes the potential for impacts on sea turtles.

Given the lack of sea turtle nesting habitat at the proposed Project location and the implementation of Bayou Casotte Energy's SPCC Plan, the Strike Avoidance Procedures, and the

proposed mitigation measures related to pile driving, we conclude that the proposed Project would not be likely to adversely affect marine sea turtles.

4.6.1.4 Birds

Bald Eagle

The bald eagle is the second largest North American bird of prey with an average 7-foot wingspan. It has a distinctive white head and white tail offset against a dark brown body and wings in adult birds. The current range of the bald eagle includes all of the conterminous United States and it is especially common in areas with large expanses of aquatic habitat (FWS 2006a). Bald eagles that nest in southern latitudes frequently move northward in late spring and early summer, often summering as far north as Canada. Most eagles that breed at northern latitudes migrate southward during winter, or to coastal areas where waters remain unfrozen. Migrants frequently concentrate in large numbers at sites where food is abundant and they often roost together communally (FWS 2006b). Bald eagles are opportunistic foragers and diet varies across the range based on prey species available. They prefer fish, but will eat a great variety of mammals, amphibians, crustaceans, and birds, including many species of waterfowl (FWS 2006a).

Bald eagles are most vulnerable during the first 12 weeks of the nesting cycle in which courtship, nest building, egg laying, incubation, and brooding occur. Nests are typically built high in tall trees or more rarely, on cliffs. Disturbance during this critical period may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements (FWS 2006b). Project activities near a nest late in the nesting cycle may also cause flightless young birds to prematurely leave nests, thus reducing their chance of survival.

Bayou Casotte Energy conducted field investigations of the project area during April and December 2005. These surveys were conducted at the proposed LNG terminal and along the pipeline interconnect route. Suitable nesting habitat is not present on site, and no eagle nests were observed in the project area during these surveys. However, because the waters of the Mississippi Sound may provide foraging habitat for bald eagles, we have recommended that Bayou Casotte Energy consult with the FWS and conduct additional surveys, as necessary, if construction has not begun within 1 year from the date of issuance of the FERC approval (see Section 4.6.3).

Construction activities, including dredging and dredged material placement, may have a temporary impact on foraging habitat. Increases in noise, traffic, and lighting levels could also temporarily affect bald eagle foraging habits, potentially increasing stress to this species. However, given the high mobility of the bald eagle, the lack of nesting habitat at the proposed Project location, and the abundance of foraging habitat in the vicinity of the Project area, we conclude that the proposed Project would not be likely to adversely affect bald eagles.

Brown Pelican

The adult brown pelican is a large dark gray-brown water bird with white about the head and neck. Immatures are gray-brown above and on the neck, with white underparts. This species can reach up to 8 pounds and larger individuals have a wing spread of over 7 feet. Brown pelicans forage in shallow estuarine and inshore waters for fishes, especially menhaden, mullet, sardines, pinfish, and anchovies (FWS 2006c).

The brown pelican has a large range extending from North America to South America. The eastern brown pelican (*Pelecanus occidentalis carolinensis*) occurs in North Carolina, South Carolina,

Florida, Louisiana, Mississippi, Texas, and in the Barrier Islands. Habitat of the brown pelican is mainly coastal and these birds are rarely seen inland or far out at sea. They typically feed in shallow estuarine waters less than 40 miles from shore. Pelicans make extensive use of sand spits, offshore sand bars, and islets. Dry roosting sites are essential and some roosting sites eventually may become nesting areas. Nests are usually located on coastal islands that are free of most predators (such as raccoons) and human disturbance, and are located on the ground or in small bushes and trees. Pelicans may shift between different breeding sites in response to changing food supply distributions and to erosion and flooding of nesting sites (FWS 2006c).

Brown pelican populations are extremely vulnerable to chemical/pesticide pollution, disturbance of nesting birds by humans, declining food sources, and increased turbidity. Human disturbance not only disrupts reproductive success but may affect distribution patterns and age structure of pelicans using roosting sites. Habitat degradation affects both roosting and nesting patterns (FWS 2006c).

The field surveys found that the project area does not contain suitable habitat for nesting, but may contain potential loafing habitat onshore and foraging habitat offshore. Because the project area may contain loafing and foraging habitat, we have recommended that Bayou Casotte Energy consult with the FWS and conduct additional surveys, as necessary, if construction has not begun within 1 year from the date of issuance of the FERC approval (see Section 4.6.3).

Although construction activities, including dredging, may have a temporary impact on loafing and foraging habitat, the brown pelican is highly mobile and suitable habitat within the Grand Bay National Estuarine Research Reserve would provide ample habitat for any displaced individuals. Operation of the proposed project would result in an increase in marine traffic; however, because of the existing levels of marine traffic within the port, no impacts on brown pelicans are anticipated.

Therefore, due to the high mobility of the brown pelican, the lack of nesting habitat at the proposed Project location, and the abundance of foraging habitat in the vicinity of the Project area, we conclude that the proposed Project would not be likely to adversely affect brown pelicans.

4.6.2 Other Special Status Species

4.6.2.1 State Listed Threatened and Endangered Species

We initially identified 21 state listed endangered or threatened species that are not federally listed and which may occur in the Project area. Mississippi does not provide legal protection for state listed plants. Fifteen of the 21 species initially identified have been eliminated from further discussion based on a lack of suitable habitat at the proposed Project site or due to the highly transient nature of the species. Field surveys conducted in April 2005 and December 2005 identified possible habitat for several state listed endangered and threatened species. These species and their status, preferred habitat, potential for occurrence, and our assessment of potential Project effect are discussed in Table 4.6.2-1.

We identified six state listed species that could potentially be affected by the proposed Project based on known distribution and evaluation of habitat in the Project vicinity. These species, their status, potential for occurrence, and Project effects are listed in Table 4.6.2-2. Suitable habitat may exist at the proposed Project site for the following six state listed species: Gulf salt marsh snake, Mississippi diamondback terrapin, American white pelican, gull-billed tern, least tern, and royal tern. However, due to the existence of low quality habitat on-site, the availability of higher quality and suitable habitats nearby, general species mobility and ability to avoid disturbance, and because the state listed species were not observed in field surveys, we conclude that the proposed Project would not be likely to adversely affect these species.

TABLE 4.6.2-1
State Listed Species Eliminated From Further Consideration for the Casotte Landing LNG Project Area

Species	State Status	Project Effect	Habitat	Potential for Occurrence
Invertebrates				
Burris' burrowing crawfish (*Fallicambarus burrisi*)	S2	No effect.	Pitcher plant bogs.	Suitable habitat does not occur at the proposed Project site.
Least crayfish *(Cambarellus diminutus)*	S2	No effect.	Small to moderate, vegetated blackwater streams in pine woods.	Suitable habitat does not occur at the proposed Project site.
Mobile crayfish *(Procambarus lecontei)*	S2	No effect.	Temporary, freshwater, lentic bodies of water.	Suitable habitat does not occur at the proposed Project site.
Southern hickorynut *(Obovaria jacksoniana)*	S2	No effect.	Medium-sized gravel in freshwater with slow to moderate current.	Suitable habitat does not occur at the proposed Project site.
Speckled burrowing crayfish *(Fallicambarus danielae)*	S2	No effect.	In or around pitcher plant bogs.	Suitable habitat does not occur at the proposed Project site.
Spiny-tailed crayfish (*Procambarus fitzpatricki*)	S2	No effect.	Burrows in sandy soil with high water table (freshwater).	Suitable habitat does not occur at the proposed Project site.
Birds				
Bewick's wren (*Thryomanes bewickii*)	S2, S3B, SZN	No effect.	Brushy areas; thickets and scrub in open country; riparian woodland; and chaparral.	Suitable habitat does not occur at the proposed Project site.
Black rail (*Laterallus jamaicensis*)	S2N	Not likely to adversely affect.	Salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps.	Highly disturbed habitats at the proposed Project site could provide marginal, low quality habitat.
Golden eagle (*Aquila chrysaetos*)	S1N	No effect.	Open areas in prairies, alpine and arctic tundra, woodlands, and hilly or mountainous regions.	Suitable habitat does not occur at the proposed Project site.
Swallow-tailed kite (*Elanoides forficatus*)	S2B	No effect.	Tall trees for nesting and open areas for foraging.	Suitable habitat does not occur at the proposed Project site.
Yellow rail (*Coturnicops noveboracensis*)	S2N	Not likely to adversely affect.	Emergent wetlands, grass or sedge marshes, and wet freshwater meadows.	Highly disturbed habitats at the proposed Project site could provide marginal, low quality habitat.

TABLE 4.6.2-1 (continued)
State Listed Species Eliminated From Further Consideration for the Casotte Landing LNG Project Area

Species	State Status	Project Effect	Habitat	Potential for Occurrence
Amphibians				
Dark gopher frog *(Rana sevosa)*	S1	No effect.	Sandy soil that was previously forested. Breeds in forested wetlands. Utilizes gopher tortoise burrows.	Suitable habitat does not occur at the proposed Project site.
One-toed amphiuma (*Amphiuma pholeter*)	S1	No effect.	Deep, organic, liquid mud in alluvial swamps of low-gradient 2nd and 3rd order streams, spring runs, and occasionally floodplain swampy terrace streams.	Suitable freshwater habitat does not occur at the proposed Project site.
River frog (*Rana heckscheri*)	S1	No effect.	Swamps along streams and margins of shallow ponds. Eggs and larvae develop in permanent swamp waters.	Suitable freshwater habitat does not occur at the proposed Project site.
Reptiles				
Rainbow snake (*Farancia erytrogramma*)	S2	Not likely to adversely affect.	In or near rivers, streams, swamps, springs, open marshes, and sandy fields near water.	Highly disturbed habitats at the proposed Project site could provide marginal, low quality habitat.

Notes:

S1 — Critically imperiled in Mississippi because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it vulnerable to extirpation.

S2 — Imperiled in Mississippi because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it vulnerable to extirpation.

S3 — Rare or uncommon in Mississippi (on the order of 21 to 100 occurrences).

SZ — Zero occurrences in the state. Not of practical conservation concern in the state, because there are no definable occurrences, although the taxon is native and appears regularly in the state.

Breeding Status: (Applicable to migratory species, mainly birds, but also includes sea turtles, some fish, and some insects).

B — Breeding Status

N — Non-breeding Status

Sources: Mississippi Museum of Natural Science – Natural Heritage Program (including letter dated March 31, 2005)

TABLE 4.6.2-2
State Listed Species Potentially Affected in the Casotte Landing LNG Project Area

Species	State Status	Project Effect	Habitat	Potential for Occurrence
Reptiles				
Gulf salt marsh snake (*Nerodia clarkii clarkii*)	S2	Not likely to adversely affect.	Estuarine; coastal salt marshes containing cordgrass (*Spartina sp.*), rush (*Juncus sp.*), and pickle weed (*Salicornia sp.*).	Marginal habitat occurs at the proposed Project site, but is considered low quality. The species was not observed during field surveys.
Mississippi diamond terrapin (*Malaclemys terrapin pileata*)	S2	Not likely to adversely affect.	Coastal marshes, tidal flats, coves, estuaries, and lagoons behind barrier beaches; brackish and salt water. Nests in sandy marsh margins, offshore islands, and dunes.	Marginal habitat occurs at the proposed Project site, but is considered low quality. Potential nesting habitat is not readily available adjacent to upland marsh habitats essential for juvenile development. The species was not observed during field surveys.
Birds				
American white pelican *(Pelecanus erythrorhynchos)*	S2N	Not likely to adversely affect.	Rivers, lakes, reservoirs, estuaries, bays, marshes. May utilize dredge spoil or natural islands.	Marginal habitat occurs at the proposed Project site, but is considered low quality. The species was not observed during field surveys and represents a highly mobile species that could avoid disturbance.
Gull-billed tern (*Sterna nilotica*)	S2?B, S4?N	Not likely to adversely affect.	Coastlines, salt marshes, estuaries, lagoons, plowed fields, and occasionally along rivers and freshwater marshes.	Marginal habitat occurs at the proposed Project site, but is considered low quality. The species was not observed during field surveys and represents a highly mobile species that could avoid disturbance.
Least tern (*Sterna antillarum*)	S3B, SZN	Not likely to adversely affect.	Shallow and deepwater marine and lacustrine habitats and beach dunes	Marginal habitat occurs at the proposed Project site, but is considered low quality. The species was not observed during field surveys and represents a highly mobile species that could avoid disturbance.

TABLE 4.6.2-2 (continued)
State Listed Species Potentially Affected in the Casotte Landing LNG Project Area

Species	State Status	Project Effect	Habitat	Potential for Occurrence
Birds				
Royal tern (*Sterna maxima*)	S1B, S4N	Not likely to adversely affect.	Seacoasts, lagoons, estuaries, mudflats, sandspits, salt pond dikes and rarely on lakes.	Marginal habitat occurs at the proposed Project site, but is considered low quality. The species was not observed during field surveys and represents a highly mobile species that could avoid disturbance.

Notes:

S1 — Critically imperiled in Mississippi because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it vulnerable to extirpation.

S2 — Imperiled in Mississippi because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it vulnerable to extirpation.

S3 — Rare or uncommon in Mississippi (on the order of 21 to 100 occurrences).

S4 — Widespread, abundant, and apparently secure in the state, but with cause for long-term concern (more than 101 occurrences).

SZ — Zero occurrences in the state. Not of practical conservation concern in the state, because there are no definable occurrences, although the taxon is native and appears regularly in the state.

Qualifiers:

? — Inexact

Breeding Status: (Applicable to migratory species, mainly birds, but also includes sea turtles, some fish, and some insects).

B — Breeding Status

N — Non-breeding Status

Sources: Mississippi Museum of Natural Science – Natural Heritage Program (including letter dated March 31, 2005)

NOAA Fisheries (including letter dated June 8, 2005)

4.6.2.2 Marine Mammals

The Marine Mammal Protection Act regulates activities that may adversely affect marine mammals in waters of the United States. Federally protected whales and the Florida manatee are discussed above. Other marine mammals including pantropical spotted, bottlenose, and spinner dolphins and several other species of whales and dolphins may occur in the Gulf of Mexico (MMS 2006). Due to the mobility of many dolphin species, the planned use of wildlife observers during marine construction activities, Bayou Casotte Energy's implementation of NOAA Fisheries' *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* policy, and the other measures discussed above, we conclude that the proposed Project would not be likely to adversely affect marine mammals.

4.6.2.3 Migratory Birds

The Migratory Bird Treaty Act regulates taking of or impacts to migratory birds, including their nests. Migratory birds would be expected to occur at least as transients at the proposed Project site. However, given the fragmented and generally low quality nature of the habitats found at the proposed terminal site and along the pipeline interconnects, as well as the availability of more suitable habitats nearby, the potential for occurrence of migratory birds and/or their nests would be greatly reduced. However, in order to avoid adverse impacts to resident and migratory bird species, the FWS has recommended that clearing of terrestrial habitats be conducted outside the peak nesting season (April 1 through June 30). As currently proposed, Bayou Casotte Energy would complete clearing and site preparation during the first quarter of 2007, which would be consistent with the FWS guidance. In order to adequately protect nesting birds, **we recommend that:**

- **Bayou Casotte Energy should consult with the FWS regarding appropriate measures that should be implemented to avoid or minimize impacts to migratory bird species if construction activities were to occur during peak nesting season (April 1 through June 30). In addition, Bayou Casotte Energy should file the results of that consultation with the Secretary and receive written approval from the Director of OEP prior to implementing any associated mitigation measures.**

Given the nature of the habitats available and our recommendation above, we conclude that the proposed Project would not be likely to adversely affect migratory birds or their nesting habitat.

4.6.3 Conclusions and Recommendations

The proposed Project site and adjacent Bayou Casotte are already highly disturbed, industrialized, and regularly dredged. Nesting habitats for the bald eagle and brown pelican are lacking in the area that would be affected by the proposed Project. Additionally, Bayou Casotte Energy has agreed to adopt and comply with NOAA Fisheries' Vessel Strike Avoidance and Injured/Dead Protected Species Reporting policy and its Pile-Driving Harm Avoidance and Listed Species / Critical Habitat and Vessel Impacts guidelines. Therefore, we expect that construction and operation of the proposed Project would be not be likely to adversely affect federally or state threatened and endangered species, marine mammals, or migratory birds. However, 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 vicinity of the project. In conclusion, **we recommend that:**

- **Bayou Casotte Energy not begin construction activities at the LNG terminal and along the pipeline route until:**

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

b. **Bayou Casotte Energy receives written notification from the Director of OEP that construction and/or implementation of conservation measures may begin.**

- **If construction has not begun within 1 year from the date of issuance of the FERC approval of the project, Bayou Casotte Energy should consult with the appropriate offices of the FWS and NOAA Fisheries to update the species list and to verify that previous consultations and determinations of effect are still current. Documentation of these consultations, and the need for additional surveys and survey reports (if required), and FWS or NOAA Fisheries comments on the surveys and survey reports and their conclusions, should be filed with the Secretary and the COTP before beginning construction.**

4.7 LAND USE, RECREATION AND VISUAL RESOURCES

The proposed Project, located entirely within Jackson County, Mississippi, would affect a total of 313.0 acres of land during construction (see Table 4.7-1). The proposed terminal site is a 259.4-acre parcel that consists of previously disturbed sediments and existing industrial areas located south of Chevron's Pascagoula Refinery. The proposed pipeline interconnect system would be used to transport gas to existing infrastructure. It would include a 36-inch-diameter interconnect spur extending about 1.5 miles north along Ranson Road and then east to the existing 36-inch-diameter Gulfstream pipeline. Two 16-inch-diameter and two 12-inch-diameter laterals would branch off the 36-inch-diameter spur and interconnect with other existing pipelines. The spur and laterals would require an additional 17.4 acres of construction right-of-way. Bayou Casotte Energy has indicated that no additional acreage would be required for extra workspace and staging areas outside the terminal site. An additional 36.2 acres of right-of-way would be associated with construction of nonjurisdictional facilities.

Due to the collocation of the spurs and laterals, only 7.9 acres of new right-of-way would be required for operation of the jurisdictional facilities. The nonjurisdictional NGL pipeline and meter station would require 8.6 acres of new right-of-way during operation (see Table 4.7-2).

Potential land use impacts include alterations to the current land use, the imposition of easements, and impacts on existing residences or planned developments. Recreation could be impacted if construction or operation of the proposed Project limited access to recreational sites or reduced enjoyment of those sites once access was gained. Recreational impacts could also occur along the waterway from the territorial seas to the facility's berthing area due to potential security zones imposed around the LNG marine traffic, if the Coast Guard issues a LOR finding the waterway to be suitable for LNG vessel traffic with conditions. Impacts to visual resources are dependent upon the existing viewscape, the alteration to that viewscape, the sensitivity of viewers, and the number of potential viewers.

4.7.1 Land Use

4.7.1.1 Terminal Site

The proposed LNG terminal site is a 259.4-acre parcel of land located east of Pascagoula, Mississippi. The majority of this parcel consists of previously disturbed and developed industrial areas, which include 119.3 acres of wetland (see Table 4.7-1). The Chevron Pascagoula Refinery is adjacent to the proposed terminal site to the north, Bayou Casotte is adjacent to the west, and wetlands are adjacent to the south and east. The nearest non-industrial development is approximately one-mile northwest (Google Maps 2005).

TABLE 4.7-1
Acreage Used During Construction

	Wetlands	Upland Forest	Open Space	Existing Right-of-Way	Open Water	Commercial / Industrial	Total
Jurisdictional Facilities							
Terminal Site	119.3	0.0	0.0	0.0	25.5	114.6	**259.4**
Interconnect Spur and Laterals	12.5[a]	0.0	0.0	2.1	0.0	0.0	**14.6**
Meter Station (Interconnect Laterals)	1.5[a]	0.0	0.0	0.0	0.0	0.0	**1.5**
Meter Station (Interconnect Spur)	1.3[a]	0.0	0.0	0.0	0.0	0.0	**1.3**
Total for Jurisdictional Facilities	134.6	0.0	0.0	2.1	25.5	114.6	**276.8**
Nonjurisdictional Facilities							
Circulation Water System to Cooling Tower 1 and 2	0.0	0.0	0.0	0.0	0.0	7.9	**7.9**
NGL Interconnect Pipeline	11.1[a]	0.0	0.0	0.0	0.0	16.0	**27.1**
Meter Station (NGL Interconnect Pipeline)	1.2[a]	0.0	0.0	0.0	0.0	0.0	**1.2**
Total for Nonjurisdictional Facilities	12.3	0.0	0.0	0.0	0.0	23.9	**36.2**
Total	**146.9**	**0.0**	**0.0**	**2.1**	**25.5**	**138.5**	**313.0[b]**

[a] Acreage described as wetland may also be in existing Right-of-Way.

[b] This total does not include acreage associated with the Mississippi Power Company transmission line, classified as nonjurisdictional facility.

TABLE 4.7-2
Acreage Converted from its Current Designation During Operation

	Wetlands	Upland Forest	Open Space	Existing Transportation, Utility, or Communication Right-of-Way	Open Water	Commercial / Industrial	Total
Jurisdictional Facilities							
Terminal Site	119.3	0.0	0.0	0.0	25.5	114.6	**259.4**
Interconnect Spur and Laterals	6.1[a]	0.0	0.0	0.0	0.0	0.0	**6.1**
Meter Station (Interconnect Laterals)	0.9[a]	0.0	0.0	0.0	0.0	0.0	**0.9**
Meter Station (Interconnect Spur)	0.9[a]	0.0	0.0	0.0	0.0	0.0	**0.9**
Total for Jurisdictional Facilities	127.2	0.0	0.0	0.0	25.5	114.6	**267.3**
Nonjurisdictional Facilities							
Circulation Water System to Cooling Tower 1 and 2	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
NGL Interconnect Pipeline	0.2[a]	0.0	0.0	0.0	0.0	7.7	**7.9**
Meter Station (NGL Interconnect Pipeline)	0.7[a]	0.0	0.0	0.0	0.0	0.0	**0.7**
Total for Nonjurisdictional Facilities	0.9	0.0	0.0	0.0	0.0	7.7	**8.6**
Total	**128.1**	**0.0**	**0.0**	**0.0**	**25.5**	**122.3**	**275.9[b]**

[a] Acreage described as wetland may also be in existing Right-of-Way.

[b] This total does not include acreage associated with the Mississippi Power Company transmission line, classified as nonjurisdictional facility.

If the proposed Project were constructed, 49 acres within the proposed terminal site would be permanently converted to open water. The site would include docking equipment, regasification equipment, LNG storage tanks, and associated buildings. During construction, the site would also include a laydown area, a workshop and pre-assembly area, a MPC substation yard, and a concrete batch plant.

Following construction, those areas not utilized for an industrial application would be allowed to revert to pre-construction conditions.

Given the existing setting, the relatively small acreage, the existing cover type, and the federal requirement to mitigate wetland impacts, construction and operation of the proposed LNG terminal would represent a negligible, long-term land use conversion.

4.7.1.2 Pipeline Interconnect System

The 36-inch-diameter Gulfstream Pipeline interconnect spur and four laterals would connect the proposed LNG terminal to existing natural gas infrastructure. The 36-inch-diameter spur would extend 1.5 miles beyond the terminal site to a point where it would connect to the existing Gulfstream Pipeline. The four interconnect laterals would branch off at MP 0.5. The total length of the nonjurisdictional NGL pipeline would be about 4.3 miles. As proposed, construction right-of-way along the 36-inch-diameter interconnect spur and collocated 12-inch-diameter NGL pipeline interconnect would be 110 feet wide. Where only one pipeline would be within the right-of-way, width would be reduced to 85 feet.

These pipeline and lateral interconnects would require 14.6 acres of right-of-way during construction (see Table 4.7-1) in addition to the acreage within the proposed terminal site. Approximately 86 percent of those 14.6 acres are currently designated as wetland and are owned by utilities or other industrial interests. Assuming a 50-foot operational right-of-way would be associated with the 1 mile of 36-inch-diameter Gulfstream interconnect, were it not collocated with the nonjurisdictional 12-inch-diameter NGL pipeline, about 6.1 acres of new permanent right-of-way would be required for operation (see Table 4.7-2).

During construction, acreage within the pipeline interconnect right-of-way would be temporarily converted to open space. Following construction, hydrological gradients and flow patterns would be restored. All disturbed acreage outside the permanent right-of-way would be allowed to revert to pre-construction conditions. Acreage within the permanent right-of-way would be maintained free of woody vegetation. The proposed pipeline interconnects would be constructed and maintained in accordance with measures contained in Bayou Casotte Energy's Plans and Procedures, as modified in this EIS.

Given the existing setting, the relatively small acreage, and the federal requirement to mitigate wetland impacts, construction and operation of the proposed pipeline interconnect system would represent a negligible, long-term impact.

4.7.1.3 Extra Work Space and Staging Areas

Bayou Casotte Energy has indicated that all of the acreage required for extra workspaces and staging would be located within the proposed LNG terminal site.

4.7.1.4 Above ground Facilities Outside the Proposed Terminal Site

Two meter stations would be associated with the interconnect spur and laterals, with an additional meter station for the nonjurisdictional NGL interconnect pipeline (see Table 4.7-1 and Table 4.7-2). The

jurisdictional meter stations would be located at the tie-in locations to the existing pipelines. The first tie-in location is associated with four existing pipelines: the 16-inch-diameter Destin pipeline, a 16-inch-diameter and 12-inch-diameter Chandeluer, and the 12-inch-diameter Gulf South, while the second ties into the Gulfstream pipeline.

The land required for the meter stations is currently classified as wetland but it is also in an existing right-of-way. The proposed Project would require these areas to be filled and a hurricane levee would be constructed around the perimeter of each meter station. As such, the above ground facilities located outside the proposed terminal site would represent the conversion of 1.8 acres of land currently classified as wetlands and maintained as industrial right-of-way to commercial industrial right-of-way. This would be a permanent (for the life of the Project) impact to the land classification.

4.7.1.5 Access Roads

Bayou Casotte Energy anticipates that existing access roads, in conjunction with proposed rights-of-way, would be sufficient to meet both construction and operation needs of the proposed Casotte Landing Project. Moreover, no improvements or modifications to existing roads, or construction of new roads outside the terminal site are expected.

4.7.1.6 Disposal of Spoils from Slip Creation

The proposed Project would include the creation of a marine slip to be situated less than 0.25 miles north of the mouth of Bayou Casotte. This slip, created by removing soil and sediments from the proposed terminal site, would serve to promote ease of navigation, alleviate congestion and delays within the channel, and simultaneously accommodate an LNG carrier and a crude tanker.

Bayou Casotte Energy has indicated that about 22 percent of the dredged spoils would be used for both on and off-site construction needs such as fill, site leveling, and hurricane levee construction. The remaining 78 percent would be transported to placement locations. Preferred placement options, as outlined in Bayou Casotte Energy's DMMP, are at the Pascagoula ODMDS or at approved and available Federal and state coastal or offshore Beneficial Use projects sites, or some combination thereof (see Appendix E). Final agency approval for disposal at the ODMDS has not been granted by the COE or EPA.

4.7.1.7 Nonjurisdictional Facilities

Nonjurisdictional facilities would include two relocated refinery ship berths, electric transmission lines, connections to a circulating water cooling system, and the 12-inch NGL interconnect pipeline.

Acreage associated with the ship berths is included in discussions of the proposed LNG marine terminal. The electric transmission lines would be constructed by Mississippi Power. The exact timing for construction and route of the transmission lines has not been determined; therefore, land use impacts as a result of constructing and operating this system have not been addressed.

The circulating water cooling system and the 12-inch-diameter NGL pipeline facilities would require 36.2 acres of right-of-way during construction and maintenance of about 8.6 acres of new permanent right-of-way during operation (see Tables 4.7-1 and 4.7-2). Construction disturbance would primarily be associated with commercial industrial land (66 percent), with wetlands comprising the remainder (34 percent). Following construction, hydrological gradients and flow patterns would be restored to all disturbed acreage. The area outside the permanent right-of-way would be allowed to revert

to pre-construction conditions. Acreage within the permanent right-of-way would be maintained free of woody vegetation.

4.7.2 Existing Residences and Planned Developments

The nearest residence is approximately one-mile northwest of any proposed Project component. The majority of land within one mile of the proposed Project components is open water, wetland, or land owned by industrial interests. Bayou Casotte Energy indicated that construction notices would be distributed to landowners within one mile and minimization techniques would be used to reduce any potential impacts such as dust and noise. As such, terminal construction would not significantly impact any existing residences. No residences or planned residential developments are located along the centerline of the LNG ship transit route.

Two planned industrial developments have also been identified in the immediate area. One known planned development is an expansion by Chevron Pascagoula Refinery to increase processing capacity by 15,000 barrels per day by upgrading its Fluid Catalytic Cracking Unit (FCCU). Upgrades to the FCCU would also require upgrading and replacing other process equipment at the refinery; however, all expansion activities are currently planned to take place within the existing refinery property on land already developed industrially. Since Chevron is a participant in the proposed Project, no conflicts are perceived with the proposed Casotte Landing Project.

Gulf LNG Energy has also filed an application with the FERC to construct, own, and operate an LNG import terminal and natural gas pipeline. Gulf LNG's proposed terminal is located south of the proposed Casotte Landing LNG Terminal on Bayou Casotte. The FERC is currently preparing a separate EIS for the Gulf LNG Energy project.

4.7.3 Recreation and Special Interest Areas

All of the land that would be used for the proposed Project is privately owned. The FERC has not identified any designated natural, recreational, or scenic areas within 1.0 mile of the proposed LNG terminal site or pipeline interconnects. It is also noted that portions of Bayou Casotte are in the Bayou Casotte-Bangs Lake Special Management Area (SMA) which were established as part of the SMA Planned for the Port of Pascagoula. The nearest designated special interest area, located about 1.0 mile to the east and southeast, is The Nature Conservancy's Grand Bay National Estuary Research Reserve (NERR). The oldest standing structure in the Mississippi Valley, the Old Spanish Fort, and Shepards National Park are within 6 miles of the proposed Project (American Forts East 2005). During transit to the LNG terminal, the LNG marine traffic would pass between Petit Bois and Horn Islands, which are included as part of the Gulf Islands National Seashore.

4.7.3.1 Gulf Islands National Seashore

In 1971 the National Seashore was established for preservation of coastal islands, historic forts and other historic structures, nature trails, and adjacent open waters (NPS 2005). In 1978, congress set aside Horn and Petit Bois Islands as wilderness areas within Gulf Islands National Seashore. These areas are several miles south of the proposed facilities and would not be affected by the construction or operation of the proposed LNG terminal. As discussed previously, LNG marine traffic would transit the confined areas of Horn Island Pass en route to the LNG terminal, Section 4.1.3.6 contains a discussion of the potential for shoreline erosion on Horn Island due to LNG marine traffic. Additional information on the environmental impacts resulting from the transit of the LNG ships is provided in Section 4.13.5.3.

4.7.3.2 Grand Bay National Reserve, Mississippi

The Grand Bay National Reserve is an 18,400-acre reserve that was designated in 1999 due to its ecological productivity and limited development (Project Summary 2005 and American Forts East 2005). The reserve includes saltwater marshes, maritime pine forest, pine savanna and pitcher plant bogs, as well as supporting oyster reefs and seagrass habitat (National Estuary Research Reserve System 2005). Recently an archaeological survey found 16 American Indian earth and shell middens within the reserve (Mississippi DMR 2005). Principal threats to the Grand Bay National Reserve are habitat loss, fire suppression, exotic species, alteration of hydrology, and water quality degradation (Project Summary 2005).

4.7.3.3 Port of Pascagoula

In November of 1985 the Mississippi Commission on Wildlife Conservation gave approval for the Port of Pascagoula SMA Plan to be part of the Coastal Program. The primary purpose of which is to balance industrial development and the coastal environment.

The SMA task force divided the Port of Pascagoula into two separate planning areas: the Bayou Casotte-Bangs Lake Planning Area and the Pascagoula River Harbor-Middle River Planning Area. The proposed LNG terminal would be located in the Bayou Casotte-Bangs Lake Planning Area. This area is comprised primarily of undeveloped tidal marsh and open water.

Given the proposed Project site is an existing industrial area, and the pipeline interconnects fall into existing rights-of-way, no impacts are expected to these, or any other special interest area, during construction or operation of the proposed Project.

4.7.3.4 Recreational Boating and Fishing

Recreational fishing in the area is limited to boat-based activity with the nearest public access boat ramp located at Lander Avenue about 1.9 miles away. This relatively small site generally provides access to fewer than 20 boats per day.

Construction and operation of the proposed Project could displace recreational boating and fishing on Bayou Casotte during construction and operation, if the LOR is issued with conditions by Coast Guard. Boaters and fishermen could need to avoid construction vessels as they delivered material to the site. While on their inbound and outbound routes or docked, LNG marine traffic could have a security zone enforced around them. Other vessels, including recreational boats, could be prohibited within the security zone during the arrival, departure, or mooring of LNG carriers. These effects could be temporary while the LNG carrier is in transit or moored at the LNG carrier unloading dock. The maximum delay expected due to the transit of an LNG carrier could be 1.5 hours. The extent of the security zone around the LNG carrier while it is unloading could be established by the Coast Guard but is not expected to interfere with traffic along the adjacent Bayou Casotte Channel.

Furthermore area bathymetry suggests that recreational and fishing vessels could be able to navigate Bayou Casotte to the Gulf of Mexico through outside-channel portions of the waterway. As such, potential displacement could be limited to the relatively few recreational operating boats in direct proximity to either the shipping lanes or the proposed terminal location. These displacements could represent a minor, periodic inconvenience to fishermen and recreational boaters that could persist for the life of Project, if the LOR is issued with conditions by the Coast Guard.

4.7.4 Visual Resources

The degree of visual impact associated with a project is a function of the existing viewscape, alterations to that viewscape, the number of potential viewers, and their sensitivity.

All Project components would be located in an industrial viewscape situated in relatively flat topography. The dominant anthropogenic component is the Chevron Pascagoula Refinery, which contains large storage tanks, and industrial facilities up to 100 feet tall. To the west is Bayou Casotte a dredged inlet used for both recreational and industrial applications.

During construction, the terminal site would include all of the equipment and activity typically associated with a large construction project. When complete, storage tanks estimated at 168 feet tall would dominate the proposed terminal site. Safety lighting would be required on the mooring dolphins, uploading platform, and the highest points of the storage tanks.

This viewscape would be observed by those who work in and around the complex, boaters on Bayou Casotte, and residents who would be located approximately 1 mile from proposed Project components. These viewers would generally be familiar with the views associated with energy infrastructure and would have grown accustomed to views of similar infrastructure at this site.

The level of marine traffic in and approaching Bayou Casotte, currently about 2,800 arrivals per year, would increase about six percent in association with increased LNG carrier traffic. These LNG carriers are generally less than 1,000 feet in length and draft up to 38 feet. Given the unique appearance of their moss tanks, LNG carriers are quite distinctive and they would be visible form several locations as they approached the proposed site. However, their appearance would be similar in size and duration to the existing Bayou Casotte traffic.

During construction, activity would be viewed by some visual receptors, as minor viewscape degradation while others would likely derive some enjoyment from watching the activity. Once complete the proposed LNG terminal site would represent a long-term, minor degradation of an already industrialized viewscape.

4.7.5 Coastal Zone Management (CZM) consistency

The CZM Act provides states whose CZM programs have met federal approval the power to review any project proposed within that state's coastal zone. Projects that require federal licenses or permits must draft a "consistency certification" to assure the proposed project meets the state's CZM program standards. CZM consistency for the Coast Guard's establishment of a moving safety zone and a safety zone around the LNG facility must also be determined.

Portions of the proposed Project fall within the coastal zone managed by the MDMR and the Pascagoula Special Management Area (SMA). MDMR is currently conducting a consistency review. Therefore, **we recommend that:**

- **Bayou Casotte Energy file documentation of concurrence from the Mississippi Department of Marine Resources that the Project is consistent with Mississippi's CMP with the secretary prior to construction and transit route usage.**

4.8 SOCIOECONOMICS

The proposed Project includes construction of a marine slip and berth for offloading LNG, relocation of two existing refinery berths, and construction of facilities to receive and regasify LNG for transport to components of the existing natural gas transportation infrastructure. The 259.4-acre terminal site is located south of the existing Chevron Pascagoula Refinery in Jackson County, Mississippi.

Several potential socioeconomic effects could be associated with construction of the proposed Project. These include altering local demographics, increased employment opportunity, increased demand for housing, and altered property values. Other potential construction effects would include increased government revenue associated with sales and payroll taxes, increased demand for the provision of public services, changes to local commerce, and increased utilization of local transportation infrastructure.

Economic activity associated with the operation of the proposed Project would include employment opportunities, ongoing local expenditures by the operating company, and an increased tax base.

The FERC notes that this EIS is being prepared while the communities surrounding the proposed Project area are still recovering from the aftermath of Hurricane Katrina. However, the following section has been updated, as appropriate, to provide additional information regarding the socioeconomic impacts on the Project area associated with Hurricane Katrina.

4.8.1 Population

Table 4.8.1-1 summarizes selected socioeconomic statistics for Mississippi, Jackson County, and Pascagoula prior to Hurricane Katrina. Populations in all areas were increasing though growth in Pascagoula had been slower than state and county averages. All areas were predominantly white non-Hispanic with African Americans making up the majority minority. These residents were living at population densities that are typical of rural areas.

TABLE 4.8.1-1
Selected Socioeconomic Statistics

Location	Population	Persons per Square Mile	White, non Hispanic (%)	African American (%)	Hispanic (%)	Asian (%)	Native American (%)	Annual Growth Rate (%)
Mississippi	2,881,281	60.6	60.7	36.3	1.4	0.7	0.4	1.3
Jackson County	133,928	180.8	74.2	20.9	2.1	1.6	0.3	1.9
City of Pascagoula	26,200	1,726.4	67.2	29.0	3.9	1	0.2	0.4

Source U.S. Census Bureau, 2005

Construction of the proposed Casotte Landing Project would occur between 2007 and 2010. During the two years of peak construction, 400 to 600 workers would be involved in construction activity. When available, suitably skilled, local workers would be used for construction. During past projects of this nature, non-local workers specializing in the construction of LNG terminals typically comprised

about 30 percent of the labor force (FERC 2005). For this Project, additional, non-local workers may be required depending upon the impacts to those displaced by Hurricane Katrina.

Construction of the proposed Project would result in a minor, short-term population increase in the local area. If non-local workers represent 30 percent of the work force and 0.8 persons accompanied each worker, total in-migration would be 324. This would represent a minor influx of persons into Jackson County.

During operation, Bayou Casotte Energy estimates that approximately 50 full-time workers would be employed. This would represent a negligible, long-term effect on population demographics.

4.8.2 Economy and Employment

In 2000, Mississippi's largest employment sector was education, health, and social services; manufacturing led Jackson County and Pascagoula. In addition, Pascagoula and Jackson County had lower unemployment rates and higher per capita incomes that the rest of Mississippi (see Table 4.8.2-1).

TABLE 4.8.2-1
Employment Statistics

Location	Per Capita Income in 1999	Civilian Labor Force in 2000	Percent Unemployed	Top Employment Industry
Mississippi	$15,853.00	1,267,092	6.9	Education, health and social services
Jackson County	$17,768.00	60,617	6.1	Manufacturing
City of Pascagoula	$16,891.00	11,230	5.3	Manufacturing

Source U.S. Census Bureau, 2005

Following Hurricane Katrina, economic activity along Mississippi's Gulf coast changed significantly. Current statistics are difficult to obtain but a much larger portion of economic activity currently centers on recovery and construction than was the case prior to the storm.

During the two years of peak construction, as many as 420 construction positions may be filled by local workers. Additional jobs could also be created as a result of secondary activity associated with construction of the proposed Project. This is because Bayou Casotte Energy has indicated it will take proactive measures to ensure that local suppliers and service providers have the opportunity to submit proposals. In addition, purchases made by non-local workers on food, clothing, lodging, gasoline, and entertainment will have a temporary, stimulatory effect on the local economy. These positions could represent a moderate increase in employment opportunities for an economy that is recovering from a major natural disaster.

The 50 positions created during operations would represent a minor, long-term increase in local employment opportunities.

4.8.3 Housing

The U.S census bureau (2005a) reported that the number of rental units in Jackson County for the year 2000 was 1,367, with an additional 613 units available for seasonal, recreational, or occupational use. An additional 808 rooms and R/V sites are available at 10 area establishments based on information from the American Automobile Association. Following Hurricane Katrina, it is difficult to assess the stock of existing and/or available housing.

If non-local workers represent 30 percent of the workforce and each non-local worker required his or her own housing, 180 units could be required during the two years of peak construction activity. Given the nearly 2,800 potentially available units in Jackson County prior to the storm this would represent a minor, short-term reduction of available housing units. During operations, impacts to housing would be negligible.

Given the recent events associated with Hurricane Katrina, the potential impact to local housing stock as it will appear in 2007 is difficult to determine. To date, FEMA has created temporary housing called Emergency Group Sites (EGS) that accommodate between 10 and 200 manufactured housing units. There are currently three completed EGS with more under review or construction. In addition, the city of Pascagoula reports hotels in the Project area are reopening. Given the 2007 to 2010 construction time period, it seems likely that housing requirements associated with construction workers would result in a moderate, short-term tightening of the available housing market. During operations, impacts to housing would be negligible.

4.8.4 Property Values

The FERC has received comments questioning whether the construction of an LNG terminal diminishes property values. The FERC notes that the impact a project may have on the value of any land parcel depends on many factors. These include the size of the parcel, the parcel's current value and land use, and the value of other nearby properties. However, subjective valuation is generally not considered in appraisals. This is not to say that the proposed Project could not affect resale values. Potential purchasers may make a decision based on intended future use and, if the presence of the proposed Project would make that use infeasible, it is possible that that potential purchaser may not acquire the parcel. However, each potential purchaser has differing criteria and means. The FERC further notes that any potential effects on property values would be mitigated by the co-location of the proposed Project near an existing industrial facility.

The FERC notes that, due to the location of the proposed terminal and collocation of pipeline right-of-way within existing right-of-way, the proposed Project would not require the negotiation of easements with individual parcel owners nor would there be any potential use of eminent domain. Therefore, property value changes associated with easement imposition are not at issue.

The FERC has previously consulted with insurance professionals to determine if construction of an LNG terminal near an existing industrial facility would likely increase homeowners insurance rates (FERC 2004). The FERC has determined that homeowners' insurance rates are not likely to increase as the result of LNG terminal siting near existing industrial sites.

4.8.5 Government Revenue

During construction a portion of the $100 to $150 million dollar construction payroll would be spent locally for the purchasing of housing, food, gasoline, and entertainment. The exact amount would be dependent upon the behavior of individual workers and the duration of their stay. In addition, Bayou

Casotte Energy has indicated that local suppliers have the opportunity to submit proposals for Project related work. To the extent that these local providers bid successfully, local expenditures during construction would increase. The majority of these construction-related expenditures would be subject to Mississippi's state sales tax of seven percent. Additional expenditures may be subject to Pascagoula's hotel and room tax. This increase in sales tax would represent a minor, short-term increase in government revenues.

During operation, taxable payroll expenditures would be approximately $3 million annually. In addition, the facility would be subject to property taxes. Associated tax revenues (Table 4.8.5-1) would represent a moderate, but long term increase in tax revenue.

TABLE 4.8.5-1
Estimated Local, County and State Taxes

Tax Category	Estimated Annual Payment (in thousands)
Property	
County	$6,477
School	$5,481
Mississippi State	
Income	$1,620
Sales & Use	$28

While the presence of an industrial facility could, under some circumstances, reduce the assessed values of some parcels and hence taxes levied against them, the net effect on tax revenues would likely be positive, moderate, and long-term.

4.8.6 Public Services

Prior to Hurricane Katrina there were 491 fire, police, and medical full time equivalent positions in Jackson County (U.S. Census Bureau 2005b), a level typical of a semi-rural community. Table 4.8.6-1 describes the local fire, police, and ambulance services prior to Hurricane Katrina. Most of these services are within approximately 5miles of the proposed Project area. Singing River Hospital, located in Pascagoula, has 415 licensed beds and a 24-hour emergency center.

TABLE 4.8.6-1
Local Fire, Police, and Ambulance

Service Provider	Employees
Jackson County Ambulance Service	50 Medics
Escatawpa Fire Dept.	4 Full Time Fire Fighters, 30 volunteer
Moss Point Fire Dept.	39 Fire Fighters at 4 stations
Pascagoula Police Dept.	57 Officers
Pascagoula Fire Dept.	58 Fire Fighters at 3 stations

The Pascagoula Fire Department currently has the equipment and personnel necessary to handle a large, industrial-related emergency at the proposed LNG terminal. However, additional training specifically for LNG firefighting would be coordinated with Bayou Casotte. The fire department would also respond to any medical, hazardous materials, safety incidents, and other non-fire emergencies at the proposed LNG terminal.

Although incidents are not anticipated, Bayou Casotte Energy has taken the precautions of preparing a SPCC Plan (see Appendix D) and an Emergency Response Plan (currently being prepared by Bayou Casotte Energy) in accordance with the Oil Pollution Act 1990 (OPA-90). An Emergency Response Plan would include procedures for coordinating with local, state, and federal emergency response authorities. Specific components of the plan consist of periodic informational meetings, drills, demonstrations, and training sessions associated with potential incidents involving facilities operated by Bayou Casotte Energy.

Jackson County also had 3,293 full time equivalent education workers distributed throughout four public school districts and seven private or parochial schools. They served over 25,000 students (Jackson Chamber). The provision of these services was impacted by Hurricane Katrina. Individual service providers were displaced and facilities were damaged. By early 2006, area schools had re-opened and the provision of medical and policing services were normalizing.

Project construction could temporarily increase the demand for permit issuance and law enforcement activities and impact the demand for local medical and education services. Given the peak workforce of 600, and a maximum expected in-migration of 324 individuals, the aforementioned sectors would experience a minor, short-term strain during construction and a negligible, long-term impact during operation. In addition, any increase in demand for public services could be partially or wholly offset by the proposed Project's related increase in government revenue.

4.8.7 Local Commerce

Potentially significant effects on economic sectors not associated with energy production are limited to marine based transportation. These impacts, primarily resulting from the LNG vessel traffic along the waterway from the territorial seas to the berthing facility, are discussed in Section 4.9.

4.8.8 Environmental Justice

In December 1997 the Council on Environmental Quality called upon the Federal agencies to actively scrutinize the following issues with respect to environmental justice (CEQ 1997):

- the racial and economic composition of affected communities;
- health related issues that may amplify Project effects on minority or low-income individuals; and
- public participation strategies, including community or tribal participation in the process.

4.8.8.1 Racial and Economic Composition

Tables 4.8.1-1 and 4.8.2-1 summarize the demographic composition and economic status of Jackson County residents. They are not indicative of a community that is disproportionately low income or minority.

4.8.8.2 Public Health

The primary health issue related to the Project is the risk associated with cryogenic or thermal impacts from an accidental or intentional release during LNG vessel transit along the waterway, facility fires or pipeline failure. Section 4.12 addresses these risks and the measures that would be taken to minimize them. These risks would not be disproportionately borne by any minority or low-income group.

4.8.8.3 Public and Community Participation

Bayou Casotte has conducted two open houses: March 3, 2005 at the Pascagoula High School and August 4, 2005 at the Pascagoula Civic Center. In addition, the NEPA process is designed to solicit public input during preparation of the EIS and all public documents filed in association with this proposed Project can be accessed via the FERC's website. On April 20, 2005, the FERC conducted a public scoping meeting in Pascagoula to provide an opportunity for the general public to learn more about the proposed Project and to participate in our analysis by commenting on issues to be included in the EIS. On December 7, 2005, the Coast Guard conducted a public meeting in Pascagoula to provide an opportunity for the general public to provide comments on waterway suitability and maritime safety and security aspects of the proposed LNG facilities. The FERC conducted a public comment meeting on June 22, 2006, in Pascagoula to provide an opportunity for the general public to comment on the draft EIS.

4.8.8.4 Conclusions Regarding Environmental Justice

The FERC believes the proposed Project is practical, economical, and designed to meet energy infrastructure needs while minimizing environmental, safety, and engineering concerns. The FERC has not identified any high adverse human health or environmental effects that would be borne disproportionately by any low income or minority group.

4.9 TRANSPORTATION

4.9.1 Marine Transportation

More than 2,800 marine vessels, excluding tugs and tows, accessed Bayou Casotte via the Bayou Casotte Channel in 2002 (COE 2002). Traffic restricted to shipping channels included tankers calling on the Chevron Pascagoula Refinery, and vessels exporting both dry goods and timber. Fishing vessels and recreational boating traffic, while frequent, is not restricted to the main shipping channel. The Pascagoula Channel, from which the Bayou Casotte Channel branches, is also used by several hundred vessels per year to access the Port of Pascagoula via the Pascagoula River Harbor.

Vessels that had been traveling along the Alabama or Mississippi coasts would likely arrive at the Pascagoula Channel via the Mississippi Intracoastal Waterway at a point north of Petit Bois and Horn Islands. Ships arriving from offshore, such as LNG carriers, could pass between Petit Bois and Horn Islands via the Horn Island Pass. All ships and large barges, regardless of their approach to Bayou Casotte, are required to be under the control of a Pascagoula Bar Pilot. Large vessels, such as LNG carriers, require two pilots.

Findings of a traffic study (MNI 2005) identified vessels that were night restricted and extreme weather events as causing the majority of the existing marine traffic delays at Bayou Casotte. Conditions at the time of the study found average delays to be 0.8 hours for inbound traffic and 0.7 hours for outbound traffic.

Impacts during construction could be limited to the delivery of construction material; dredging of the Pascagoula and Bayou Casotte Channels is not anticipated. Deliveries could likely occur primarily via barge accessing the site from the Mississippi Intracoastal Waterway and then the Bayou Casotte Channel.

During operation, approximately 170 LNG carriers per year, under the control of Pascagoula Bar Pilots, could access the proposed terminal via existing shipping channels from the territorial seas, if LOR issued by the Coast Guard finds the waterway suitable for LNG vessel traffic with conditions. The Coast Guard, with input from the Pascagoula AMSC, has completed a review of Bayou Casotte Energy's WSA in accordance with the guidance in Coast Guard NVIC 05-05. The WSA review focused on the navigation safety and maritime security risks posed by LNG ship traffic, and the measures needed to responsibly manage these security risks. The WSA itself is designated Sensitive Security Information as defined in 49 CFR Part 1520. Because any unauthorized disclosure of these details could be employed to circumvent the proposed security measures, they are not releasable to the public.

As a result of this review, the Coast Guard advised the FERC in its WSR letter dated April 1, 2006, that the Pascagoula Bar, Horn Island Pass, Lower Pascagoula, and Bayou Casotte Channels can accommodate the LNG vessel traffic associated with the project. The letter stated that these waterways can accommodate the proposed traffic and there is sufficient capability within the port community to responsibly manage the safety and security risks of this project. In a follow-up letter to the FERC dated September 5, 2006, the Coast Guard clarified that the April 1, 2006 letter gave a preliminary evaluation to meet the recommendations of NVIC 05-05. The evaluation is not final until the Coast Guard completes its NEPA Review. The September 5 letter also stated that any final determination of waterway suitability is contingent upon an evaluation of certain conditions including those identified in Section 2.0. With the completion of this Final EIS, the Coast Guard will complete its review and issue an LOR to address the suitability of the waterways for LNG transport.

The FERC notes that, while Bayou Casotte Energy has designed a marine slip capable of servicing LNG carriers up to 200,000 m^3, which could require channel deepening, they are not planning to deepen the channel at this time.

LNG marine traffic could enter the port area starting at the "HI" sea buoy and travel northeast to the Horn Island Pass. While transiting the Horn Island Pass, ships would turn from a northeasterly to a northern course. After transiting the Horn Island Pass, LNG marine traffic could cross the Mississippi Intracoastal Waterway and proceed to Bayou Casotte via the Bayou Casotte Channel. A similar course could be followed by exiting LNG marine traffic. The Pascagoula Pilot's Association[1] restricts the passage of all LNG marine traffic to daylight hours due to LNG carrier sizes exceeding 700 feet in length and with beams greater than 125 feet.

While moored, LNG carriers may have a security zone enforced around them prohibiting other vessels and recreational boats within the security zone, unless permission to enter the zone is obtained from the Captain of the Port. These effects could be temporary while the LNG carrier is moored at the unloading dock. The extent of the security zone around the LNG carrier while it is moored may be established by the Coast Guard but is not expected to interfere with traffic along the adjacent Bayou

[1] The Pascagoula Pilots are the controlling body in terms of scheduling, monitoring of weather conditions, establishing working conditions, and declaring channel closure days based on inclement weather. Pilots meet ships, day or night, at the sea buoy located at the southern end of the Horn Island Pass Channel.

Casotte Channel. An example of existing safety and security zones consist of 500 yards on either side of the vessel, and 1,000 yards from the bow and stern of the vessel.

Bayou Casotte Energy conducted a marine traffic simulation. This simulation controlled for the one way restriction placed on large vessels, the one-half hour which must be maintained between incoming and exiting vessels, weather related travel restrictions, existing vessel traffic patterns, pilot and tug availability, and the potential growth of that traffic for reasons unrelated to the proposed Project. The results of Bayou Casotte Energy's marine traffic simulations suggest that the proposed Project related arrivals may increase inbound marine traffic delays by 0.25 percent and outbound traffic delays by 0.14 percent relative to current conditions. This could represent a moderate, long-term impact.

The FERC notes that anticipated impacts of project related LNG carrier traffic are based on the assumption that the Coast Guard could establish a safety and security zone 2 miles ahead and 1 mile behind each LNG carrier. However, the one-half hour separation requirement for in and outbound traffic is more burdensome than the assumed Coast Guard safety and security zone. As such, results of the analysis are robust to minor changes in the assumed Coast Guard safety and security requirements.

To summarize, Project construction could have only minor impacts on commercial and recreational boat traffic. These effects could be associated with the waterborne delivery and removal of construction materials. Other shipping activities would be moderately affected by the increase in traffic during operations; however, based on the relatively low volume of existing shipping activity in the berthing area to the territorial sea, the impact is not expected to be substantial.

4.9.2 Land Transportation

The area's overland infrastructure includes U.S. Highway 90 that is an east to west highway located approximately 3.5 miles north of the proposed site. The proposed site is accessed from U.S. Highway 90 via Highway 611. Located several miles north of U.S. Highway 90 is Interstate Highway 10. Access to the site from Interstate 10 is via Highway 63 that turns into Highway 611. The proposed site can also be accessed via Bayou Casotte waters.

The FERC notes that the current primary function of Highway 611 is to provide overland access to existing industrial facilities on Bayou Casotte. As such, traffic is light except during shift changes when more than 1,200 employees make their way to and from facilities in and around the proposed site. The FERC also notes that these roads are expected to be similar to pre-Hurricane Katrina conditions prior to the 2007 construction initiation.

During the two years of peak construction, 400 to 600 workers would be involved in construction activity. Assuming 1.3 persons per vehicle implies an extra 308 to 462 commuter vehicles per day. This represents a three to five percent increase in roadway traffic on Highway 611. Bayou Casotte Energy has indicated that the majority of construction materials and oversized loads would be delivered via marine transport. As such, the impact of the proposed Project to local roadways is expected to be minimal. An increase in commuter traffic is expected during the construction phase, but this increase is expected to be minor, as most workers would be onsite prior to peak commuting hours. This impact would fluctuate during the peak construction phase.

Bayou Casotte Energy has indicated that it would consult with state and local transportation authorities to determine whether a Maintenance of Traffic Study would be required. **We therefore recommend that:**

- **Bayou Casotte Energy file with the Secretary the outcome of those consults prior to the initiation of construction.**

Operation of the proposed Project would require an estimated 50 employees. The commuting activities of these 50 employees would represent a minor increase in area traffic for the life of the Project.

4.10 CULTURAL RESOURCES

Section 106 of the NHPA, as amended, requires that the FERC take into account the effects of its undertakings (including the issuance of permits or certificates) on properties listed in, or eligible for listing in, the NRHP and to provide the ACHP an opportunity to comment on the undertaking. Bayou Casotte Energy, as a non-federal party, is assisting the FERC in meeting its obligations under Section 106 and the implementing regulations in 36 CFR 800.

4.10.1 Cultural Resources Assessment

4.10.1.1 LNG Terminal

Bayou Casotte Energy completed a cultural and architectural resources survey of the 259.4-acre proposed LNG terminal site. No previously recorded sites were found within the proposed Project area, and no cultural or architectural resources were identified during survey of the proposed LNG terminal site. A Cultural Resource Report was submitted to the Mississippi State Historic Preservation Officer (SHPO), who agreed with the report's conclusion that no historic properties would be affected by construction (letter of May 17, 2005).

4.10.1.2 Natural Gas Pipeline System Interconnects

Detailed engineering was completed for the interconnects in January 2006, and supplemental cultural resource field surveys were conducted. An addendum to the Phase I report, was approved on May 9, 2006, by the Mississippi Department of Archives and History (MDAH). The report indicated that no cultural resources and/or historic standing structures were identified and the extensive deposits of man made land and inundated wetlands indicated that no additional testing was necessary. The SHPO concurred with the conclusions that impacts to cultural or architectural resources as part of the construction and operation of the natural gas pipeline interconnects are not expected.

4.10.1.3 Dredged Material Placement/Disposal Location(s)

Currently, Bayou Casotte Energy is not proposing onshore placement of dredged material, with the exception of the use of material on the proposed terminal site. No cultural or architectural resources were identified during the survey of the proposed LNG terminal site. In the event that additional onshore locations are necessary for disposal, additional surveys would be required and results provided to the Mississippi Department of Archives and History. Any additional field surveys would require that an addendum to the Phase I report be provided to the Mississippi Department of Archives and History for review, comment, and approval.

4.10.1.4 NGL Pipeline

Detailed engineering was completed for the 12-inch-diameter NGL pipeline route in January 2006, and supplemental cultural resource field surveys were conducted for the finalized NGL pipeline. Results of the supplemental field surveys were filed in an addendum to the Phase I report and were provided to MDAH for review, comment, and approval. The SHPO agreed with the conclusions of

the report that assessed the cultural and historical data and found that no impact would be generated by the NGL pipeline (letter of May 9, 2006).

4.10.1.5 Electric Transmission Lines

Bayou Casotte Energy has not conducted cultural and architectural resources surveys along the electric transmission line proposed by Mississippi Power. Mississippi Power will apply for environmental permits for construction of the facility separately from the Casotte Landing Project closer to the time of construction. Bayou Casotte Energy does not have control over the routing, siting, or permitting of this facility. The Phase I report cites a 2000 survey of the Destin Pipeline right-of-way, and no cultural or architectural resources of concern were located. Impacts to cultural or architectural resources associated with the proposed electric transmission lines are not expected.

4.10.1.6 Waste Heat Delivery and Cool Water Return System

Detailed engineering was completed for the Circulation Water System in January 2006, and supplemental cultural resource field surveys were conducted for the finalized pipe routes. An addendum to the Phase I report was provided to MDAH for review, comment, and approval. Based on current approved surveys and historical data, the SHPO concurred that no impacts to cultural or historical resources associated with the waste heat delivery and cool water return system are anticipated.

4.10.1.7 Additional Extra Workspace Areas

Detailed engineering of additional extra workspace areas associated with finalized natural gas system interconnects, the 12-inch-diameter NGL pipeline, and other nonjurisdictional facilities was completed in January 2006, and supplemental cultural resource field surveys were conducted for the additional extra workspace areas. An addendum to the Phase I report was provided to MDAH for review, comment, and approval. The SHPO concurred with the report that no sites or properties listed in or eligible for listing in the National Register of Historic Places will be affected (letter of May 9, 2006).

4.10.1.8 Transit Waterway

The LNG marine traffic would transit along the waterway from the territorial seas to the berthing facility, passing through the Horn Island Pass. In the unlikely event of an LNG spill, the physical properties of LNG would limit any potential impacts to cultural resources on either Horn or Petit Bois Island. Additional information on the environmental impacts resulting from the transit of the LNG ships is provided in Section 4.12.5.3.

4.10.2 Unanticipated Discovery Plan

As part of its application and survey reports, Bayou Casotte Energy filed an acceptable Unanticipated Discoveries Plan that outlines procedures to be followed in the event that cultural resources or human remains are discovered during construction.

4.10.3 Native American Consultation

On April 8, 2005, Bayou Casotte Energy sent a consultation letter to the Mississippi Band of Choctaw Indians to describe the Project and to provide an opportunity to comment on the proposed Project and identify sites or places that might be of religious or cultural significance to the tribe. To date, no response has been received.

4.10.4 Impact and Mitigation

We have completed the process of complying with Section 106 of the NHPA the proposed Casotte Landing Project. All cultural resources surveys have been completed, and survey results for alternative interconnect locations were included in the Phase I report and Supplemental report and was submitted to the SHPO. Since no historic or cultural resources were identified there is no need to determine eligibility or Project effects.

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

4.11.1.1 Regional Climate

The local climate for the proposed Project area is characteristic of subtropical regions, with short mild winters and warm humid summers. The Gulf of Mexico plays an important part in moderating the local weather by producing a pronounced sea breeze effect in the summer and tempering the effects of polar outbreaks. The prevailing winds are generally from offshore to onshore from the southeast to south-southeast, except during winter months when passing cold fronts bring prevailing winds from the north to north-northeast. Wind speeds average between 7 to 10 miles per hour throughout the year.

This portion of Mississippi is subject to sever weather. Tropical cyclones (hurricanes) are not unusual for the Project area. According to the NOAA Storm Events Database, numerous tornados, hurricanes, and tropical storms occurred in Jackson County, Mississippi between 1950 and 2004. Data for the recent hurricanes, Rita and Katrina, are not yet available from NOAA.

According to data obtained from the Office of the Mississippi Climatologist for National Weather Service Cooperative Station Pascagoula 3NE for the period of 1971 to 2000, precipitation averages about 67 inches per year with the most rainfall occurring in July. The mean monthly temperatures in the Pascagoula area range from a low of 49.4 °F to a high of 80.8°F, with an average annual temperature of about 66°F.

4.11.1.2 Existing Air Quality

Ambient Air Quality Standards

The EPA has established National Ambient Air Quality Standards (NAAQS) for criteria pollutants for the purpose of protecting human health (primary standards) and public welfare (secondary standards). The EPA set the NAAQS for the following criteria pollutants: nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), sulphur dioxide (SO_2), lead (Pb), particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), and particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$).

In 2004, EPA provided designations for a new 8-hour O_3 standard. The new 8-hour standard is now effective and the 1-hour O_3 standard became ineffective after June 15, 2005 in most areas including Jackson County, Mississippi. Mississippi has adopted the NAAQS as the ambient air quality standards within the State of Mississippi by Regulation APC-S-4; however, this regulation has not been amended to reflect the revocation of the 1-hour ozone standard.

Air Quality Control Regions and Attainment Status

Air quality control regions (AQCR) are areas established for air quality planning purposes in which implementation plans describe how ambient air quality standards will be achieved and maintained. The local Project area is located in the Mobile-Pensacola-Panama City-Southern Mississippi AQCR.

AQCRs were established by the EPA and local agencies, in accordance with Section 107 of the CAA, as a means to implement the CAA and comply with the NAAQS through state implementation plans. The AQCRs are intra- and interstate regions such as large metropolitan areas where improvement of the air quality in one portion of the AQCR requires emission reductions throughout the AQCR. Each AQCR, or portion thereof, is designated based on compliance with the NAAQS. AQCR designations fall under three categories as follows: "attainment" (areas in compliance with the NAAQS); "nonattainment" (areas not in compliance with the NAAQS); or "unclassifiable". Jackson County is designated as "attainment" or "unclassifiable" for all criteria pollutants.

Air Quality Monitoring and Existing Air Quality

Air quality monitors are located throughout the state and region for a variety of purposes. The nearest monitoring site for NO_2, O_3, SO_2, $PM_{2.5}$, and PM_{10} is in Pascagoula, Mississippi. The nearest monitoring location for CO is in Mobile, Alabama. The nearest Pb monitoring site is in Pike County, Alabama. The available monitoring data are summarized in Table 4.11.1-1 along with the standards established under the NAAQS.

TABLE 4.11.1-1
National Ambient Air Quality Standards for the Casotte Landing Project

Pollutant	Averaging Time	Primary Standard (μg/m^3)	Secondary Standard (μg/m^3)	Background (μg/m^3)	Monitoring Station Number and Location
SO_2	Annual [a]	80 (0.03 ppm)	-	8	28059006 Pascagoula, MS
	24-hour [b]	365 (0.14 ppm)	-	52	28059006 Pascagoula, MS
	3-hour [b]	-	1,300 (0.5 ppm)	121	28059006 Pascagoula, MS
PM_{10}	Annual [a]	50	50	20	28059006 Pascagoula, MS
	24-hour [b]	150	150	51	28059006 Pascagoula, MS
$PM_{2.5}$	Annual [c]	15	15	15.2	28059006 Pascagoula, MS
	24-hour [d]	65	65	32	28059006 Pascagoula, MS
CO	8-hour [b]	10,000 (9 ppm)	-	1,947	010973101 Mobile, AL
	1-hour [b]	40,000 (35 ppm)	-	2,290	010973101 Mobile, AL
O_3	8-hour [e]	157 (0.08 ppm)	157 (0.08 ppm)	165	28059006 Pascagoula, MS
NO_2	Annual [a]	100 (0.05 ppm)	100 (0.05 ppm)	15	28059006 Pascagoula, MS
Pb	Quarter [a]	1.5	-		-

[a] Arithmetic mean.
[b] High second high.
[c] 3-year average of annual arithmetic mean.
[d] 3-year average of the 98th percentile of 24-hour values.
[e] 3-year average of 4th highest 8-hour values.
ug/m^3 micrograms per cubic meter
ppm parts per million

As indicated previously and demonstrated by the local monitoring data, the State of Mississippi is in attainment of the NAAQS for all criteria pollutants. No background concentration for Pb is identified in Table 4.11.1-1. Lead is usually monitored only in locations that have a specific source of lead emissions. The nearest ambient monitor for lead is in Pike County, Alabama where a secondary lead smelter is located. The ambient Pb concentrations monitored in Pike County, Alabama would not be representative of ambient conditions in Jackson County, Mississippi.

4.11.1.3 Regulatory Requirements for Air Quality

The proposed Project is potentially subject to a variety of federal, state, and local regulations pertaining to the construction or operation of air emission sources. The MDEQ has the primary jurisdiction over air emissions produced by the proposed LNG terminal. The MDEQ enforces its own regulations as well as EPA's federal requirements. The following sections summarize the applicability of various MDEQ and federal regulations. Jackson County does not have any additional air permit requirements beyond the MDEQ and federal programs.

Jackson County is designated as in attainment for all of the NAAQS. However to avoid exceedances of the O_3 standards, 40 CFR 80.27 mandates using less volatile gasoline from May through September.

Federal Air Quality Requirements

The CAA, 42 USC 7401 et seq., as amended in 1977 and 1990, and 40 CFR Parts 50 through 99 are the basic federal statutes and regulations governing air pollution in the United States. The following federal requirements have been reviewed for applicability to the proposed Project.

New Source Review/Prevention of Significant Deterioration

Separate preconstruction review procedures have been established for projects that are proposed to be built in attainment areas versus nonattainment areas. The preconstruction review process for new or modified major sources located in attainment areas is called New Source Review (NSR) and may include a Prevention of Significant Deterioration (PSD) review. This review process is intended to keep new air emission sources from causing existing air quality to deteriorate beyond acceptable levels codified in the federal regulations.

The proposed Project is located in a designated attainment area for the NAAQS. Therefore, new major sources and major modifications in this area are subject to the PSD rule. The PSD rule defines a major source as any source with a potential to emit 100 tons per year (tpy) or more of any criteria pollutant for source categories listed in 40 CFR 52.21(b)(1)(i) or 250 tpy or more of any criteria pollutant for source categories that are not listed. Because the proposed Project is not one of the named sources, the PSD threshold for the proposed Project is 250 tpy. Sources which exceed the 250 tpy threshold are then subject to a PSD review and PSD increments which are used to define the maximum allowable pollutant concentration increases over baseline concentrations that are allowed in attainment areas. The Class I and Class II PSD increments are listed in Table 4.11.1-2. A summary of the stationary source emissions for the LNG terminal and unloading is included in Table 4.11.1-4 which shows that no pollutant is emitted at the 250 tpy level and Bayou Casotte Energy is not a major PSD source and is not subject to a PSD review.

TABLE 4.11.1-2 PSD Class I and Class II Increments			
Pollutant	**Averaging Time**	**Class I Increment ($\mu g/m^3$)**	**Class II Increment ($\mu g/m^3$)**
SO_2	Annual	2	20
	24-hour	5	91
	3-hour	25	512
PM_{10}	Annual	4	17
	24-hour	8	30
NO_2	Annual	2.5	25

Source: : 40CFR52.21(c)

One additional factor considered in the PSD permit review process is potential impacts on protected Class I areas. If a project is located within 100 kilometers of a federal Class I area, additional modeling analysis may be required to determine the potential impacts on the area. The proposed project is within 47 kilometers of the Breton National Wildlife Refuge (BNWR), a federally designated Class I area.

Although the proposed project would not be subject to a PSD review and would also not be required to perform an analysis on the Class I area, FERC staff required Chevron to conduct a refined Class I and Class II modeling analysis to evaluate the potential impacts of the proposed project using a model suggested for use in complex coastal environments similar to the proposed project location. Section 4.11.1.4 includes a discussion of the refined Class I and Class II modeling analyses performed by Bayou Casotte Energy to assess impacts associated with operation of the proposed project as request by the Commission.

New Source Performance Standards

New Source Performance Standards (NSPS), codified at 40 CFR 60 establish requirements for new, modified, or reconstructed units in specific source categories. NSPS requirements include emission limits, monitoring, reporting, and recordkeeping. The following NSPS requirements were identified as potentially applicable to the specified sources at the facility.

Subpart Db of 40 CFR 60, *Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units*, applies to fuel-fired steam-generating units with a heat input capacity of greater than 100 million btu/hour (MMBtu/hr). The definition of an applicable unit includes sources that produce steam or heat water or any other heat transfer medium. The process heaters, which would be used to vaporize the LNG, would have a capacity of 280 MMBtu/hr each and would burn natural gas to heat an intermediate fluid (glycol). The heaters are therefore subject to Subpart Db. Subpart Db requirements include a NO_x emission limit of 0.1 or 0.2 pound per million British thermal units (lb/MMBtu), installation and operation of a continuous emissions monitor, as well as associated reporting and recordkeeping.

Subpart Kb of 40 CFR 60, *Standards of Performance for Volatile Organic Liquid Storage Vessels* lists affected emission sources as storage vessels containing volatile organic liquids (VOLs). Regulatory applicability is dependent on the construction date, size, vapor pressure, and contents of the storage vessel. Subpart Kb applies to new tanks, unless otherwise exempted, that have a storage capacity between 75 m^3 (19,813 gallons) and 151 m^3 (39,890 gallons) and contain volatile organic compounds (VOCs) with a maximum true vapor pressure greater than or equal to 15.0 kilopascals (kPa). Subpart Kb also applies to tanks that have a storage capacity greater than or equal to 151 m^3 and contain VOCs with a maximum true vapor pressure greater than or equal to 3.5 kPa. Each of the LNG storage tanks would have a capacity of 160,000 m^3, which meets the volume criteria for Subpart Kb. The LNG is considered a VOL because a small portion of the LNG would consist of VOCs. The vapor pressure of the VOC (assumed to be propane) that would be stored in the LNG tanks is about 0.0007 kPa at the proposed storage temperature of -270°F (Perry and Green, 1997). Therefore, the proposed LNG storage tanks are not subject to NSPS Subpart Kb. The proposed LNG Terminal would also have two diesel fuel storage tanks. The largest diesel storage tank would be about 7,450 gallons in capacity so these tanks would also not be subject to NSPS Subpart Kb.

Proposed New Source Performance Standards (NSPS) – On July 11, 2005, EPA proposed a new NSPS for compression ignition (CI) internal combustion engines (ICE). Under the proposed rule, beginning on October 1, 2007, diesel fuel will be restricted to 500-ppm sulfur and 15-ppm sulfur by October 1, 2010. Also, any CI ICEs would comply with the model year requirements described in the final rule. When the rule becomes finalized, the proposed Project would comply with any applicable standards of the final rule.

Subpart KKK of 40 CFR 60, *Standards of Performance for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants* applies to a natural gas processing plant engaged in the extraction of natural gas liquids from field gas, fractionation of mixed natural gas liquids to natural gas products, or both. The proposed project includes an NGL plant (non-jurisdictional facility) which would be subject to this subpart and therefore would meet the requirements of this subpart and would be included as part of the air permit application. This subpart would only apply to the NGL plant.

National Emissions Standards for Hazardous Air Pollutants

The National Emissions Standards for Hazardous Air Pollutants (NESHAP), codified in 40 CFR Parts 61 and 63, regulates hazardous air pollutant (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).

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 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.

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 to the Project. Part 63 establishes HAP emission standards for marine vessel loading operations (Subpart Y); oil and gas production facilities (Subpart HH); natural gas transmission storage facilities (Subpart HHH); industrial, commercial, and institutional boilers and process heaters (Subpart DDDDD); and reciprocating internal combustion engines (Subpart ZZZZ). These subparts establish requirements for major sources of HAPs only. HAP emissions (in aggregate) from the proposed LNG Terminal would be about 2.7 tpy. The single largest

HAP emitted by the Project terminal would be hexane at a rate of approximately 2.0 tpy. LNG carrier unloading would result in emission of 1.9 tpy of aggregate HAP emissions including 1.1 tpy of formaldehyde. Total stationary source aggregate HAP emissions would be 4.6 tpy; therefore, Bayou Casotte Energy would not be a major HAP source and no NESHAPs are applicable to the project.

Chemical Accident Prevention Provisions

The chemical accident prevention provisions, codified in 40 CFR 68, are federal regulations designed to prevent the release of hazardous materials in the event of an accident and minimize potential impacts if a release does occur. The regulations contain a list of substances and threshold quantities for determining applicability to stationary sources. If a stationary source stores, handles, or processes one or more substances on this list in 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 an RMP. In the latter case the facility still must comply with requirements of the general duty provisions in Section 112(r)(1) of the 1990 CAAA if there is any regulated substance or other extremely hazardous substance on-site.

Stationary sources are defined in 40 CFR 68 as any buildings, structures, equipment, installations, or substance-emitting stationary activities which belong to the same industrial group, which are located on one or more contiguous properties, which are under the control of the same person (or persons under common control), and from which an accidental release may occur. However, the definition also states that the term stationary source does not apply to transportation, including storage incidental to transportation, of any regulated substance or any other extremely hazardous substance. The term transportation includes transportation subject to oversight or regulation under 49 CFR 192, 193, or 195 or a state natural gas or hazardous liquid program for which the state has in effect a certification to DOT under 49 USC Section 60105. Based on these definitions, the only substance that would be potentially applicable to the RMP regulation is the LNG that is stored incidental to transportation. Therefore, an RMP is not required for this facility. However, the facility would have to comply with the general duty provisions of the 1990 CAAA as discussed above.

Title V Operating Permit

Title V of the CAA requires states to establish an air operating permit program. The requirements of Title V are outlined in 40 CFR 70 and the permits required by these regulations are often referred to as Part 70 permits. Mississippi has incorporated this program in Regulation APC-S-6.

If a facility's potential to emit exceeds the major source threshold for a criteria pollutant or HAP, the facility is required to obtain a Title V operating permit. The major source threshold level for an air emission source in Jackson County is 100 tpy for any criteria pollutants (PM_{10}, $PM_{2.5.}$, SO_2, NO_x, VOC, or CO), 10 tpy of any single HAP, or 25 tpy of all HAPs in aggregate. The stationary source potential to emit for the criteria pollutants NO_x, CO, and SO_2 are anticipated to be above the major source thresholds when LNG carrier unloading emissions are included (see Table 4.11.1-4). Therefore, the proposed facility is required to obtain a Title V operating permit.

General Conformity

40 CFR parts 51 and 93 define the requirements for determining conformity for federal actions to state or federal implementation plans. A conformity analysis is required for each criteria pollutant where the total of direct and indirect emissions in a nonattainment or maintenance area caused by a federal action would equal or exceed any of the rates specified in the applicable implementation plan. The

proposed LNG terminal would be located in Jackson County, which is in attainment of the NAAQS for all pollutants. Therefore, the general conformity requirements do not apply to the proposed Project.

Applicable State Air Quality Requirements

The MDEQ is the air permitting authority for the proposed Project. The MDEQ's air quality regulations are codified in Regulations APC-S-1 through APC-S-10. These regulations incorporate the federal requirements from 40 CFR Parts 50 through 99 and establish permit review procedures for all facilities that emit pollutants to the ambient air. Any new facility that may emit air contaminants is required to obtain a preconstruction permit. As indicated above, the facility is not subject to the PSD permitting requirements but is subject to the Title V permitting requirements; therefore, the facility would be required to obtain a state construction permit with federally enforceable limits. The MDEQ permit would require compliance with all applicable state and federal air regulations.

Under federal regulations (40 CFR Part 70.8(b)), the air permitting authority shall provide any affected state a copy of the draft operating permit for review and comment. An affected state is one whose air quality may be affected and that is contiguous to the state in which a title V operating permit, permit modification, or permit renewal is being proposed or one that is within 50 miles of the permitted source. The proposed LNG terminal would be located within 50 miles of the Louisiana and Alabama borders; therefore, the Louisiana Department of Environmental Quality and the Alabama Department of Environmental Management would be given the opportunity to review and comment on Bayou Casotte Energy's draft operating permit prior to issuance by the MDEQ.

A summary of the state air regulations potentially applicable to the project is provided below.

<u>APC-S-1 – Air Emission Regulations for the Prevention, Abatement, and Control of Air Contaminants</u>

APC-S-1 includes specifications for specific pollutants, hazardous air pollutants, certain specific sources of pollutants, notification of emission events, and stack heights. Section 3 contains criteria for sources of particulate matter, including opacity limitation, open burning prohibition, and nuisance prohibition. The diesel and natural gas fueled equipment is expected to comply with the 40 percent opacity standard. Section 4 contains criteria for SO_2 emissions. The natural gas and low sulfur diesel burning equipment are expected to comply with the 4.8 pound SO_2/million btu standard. APC-S-1 also incorporates by reference the federal NSPS program. As discussed previously, the terminal's MDEQ permit would require compliance with all applicable federal regulations and state air regulations. Specific requirements and compliance methods are described below.

<u>APC-S-2 – Permit Regulations for the Construction and/or Operation of Air Emissions Equipment</u>

APC-S-2 contains the requirements for obtaining permits prior to constructing new equipment and for obtaining state permits to operate, including public notice and participation requirements. The Project would obtain the required permits prior to commencing construction.

<u>APC-S-3 – Mississippi Regulations for the Prevention of Air Pollution Emergency Episodes</u>

APC-S-3 defines air pollution alerts, warnings, and emergencies, and establishes requirements for operators of certain sources to prepare plans for responding to these three levels of air pollution episodes. The Project would prepare an Emission Control Action Program in accordance with Section 4.

APC-S-4 – Mississippi Ambient Air Quality Standards

APC-S-4 adopts the federal NAAQS as the Mississippi Ambient Air Quality Standards. The Project would demonstrate through air dispersion modeling that emissions from the proposed action would not cause or contribute to a violation of the NAAQS.

APC-S-5 – Mississippi Regulations for the Prevention of Significant Deterioration of Air Quality

APC-S-5 essentially adopts the federal PSD program, with changes to refer to the Mississippi program rather than the federal program. The Project would not be a PSD source.

APC-S-6 – Air Emissions Operating Permit Regulations for the Purposes of Title V of the Federal CAA

APC-S-6 essentially adopts the federal Title V program, with changes to refer to the Mississippi program rather than the federal program. The Project would be subject to Title V and would obtain the required permit within the timeframe specified by APC-S-6.

APC-S-7 - Acid Rain Program Permit Regulations for Purposes of Title IV of the Federal Clean Air Act

APC-S-7 essentially adopts the federal acid rain program, with changes to refer to the Mississippi program rather than the federal program. The Project would not be subject to the acid rain program.

APC-S-8 – Air Toxics Regulations

APC-S-8 essentially adopts the federal case by case Maximum Achievable Control Technology (MACT) determination provisions at 40 CFR 63 Subpart B, and the federal chemical accident prevention program at 40 CFR 68, with changes to refer to the Mississippi programs rather than the federal programs. The MACT program and chemical accident prevention program are discussed in the federal rules review section of this report.

APC-S-9 – Regulations for Lead Based Paint Activities

APC-S-9 governs training and certification of individuals who provide lead based paint activity services, and work practices involving target housing and child-occupied facilities. This rule does not apply to the Project.

APC-S-10 –Regulations for the Accreditation and Certification of Asbestos Abatement Personnel

Asbestos will not be installed at the Project. This rule does not apply.

4.11.1.4 Air Quality Impacts and Mitigation

Construction Air Pollutant Emissions

The proposed Project would generate air emissions during the construction phase. The construction activities that would generate air emissions include:

- site preparation (earthmoving);
- operation of vehicles and trucks during construction;
- operation of marine vessels during construction;

- installation of terminal components;
- relocation of refinery Berths 6 and 7;
- dock construction;
- hurricane levee construction;
- pipeline and pipeline interconnection installation; and
- employee commuting trips.

Site preparation would include stripping the top layer of earth, removal of earth from high elevation areas to level the terminal site to finished grade, constructing the LNG storage tank dike, and similar site preparation for other facilities. Site preparation activities would generate fugitive dust (PM_{10}) from earthmoving and movement of construction equipment over unpaved surfaces and tailpipe emissions from construction equipment and vehicle engines. The construction equipment and vehicles would be powered by internal combustion engines that would generate PM_{10}, SO_2, NO_x, VOC, and CO emissions. Site preparation equipment would include cranes, trucks, bulldozers, front-end loaders, backhoes, compactors, graders, dump trucks, and other mobile construction equipment.

The installation of terminal components would include installation of unloading dock pile caps and beams, deck slabs, mooring and breasting dolphin caps, LNG unloading and vapor return arms, major mechanical equipment, and piping and instrumentation, as well as construction of LNG storage tanks, foundations, pipe racks, and buildings. The terminal site construction equipment would include cranes, backhoes, pile drivers, welders, and generators, which would generate tailpipe and fugitive dust emissions similar to the site preparation activities.

The proposed Project would include excavating and dredging a marine slip initially to 46 feet below MLLW. Approximately 1 million cubic yards of material would be excavated and used in the site grading, LNG containment system, and hurricane levee construction. Approximately 3.5 million cubic yards of material would be dredged. The dredged material would be placed in bottom dump scows for transport to placement areas. The emissions generated by these activities would be predominantly combustion emissions from the construction equipment and vehicle engines. The construction equipment would include a hydraulic dredge, tugboats, a workboat, cranes, excavator, barge, bulldozers, and trucks.

Site truck traffic and worker commuter vehicles would generate fugitive dust from travel on paved and unpaved surfaces as well as tailpipe emissions. The proposed LNG terminal site construction would require a workforce between 400 and 600 over a period of 36 months. The internal combustion engines for most of the construction equipment would burn diesel fuel. Some of the pickup trucks and most of the commuter vehicles would likely burn gasoline.

Air emissions would also be generated during construction of the proposed natural gas sendout pipeline. The pipeline construction activities would take place over a period of about six months. Similar to the terminal construction emissions, the pipeline construction activities would generate fugitive dust from clearing, trenching, backfilling, grading, and traffic on paved and unpaved areas, as well as combustion emissions from construction equipment, commuter trips, and supply vehicles. The internal combustion engines powering most of the pipeline construction equipment and vehicles would burn diesel fuel and the remaining vehicles would burn gasoline. Equipment that would be used for the pipeline construction activities would include earthmoving equipment, pickup trucks, compressors, pumps, trenchers, stringing trucks, welding rigs, and equipment for restoring disturbed areas.

The emissions from construction activities are not part of the permitting requirements for the LNG terminal. Nevertheless, emissions from the construction activities are discussed above to assist in assessing the environmental issues associated with the Project. Estimates were based on EPA emission factors for stationary engines (for construction equipment and commuter vehicle tailpipe emissions), EPA estimation methods for vehicle travel on paved roads (for dust generated by on-site truck and vehicle traffic and worker commuting trips), and EPA estimation methods for concrete batch plants. SO_2 emission factors were based on appropriate chapters of EPA's AP-42. AP-42 assumes that diesel fuel contains approximately 0.3 to 0.5 percent sulfur by weight. Bayou Casotte Energy indicated that it would use the diesel fuels that are commercially available in the Project area at the time of construction. These diesel fuels are expected to contain less than 0.05 percent sulfur by weight based on current EPA fuel standards. Therefore, SO_2 emissions provided by Bayou Casotte Energy are conservative. The emissions from construction activities would include $PM_{2.5}$, PM_{10}, NO_x, CO, SO_x, VOCs, and HAPs. The criteria pollutant emissions from construction are summarized in Table 4.11.1-3. It is conservatively assumed that all PM_{10} is less than 2.5 microns in diameter; therefore, the PM_{10} emissions are equal to the $PM_{2.5}$ emissions.

TABLE 4.11.1-3
Estimated Emissions from LNG Terminal and Pipeline Interconnect Construction

Emission Source	$PM_{10}/PM_{2.5}$ (tons)	NO_x (tons)	CO (tons)	SO_x (tons)	VOC (tons)
LNG Terminal and Pipeline					
Marine construction equipment	8.18/8.18	130.68	361.84	16.25	24.28
Mobile onshore construction equipment	28.90/28.90	407.50	685.69	26.92	59.73
Fugitive dust emissions from worker commuting	10.98/0.96	0	0	0	0
Vehicle emissions from worker commuting	0.03/0.03	0.51	20.41	0.03	1.00
Fugitive dust from dredging	1.38/1.38	0	0	0	0
Fugitive dust from construction vehicles	9.78/1.50	0	0	0	0
Fugitive dust from mobile construction equipment	2160/2160	0	0	0	0
Concrete Plants	16.39/16.39	0	0	0	0
Total Construction Emissions	2236/2217	538.69	1067.94	43.20	85.01

These emissions would be spread over a period of about 36 months and would increase the pollutant concentrations in the vicinity of the project; however, their effect on ambient air quality would vary with time due to the construction schedule, the mobility of the sources, and the variety of emission sources. . The emissions would cease at completion of the proposed Project. Fugitive dust could have an impact in the immediate vicinity of the construction activity and would cease once construction in a particular area is complete. To ensure that measures are implemented to reduce nuisance dust emission during construction, **we recommend that:**

- **Bayou Casotte Energy prepare a Fugitive Dust Control Plan that specifies the following:**

  a. **The precautions that would be taken to minimize fugitive dust emissions from construction activities and when/how the measures would be applied;**
  b. **the individuals with the authority to determine if/when water needs to be reapplied for dust control; and**

c. the individuals with the authority to stop work if the contractor does not comply with dust control measures.

This plan should be filed with the Secretary for review and written approval of the Director of OEP prior to the start of construction activities.

Air Pollutant Emissions from Operation

LNG Terminal Sources

New air emissions sources associated with operation of the proposed Project include:

- two 280 MMBtu/hr natural gas-fired heaters;
- one 1,500 kw natural gas or diesel-fueled emergency generator;
- one 1,750 hp boil off gas compressor engine;
- three 550 hp diesel-fueled firewater pumps;
- one high-pressure emergency flare stack with pilots and purge;
- one 7,450-gallon diesel day tank for the emergency generator;
- three 600-gallon diesel day tanks for the emergency firewater pump engines;
- one 2,300-gallon oily water surge drum;
- fugitive emission sources (valves, flanges, sampling ports, and marine vessel offloading equipment);
- three 160,000 m^3 full-containment LNG storage tanks; and
- LNG ships and tugboats.

Table 4.11.1-4 summarizes the air emissions that would be generated by stationary sources as well as mobile sources at the LNG terminal.

Unregulated pollutants such as methane (primary component of LNG) would be emitted during operation of the LNG terminal. Some of the LNG would vaporize during storage or transfer during LNG ship unloading. The vaporized LNG is referred to as boil-off gas (BOG). The BOG generated by the LNG terminal during operation would be minimized by using a closed system to capture the vapor which would be pumped into the LNG ship during LNG-offloading or condensed in a direct contact condenser with LNG as the contact liquid and then combined with the sendout natural gas prior to the sendout pumps.

Bayou Casotte Energy would minimize air emission from the proposed stationary sources through the use of clean fuel (natural gas and low sulfur diesel oil), the employment of BMPs for operation and maintenance procedures, and limiting annual hours of operation from the diesel-fired units. No operational emissions from the sendout pipeline would be regulated by the MDEQ or EPA air quality regulations. Operational emissions would be limited to blowdown emissions that would occur during emergency situations and fugitive emissions during operation. Blowdowns would rarely occur and fugitive emissions would be negligible due to the small amount of natural gas emitted and the small fraction of VOCs contained in the natural gas. Therefore, these emissions would not have a significant effect on air quality.

TABLE 4.11.1-4
Estimated Stationary Source and Mobile Marine Vessel Emissions for Operation of Casotte Landing LNG Terminal

Emission Source	$PM_{10}/PM_{2.5}$ (lb /hr)	$PM_{10}/PM_{2.5}$ (tpy)	NO_x (lb /hr)	NO_x (tpy)	CO (lb /hr)	CO (tpy)	SO_2 (lb /hr)	SO_2 (tpy)	VOC (lb /hr)	VOC (tpy)	HAP (lb /hr)	HAP (tpy)
Stationary Sources												
Heaters	4.09	7.37	17.52	31.54	4.46	8.03	0.32	0.58	2.96	5.33	1.0	1.80
Pipeline Compressor	0	0	51.91	12.98	7.09	1.77	0.01	0.00	1.50	0.38	0.92	0.23
Emergency Generator	0.84	0.21	48.29	12.07	15.09	3.77	0.80	0.20	2.66	0.66	0.11	0.03
Emergency Fire Pumps	3.63	0.11	51.15	1.53	11.02	0.33	0.02	0.00	4.15	0.12	0.01	Neg.
Flare Pilots/Purge	0.18	0.77	0.12	0.51	0.63	2.78	0	0	0.11	0.47	Neg.	0.03
Flare	1120	12.03	740	7.94	4024	43.21	135	0.07	685	7.36	36.0	0.38
Fugitive Emissions	0	0	0	0	0	0	0	0	3.70	16.22	Neg.	Neg.
Hydrocarbon Tanks	0	0	0	0	0	0	0	0	Neg.	Neg.	Neg.	Neg.
LNGC Unloading	9.60	13.12	44.40	56.65	6.50	8.26	22.20	44.85	2.40	3.19	1.6	1.90
Total Stationary Source	**1138.3**	**33.6**	**953.4**	**123.2**	**4068.8**	**68.2**	**158.4**	**45.7**	**702.5**	**33.7**	**39.6**	**4.4**
Mobile Sources												
LNGC Transit /Hotelling	5.54	4.86	24.14	21.17	3.52	3.09	19.04	16.70	1.36	1.19	-	-
Tugboat Operations	0.62	0.54	29.61	25.97	3.84	3.37	5.19	4.56	1.40	1.22	-	-
Mobile Rolling Stock	1.41	0.65	19.92	9.19	131.50	116.32	1.32	0.61	7.23	5.79	-	-
Total Mobile Source	**7.6**	**6.1**	**73.7**	**56.3**	**138.9**	**122.8**	**25.6**	**21.9**	**10.0**	**8.2**	**-**	**-**
Total Project Sources	**1145.9**	**39.7**	**1026.1**	**179.5**	**4207.7**	**191.0**	**184.0**	**67.6**	**712.5**	**41.9**	**-**	**-**

lb/hr pounds per hour
tpy tons per year
Neg. negligible

During operating of the project, air emissions from LNG marine traffic and other project-related vessels would occur along the entire waterway from the territorial seas to the ship berth. The impacts of the LNG marine traffic and other marine vessels within state waters are discussed above under the emissions inventories and below under the operational impact assessment. During transit in federal and International waters, the LNG ships would usually burn boil-off gas from vaporized LNG. The boil-off

gas (or natural gas) burned during ship transit is a "cleaner burning" fuel wit lower emissions than the heavy weight fuel typically burned during maneuvering, hotelling, and unloading operations while coming into and out of port. The operation of the LNG ships in transit outside of state waters would be moving at faster speeds and would be in a localized area for a shorter time period, and would be operating using a "cleaner burning" fuel than the transit within state waters. During times when operating off of boil-off gas is not feasible, the ships would use heavy fuels. The emissions to any one localized area during ship transit outside of state waters would be temporary and transient and would be occurring at distances allowing for considerable dispersion before reaching any sensitive receptors; therefore, air emissions from ship transit are not expected to result in a significant impact on air quality.

Operational Impact Assessment

In order to provide a more thorough evaluation of the potential impacts on air quality in the vicinity of the proposed project, the FERC asked Bayou Casotte Energy to conduct a quantitative assessment of project air emissions. The assessment included air dispersion modeling analyses to predict off-site (i.e., ambient) concentrations in the vicinity of the project for PM_{10}, SO_2, NO_2, and CO resulting from the proposed emissions associated with operation of the project for comparison to appropriate federal air quality standards. A summary of the methodology and results of the Class I and Class II analyses is provided below.

Impacts were predicted at the Breton NWR Class I area and in the Class II area surrounding the LNG terminal. The modeling was conducted using the CALPUFF model with a 3-year meteorological data set (2001 through 2003) previously approved by state and federal agencies for modeling sources in this region. CALPUFF is an advanced regulatory guideline model approved by the EPA for assessing coastline effects, overwater transport, and other non-steady-state effects that significantly contribute to the downwind dispersion of pollutants being emitted from sources such as the proposed LNG terminal. Class I impacts were also evaluated using Visibility Improvement State and Tribal Association of the Southeast (VISTAS) meteorological data, and in a manner consistent with the August 2006 VISTAS/BART Protocol. Bayou Casotte Energy evaluated impacts for three scenarios for the Class II areas and the most conservative of these three scenarios for the Class I area:

- (Scenario A) Terminal Emissions only (project emissions from sources that would be under the direct control of Bayou Casotte Energy including emissions from stationary sources).
- (Scenario B) Terminal emissions plus unloading emissions from the LNG carriers
- (Scenario C) Terminal emissions plus unloading emissions plus all other mobile sources (LNG carriers, working tugs, Coast Guard escort boats, etc.) operating within a moored safety/security zone defined by the Commission as an area extending 500 yards in all directions from the area occupied by a typical LNG carrier at berth.

Predicted impacts on Class II areas were compared to Class II SILs and the results were added to the background value and compared to the NAAQS that have been defined by the EPA for SO_2, PM_{10}, NO_2, and CO. Table 4.11.1-5 presents the modeled SO_2, PM_{10}, NO_2, and CO Class II impacts resulting from the project.

Pollutant impacts presented in Table 4.11.1-5 resulting from one or more of the three scenarios evaluated were predicted to exceed their applicable SILs, except for annual PM_{10}, 1-hour CO, and 8-hour CO. Since several pollutant impacts for some scenarios exceeded their applicable SILs, this would normally trigger further evaluation including other sources in the area. For the pollutants that exceeded their applicable SILs, a cumulative impacts evaluation was conducted and the results of this analysis are

presented in Section 4.13.9 However, when the predicted impacts are added to available monitored background concentrations in the vicinity of the proposed project, none of the impacts would exceed the NAAQS, which supports the conclusion that NAAQS compliance would be protected.

TABLE 4.11.1-5
Summary of Modeled Class II Area Impacts [a]

Scenario	Pollutants	Averaging Period	Significant Impact Level (μg/m^3)	Year 2001 Modeled Impact (μg/m^3)	Year 2002 Modeled Impact (μg/m^3)	Year 2003 Modeled Impact (μg/m^3)	Background Value [a] (μg/m^3)	NAAQS (μg/m^3)
A	SO_2	3-hour	25	2.24	2.4	2.13	121	1,300
		24-hour	5	0.2	0.22	0.21	52	365
		Annual	1	0.007	0.009	0.007	8	80
	PM_{10}	24-hour	5	2.6	2.83	2.71	51	150
		Annual	1	0.11	0.12	0.10	20	50
	NO_2	Annual	1	0.65	17.3	15.8	15	100
	CO	1-hour	2,000	268.81	299.99	287.34	2,290	40,000
		8-hour	500	25.70	22.11	20.49	1,947	10,000
B	SO_2	3-hour	25	115.61	117.88	123.52	121	1,300
		24-hour	5	55.00	56.98	54.30	52	365
		Annual	1	1.92	2.60	2.03	8	80
	PM_{10}	24-hour	5	16.08	16.66	15.87	51	150
		Annual	1	0.62	0.84	0.66	20	50
	NO_2	Annual	1	2.75	3.67	2.89	15	100
	CO	1-hour	2,000	268.81	299.99	287.34	2,290	40,000
		8-hour	500	25.70	22.11	21.31	1,947	10,000
C	SO_2	3-hour	25	157.16	160.25	167.91	121	1,300
		24-hour	5	75.47	78.20	74.52	52	365
		Annual	1	2.73	3.65	2.85	8	80
	PM_{10}	24-hour	5	22.04	22.84	21.76	51	150
		Annual	1	0.84	1.13	0.89	20	50
	NO_2	Annual	1	4.38	5.38	4.35	15	100
	CO	1-hour	2,000	269.04	299.99	287.34	2,290	40,000
		8-hour	500	28.57	26.33	29.00	1,947	10,000

[a] Background values were obtained from the EPA AIRDATA database (http://www.epa.gov/oar/data/geosel.html) as follows:
- Annual values based on maximum value from 3 most recent years of available data.
- Short-term values based on H2H value from 3 most recent years of available data.

μg/m^3 micrograms per cubic meter

Bayou Casotte Energy also modeled emissions impacts on the Class I area at BNWR. Class I impacts were evaluated under Scenario C only (the worst case scenario involving all potential sources). Predicted impacts on the BNWR Class I area were compared to Class I SILs defined by the EPA for SO_2, PM_{10}, and NO_2, and predicted visibility impacts and predicted nitrogen and sulfur deposition were compared to applicable thresholds. Visibility impacts were assessed using the procedures in the Best Available Retrofit Technology (BART) program. Results of the analysis are presented in Table 4.11.1-6 through Table 4.11.1-8.

TABLE 4.11.1-6 Class I Analysis – Primary and Secondary Emission Sources			
Pollutant	**Averaging Period**	**Maximum Concentration ($\mu g/m^3$)**	**SIL**
PM_{10}	24-hour	0.106	0.3
PM_{10}	Annual	0.002	0.2
SO_2	3-hour	0.944	1.0
SO_2	24-hour	0.178	0.2
SO_2	Annual	0.003	0.1
NO_2	Annual	0.006	0.1

Results for each pollutant and averaging period were less than the respective SILs and no further modeling was necessary to demonstrate that the project would have no significant impacts on the NAAQS at BNWR.

Table 4.11.1-7 presents the results of the visibility analysis and Table 4.11.1-8 presents the results of the deposition analysis. The years 2001, 2002, and 2003 were considered in the analysis. Bayou Casotte Energy used the CALPUFF model in a manner consistent with the VISTAS/BART approach for determining visibility impacts.

TABLE 4.11.1-7 Class I Visibility Impairment Analysis			
Statistic	**2001**	**2002**	**2003**
Days >= 5%	1	0	0
Days >= 10%	0	0	0
Max. % Change	5.28	4.01	4.31
8th High % Change	2.38	1.81	2.31

One day with visibility impact greater than 5% was indicated in 2001 and no days with greater than 5% impact were indicated in 2002 or 2003. Based on the VISTAS/BART approach the 8th high percent change, there are no days predicted with 5% impacts. These results indicate that emissions from all proposed sources would not significantly impact visibility at BNWR.

TABLE 4.11.1-8 Class I Deposition Analysis				
Pollutant	**2001 (kg/ha/yr)**	**2002 (kg/ha/yr)**	**2003 (kg/ha/yr)**	**Threshold Value (kg/ha/yr)**
Nitrogen	5.51E-04	4.14E-04	4.26E-04	1.00E-02
Sulfur	2.29E-03	1.88E-03	1.68E-03	1.00E-02

Deposition rates for both nitrogen and sulfur are below the US Forest Service thresholds. Depositional impacts from all proposed sources would not be significant at BNWR.

4.11.2 Noise

Noise would be generated during construction of the pipeline and during construction and operation of the proposed LNG terminal. 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. Federal agencies use two measures to relate the time-varying quality of environmental noise to its known effect on people. 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. A second measure, the day-night equivalent sound level (L_{dn}) is calculated by adding 10 decibels on the A-weighted scale (dBA) 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. The A-weighted scale is used because human hearing is less sensitive to low and high frequencies than mid-range frequencies.

4.11.2.1 Noise Regulations

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. 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. The FERC has adopted this criterion for new compression and associated facilities, and it is used here to assess the potential noise impact from operation of the LNG terminal.

There are no additional Mississippi or Jackson County noise ordinances.

4.11.2.2 Existing Noise Levels

The acoustical engineering company Hoover & Keith, Inc. (H&K), completed a site survey on April 13 and14, 2005 and determined that no Noise Sensitive Areas (NSAs) are located within 1 mile of the site. The nearest NSAs are shown on Figure 4.11.2-1 and listed in Table 4.11.2-1.

TABLE 4.11.2-1
Nearest Noise Sensitive Areas

Description	Distance To Property Line	Direction
NSA#1 Apartments	1.52 miles	W-NW
NSA#2 Residences	1.46 miles	Northwest

Non-Internet Public

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Figure 4.11.2-1 Proposed Casotte Landing Project
Nearest Noise Sensitive Areas

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

H&K conducted a baseline noise survey on April 13 and 14, 2005 to record existing ambient noise levels at two locations near the NSAs. The measured daytime (Ld) and nighttime (Ln) sound pressure levels were then used to calculate the Ldn levels. In addition to noise level measurements, contributing noise sources were recorded, along with the prevailing meteorological conditions. Existing noise sources during the day consisted of a combination of industrial operations, distant highway traffic, birds, insects, and wind. Nighttime noise sources were similar and included barking dogs. Meteorological conditions during the monitoring period included sunny/clear skies with temperatures ranging from 63 to 80 °F. Wind was from the north. No precipitation was recorded during the survey.

The measured Ld and Ln ambient levels and the calculated Ldn levels are summarized in Table 4.11.2-2.

TABLE 4.11.2-2
Background Noise Levels at Nearest Noise Sensitive Areas

Monitoring Location, Date	L_d (dBA)	L_n (dBA)	L_{dn} (dBA)
NSA#1, April 13, 2005	50.1	46.7	
NSA#1, April 13, 2005	48.7	46.8	
NSA#1, April 13, 2005	49.4	47.3	
NSA#1, April 14, 2005	50.7		
NSA#1, April 14, 2005	50.7		
NSA#1, April 14, 2005	48.9		
NSA#1 Averages	**49.7**	**46.9**	**53.8**
NSA#2, April 13, 2005	47.3	46.8	
NSA#2, April 13, 2005	47.1	47.1	
NSA#2, April 13, 2005	48.1	48.9	
NSA#2, April 14, 2005	49.3		
NSA#2, April 14, 2005	51.3		
NSA#2, April 14, 2005	50.8		
NSA#2 Averages	**49.0**	**47.5**	**54.2**

The existing L_d and L_n noise levels at NSA#1 ranged from 48.9 to 50.7 dBA during the day and from 46.7 to 47.3 dBA at night. The calculated L_{dn} value was 53.8 dBA at NSA#1. The existing L_d and L_n noise levels at NSA#2 ranged from 47.1 to 51.3 dBA during the day and from 46.8 to 48.9 dBA at night. The calculated L_{dn} value was 54.2 dBA at NSA#2.

4.11.2.3 Impact and Mitigation

Potential impacts from the proposed Project would be caused by temporary increases in noise during construction and permanent increases in noise due to operation of the Project. These potential noise increases were compared with the FERC standard for permissible noise at NSAs.

Construction Noise

Construction activities at the proposed LNG terminal would generate temporary increases in noise over an approximate three-year period. Increases in noise would vary depending on the type of construction activity in progress. The initial phase of construction, which involves excavation, filling, grading, and pile driving with heavy earth-moving equipment, would generate relatively high noise levels. Significant noise levels would also result from dredging of the marine terminal and from pile driving associated with construction of marine facilities.

Heavy equipment would be the primary noise source during the excavation and construction phase. Noise levels from construction equipment would typically range from 75 to 98 dBA at 50 feet from the source. Estimated noise levels from typical construction equipment are listed in Table 4.11.2-3. After accounting for attenuation due to air absorption and due to the distance to the nearest noise sensitive area, construction activity noise at NSA#1 is calculated to be 47.4 dBA L_{dn}. The expected construction noise level is below existing ambient noise levels at the NSAs.

TABLE 4.11.2-3
Estimated Construction Equipment Noise

Equipment Type	Noise at 50 feet (dBA)
Forklift	75
Diesel Generator	81
Welders	78
Bulldozer, Grader, Front End Loader	85
Trucks	88
Backhoe	80
Pile Driving	98

Source: H&K, May 2005

Dredging activities would occur 24 hours per day, seven days per week. Primary noise sources would include diesel dredges with associated pumps. Noise levels associated with the dredging activities would be 90 dBA at a distance of 50 feet. The predicted noise level at NSA#1, 5500 feet from the dredging site, was calculated to be 42.4 dBA L_{dn} after accounting for attenuation due to air absorption and due to the distance from the noise source to NSA#1. The expected dredging noise level is below existing ambient noise levels at the NSAs.

Pile driving would be required intermittently for a period of about 36 months during construction of the unloading platforms, trestles, and mooring/breasting dolphins. Noise from pile driving activities would depend on the type of pile and equipment used. Noise generated by pile driving was estimated at 101 dBA at a distance of 50 feet. The predicted noise level at NSA#1, 5500 feet from the pile driving site, was calculated to be 50.4 dBA L_{dn} after accounting for attenuation due to air absorption and due to the distance from the noise source to NSA#1. The expected dredging noise level is below existing ambient noise levels at the NSAs.

The predicted noise levels at the nearest NSA during excavation, dredging, and pile driving, would be below the FERC's L_{dn} of 55 dBA. Although construction activities at the LNG terminal may be

audible during relatively quiet periods, noise-related impacts are expected to be minimal and no mitigation would be required.

Operational Noise

H&K calculated predicted noise levels that would be generated by operation of the proposed LNG terminal. H&K based its calculations on field noise measurements of similar existing types of equipment as shown in Table 4.11.2-4. Sound levels range from 97 to 120 dBA.

TABLE 4.11.2-4
Equipment Quantities and Sound Power Levels Used in Noise Modeling

Equipment	Assumed Number in Use	Sound Power Level per Item (dBA)
Boil-Off Gas Compressor	2	120
Vapor Return Blowers	2	114
LNG Pumps	3	99
LNG Sendout Pumps	6	103
Instrument Air Compressors	3	101
Electrical Substation	1	96
Aboveground Piping	NA	115
NGL Feed Pumps	3	100
Demethanizer Feed Pumps	3	99
Deethanizer Reflux Pumps	2	97
Ethane Product Pumps	3	99
Propylene Glycol Pumps	3	103
Demethanizer Y Grade Pumps	2	100
Deethanizer Y Grade Pumps	2	100
Miscellaneous Equipment	NA	100

NA – Not Applicable

After accounting for attenuation due to air absorption and due to the distance to the nearest noise sensitive area, the predicted noise contribution of terminal operation at NSA#1 is 38.7 dBA.

Table 4.11.2-5 presents the results of the calculated noise level after adding the facility noise to the existing ambient noise levels at the nearest NSA.

TABLE 4.11.2-5
Predicted L_{dn} Noise Levels at Nearest NSA

NSA	Distance and Direction	Existing Ambient L_{dn} (dBA)	Predicted Facility Contribution (dBA)	Ambient + Facility (dBA)	Predicted Increase in Ambient (dBA)
NSA# 2	1.46 Miles NW	54.2	38.7 dBA	54.2	0.0

The predicted facility contributions of 38.7 dBA at NSA #1 is below the existing ambient noise level and would not increase the L_{dn} noise level at the nearest NSA. Although noise from the proposed LNG terminal may be perceptible during relatively quiet periods, the facility would not contribute to typical existing background noise conditions. As such, we anticipate that the proposed LNG terminal would be in compliance with our noise standard. We recognize, however, that actual results may be different from the calculated estimates. Therefore, **we recommend that:**

- **Bayou Casotte Energy make all reasonable efforts to ensure its predicted noise levels from the LNG terminal are not exceeded at the NSA and file noise surveys with the Secretary no later than 60 days after placing the LNG terminal in service. However, if the noise attributable to the operation of the LNG terminal exceeds 55 dBA Ldn at a NSA, Bayou Casotte Energy should file a report on what changes are needed and should install additional noise controls to meet the level within 1 year of the in-service date. Bayou Casotte Energy 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.**

Vessel traffic associated with operation of the project would generate underwater sounds. Cargo vessels, which are in the same category as LNG ships, are known to emit high levels of low frequency sound (6.8 to 7.7 hertz at 181 to 190 decibels (re: 1 μPa)) capable of traveling long distances (Richardson et al., 1995). Noise generated by LNG marine traffic is generally omni-directional, emitting from all sides of the vessel (Whale and Dolphin Conservation Society 2004). However, noise levels are greatest on the sides of the ship and weakest on the front and rear of the ship. As discussed in section 4.5.2.2, fish may exhibit a transient avoidance behavior in response to LNG ship noise along the waterway from the territorial seas to the proposed LNG terminal. Above-water noise associated with the LNG marine traffic would occur in areas with no sensitive noise receptors or in areas where similar other large vessel traffic occurs and would not result in significant impacts on environmental resources.

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 carriers and the marine transfer area. The Coast Guard also has authority for LNG facility security plan review, approval, and compliance verification as provided in Tile 33 CFR Part 105, and siting as it pertains to the management of vessel traffic in and around the LNG facility. In conjunction with this, the Coast Guard determines the suitability of waterways for LNG marine traffic by issuing an 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 Casotte Landing LNG Project 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.[2] 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 Bayou Casotte Energy (i.e., high-pressure steam boilers that power refrigerant compressors would not be used here nor are they used at any LNG facility under the FERC 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. A discussion of pipeline safety is presented in Section 4.12.7. Conclusions on safety issues are in Section 4.12.8.

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[2] 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, whereas fast flame speeds tend to produce flash burns rather than self-sustaining ignition.

LNG is not explosive as it is normally transported and stored. However, LNG vapors (primarily methane) can explode if contained within a confined space, such as a building or structure, or confined space aboard an LNG ship, 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 carrier 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 meters/second (66-82 feet/second) 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 carrier. 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 Bayou Casotte Energy 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 the FERC staff for review and approval.

As a result of the technical review of the information provided by Bayou Casotte Energy 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, Bayou Casotte Energy provided written answers prior to the technical conference on April 5, 2006. However, several areas of concern are noted 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 recommendation. 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 § 388.112 and PL01-1. Information pertaining to items such as: offsite emergency response; procedures for public notification and evacuation; and construction and operating reporting requirements would be subject to public disclosure. Bayou Casotte Energy should file this information a minimum of 30 days before approval to proceed is required.**

- **Complete plan drawings and a list of the hazard detection equipment should be filed prior to initial site preparation. The list 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.**

- **A technical review addressing the following information for the proposed facility should be filed <u>prior to initial site preparation</u>:**

    a. **Identification of all combustion/ventilation air intake equipment and the distances to any possible hydrocarbon release (LNG, flammable refrigerants, flammable liquids and flammable gases); and**

    b. **A demonstration that these areas are adequately covered by hazard detection devices, including a description of how these devices would isolate or shutdown any combustion equipment whose continued operation could add to or sustain an emergency.**

- **Complete plan drawings and a list of the fixed and wheeled dry-chemical, fire extinguishing, and high expansion foam hazard control equipment should be filed <u>prior to initial site preparation.</u> The list 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 <u>prior to initial site preparation.</u>**

- **A copy of the hazard design review and list of recommendations that are to be incorporated in the final facility design should be filed <u>prior to initial site preparation.</u>**

- **Drawings of the storage tank piping support structure and support of horizontal piping at grade should be filed <u>prior to initial site preparation.</u>**

- **The P&IDs and design information for the NGL Recovery System should be submitted <u>prior to initial site preparation.</u>**

- **Procedures should be developed for offsite contractors' responsibilities, restrictions, limitations and supervision of these contractors by Bayou Casotte Energy staff, <u>prior to initial site preparation.</u>**

- **The <u>final design</u> of the hazard detection equipment should identify manufacturer and model.**

- **The <u>final design</u> of the fixed and wheeled dry-chemical, fire extinguishing, and high expansion foam hazard control equipment should identify manufacturer and model.**

- **The <u>final design</u> should include detailed drawings of the spill control system to be applied to the LNG tank roof.**

- **The final design should specify that the LNG tank carbon steel piping support plates and connections to piping supports should be designed to ensure that corrosion protection is adequately provided and provisions for corrosion monitoring and maintenance of carbon steel attachments are to be included in the design and maintenance procedures.**

- **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 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 should include provisions to install LNG transfer pumps at Jetty KO drum.**

- **The final design should include details of the boiloff gas flow and temperature measurement for each tank.**

- **The final design should include bypass valves around the intank discharge valves for cooldown of the 24-inch headers and piping.**

- **The final design should include an automatic shutoff valve in the LNG intermediate pump inlet line from the suction header.**

- **The final design should include an automatic shutoff valve in the LNG sendout pump inlet line from the suction header.**

- **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; should alarm the hazardous condition; and should shutdown the appropriate systems.**

- **The final design should include a hazard and operability (HAZOP) review of the completed design. A copy of the review and a list of the recommendations should be filed.**

- **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. Instrumentation valves are excluded from this recommendation.**

- **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 list 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 tank 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, and 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 Commission 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, Commission staff would determine the need for an on-site inspection by Commission staff, and the timing of an initial incident report (normally within 10 days) and follow-up reports.

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 Casotte Landing LNG facility with respect to high wind speed and storm surge conditions.

Storm surge refers to water levels above normal tide levels caused by wind and pressure effects associated with hurricanes. Bayou Casotte Energy proposes to construct a hurricane protection levee to an elevation of 24 feet which exceeds the 100 year return storm criteria. The LNG unloading platform deck elevation was set at 29 feet. The Terminal's specified design criteria include sustaining wind of 150 mile per hour and 3-second wind gusts of 183 miles per hour at 33 feet above ground. The Staff agrees that the design is adequate for predicted storm surge and wave height levels.

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.);
- 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 (the design proposed by Bayou Casotte Energy is of this type);
- 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 pre-stressed 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 or 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 FERC for use at new LNG import facilities or expansions of existing terminals. To date, only single- and double-containment tanks have been constructed and operated. Several full-containment tanks have started construction in the United States, while approximately 50 have been constructed worldwide. During the review of earlier proposals, a number of issues surfaced concerning the applicability of existing codes and regulations to full-containment tanks. Specifically, the term "full containment" does not appear in U.S. codes or standards for LNG facilities, including the Federal Safety Standards in Title 49 CFR Part 193, NFPA 59A, or American Petroleum Institute 620. As a result, some project proponents have made the assumption that to design and construct a full-containment tank in accordance with EN 1473 will satisfy the U.S. codes and standards.

For example, it has been suggested that thermal exclusion zones are not required for a full-containment tank because EN 1473 does not consider a tank fire scenario for full-containment tanks with a pre-stressed concrete wall and concrete roof. The staffs of the FERC and the Office of Pipeline Safety (OPS) do not agree because neither NFPA 59A nor Part 193 excludes full-containment tanks from thermal exclusion zone requirements. As a result, a thermal exclusion zone analysis is required for an LNG storage tank fire at the top of the secondary container (see Section 4.13.4).

Further, EN 1473 does not specify a minimum distance to the property line for full-containment tanks because no tank fire scenario is considered. However, NFPA 59A requires a separation of 0.7 times the tank diameter from the property line. Bayou Casotte Energy's proposed tank separation distance to the property line meets this separation requirement.

Another issue regarding the full-containment design is that the tank outer wall (secondary containment) serves as the impoundment, a concept allowed under Parts 193.2161 and 193.2167, and under the "exception" in Figure 2.2.2.6 of NFPA 59A. A specific concern is the dual function of the concrete secondary container - it serves both the operational function of holding the insulation and gas pressure, and a safety function of containing liquid in the event of an inner tank failure. Conversely, in single- and double-containment tanks, independent systems provide operational and safety functions. While recognition must be given to the benefits of a concrete secondary container with respect to external events, such as projectiles or small aircraft, its ability to provide the dual functions while retaining its integrity has not been convincingly supported for all scenarios. This becomes increasingly important as proposed site acreage is reduced and buffer zones between adjacent properties are minimized. As such, the FERC staff considers it prudent design practice to provide some form of barrier to prevent liquid from flowing to an unintended area (i.e., outside the plant property) in the event that the storage tank primary and secondary containers fail.

Concerns have also been expressed that the barrier could be considered a containment and prohibit certain equipment being located within the barrier and/or may conflict with other parts of the various codes with respect to hazardous and electrical code classifications. Other concerns are that the barrier could be considered an impounding area that would require new thermal and vapor cloud calculations. The purpose of the barrier is to prevent liquid from flowing off the plant property, and it is not the intent to define a containment or impounding area for thermal radiation or flammable vapor exclusion zone calculations or other code requirements.

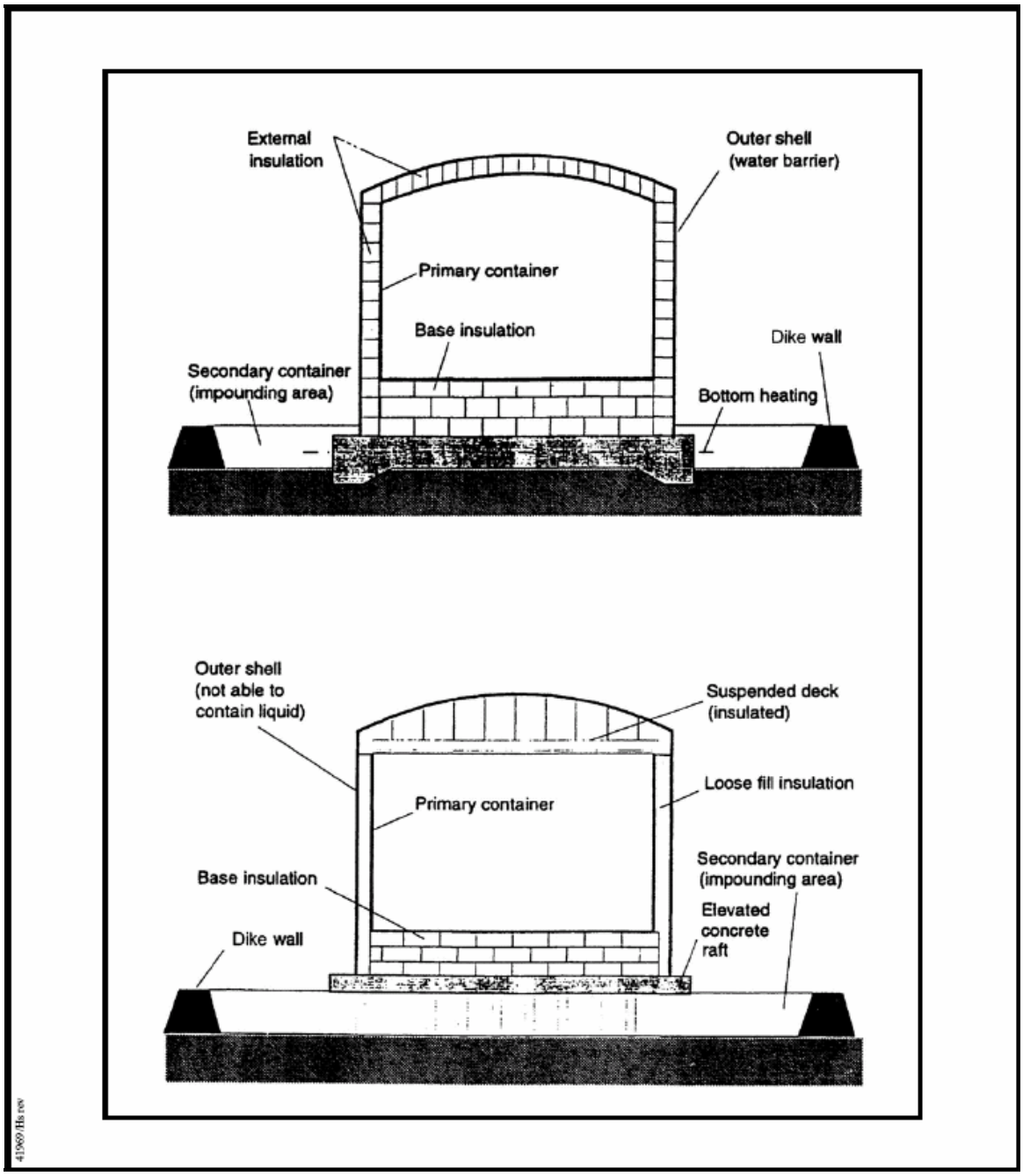

Figure H-1
Examples of Single Containment Tanks

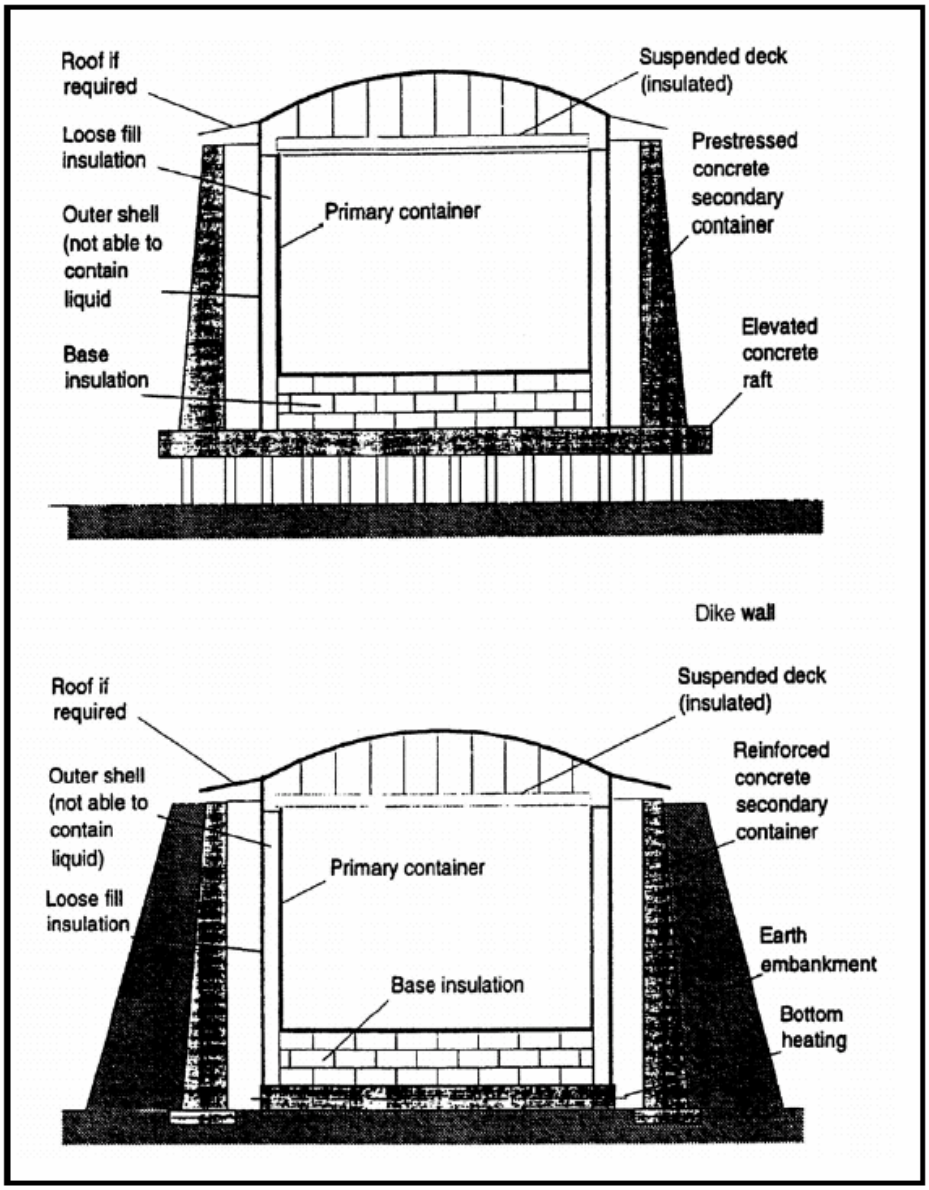

Figure H-3
Examples of Double Containment Tanks

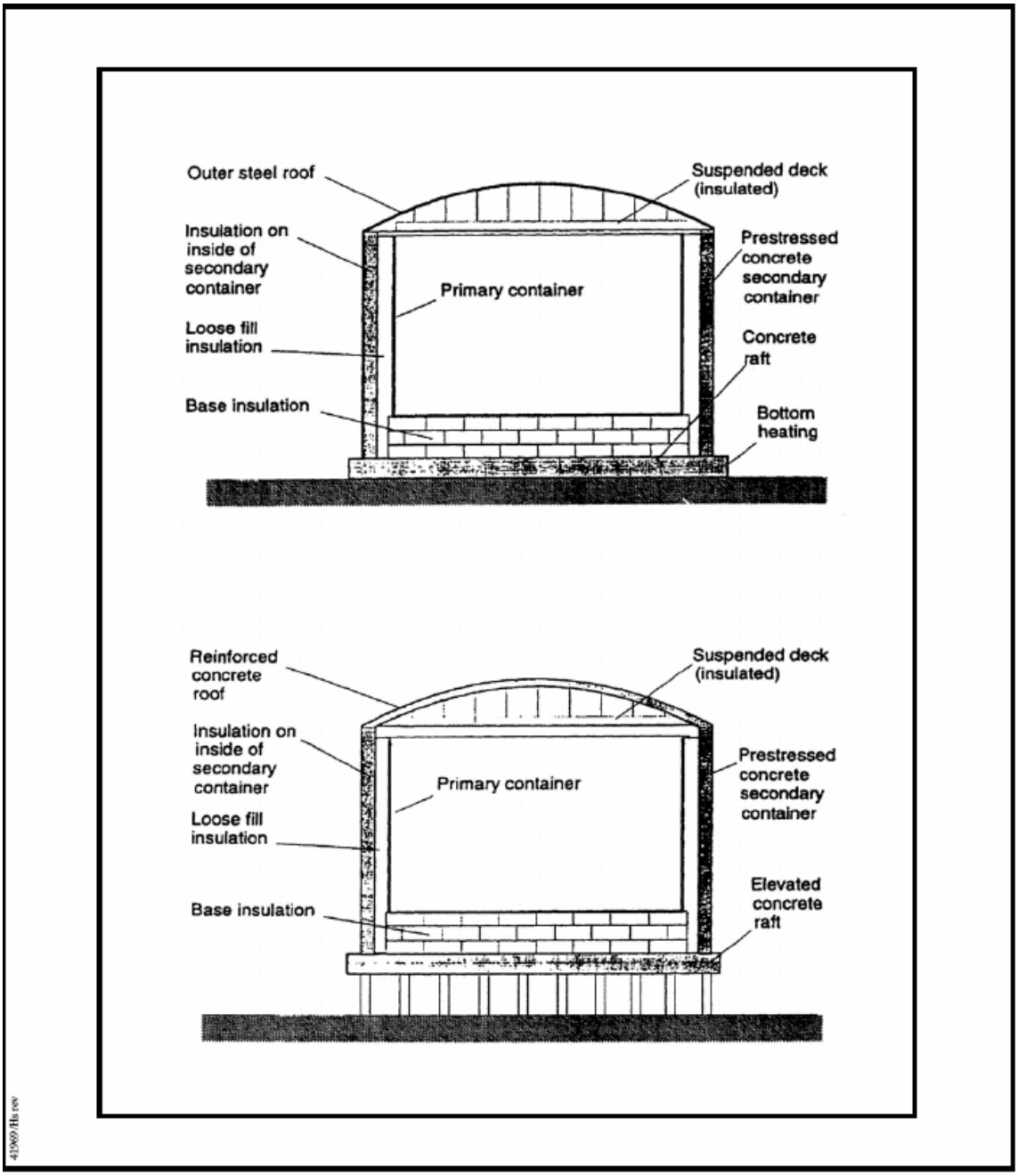

Figure H-4
Examples of Full Containment Tanks

Bayou Casotte Energy proposes to install a hurricane protection levee around the LNG storage tanks. The structure would have a height of 24 feet and would enclose an area approximately 1,161 feet by 1,731 feet. The structure's volumetric capacity would exceed 100 percent of a single LNG tank's maximum liquid capacity. Rainwater that collects inside the hurricane protection levee would be drained into the spill impoundment basin and pumped out in accordance with 49 CFR 193.2173. This hurricane protection levee would confine LNG on the project site in the event of any hypothetical catastrophic event.

4.12.4 Siting Requirements – Thermal and Vapor Dispersion Exclusion Zones

4.12.4.1 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:

- Three 1,006,000-barrel (160,000 m^3) full 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.
- A slip with one LNG berth and a marine cargo transfer system consisting of three 16-inch-diameter liquid transfer arms; one 16-inch-diameter vapor return arm; three 20-inch connecting pipes; and two underground 32-inch-diameter transfer lines - Parts 193.2001, 2057, and 2059 require thermal and flammable vapor exclusion zones for the transfer system. NFPA 59A does not address LNG transfer systems.
- Nine 4,211 gallons per minute (gpm) in-tank pumps (three per tank) with a common warehouse spare pump; four 3,810 gpm intermediate pressure pumps; and six 2,730 gpm high-pressure sendout pumps - Parts 193.2057 and 2059 require thermal and flammable vapor exclusion zones. NFPA 59A Section 2.2.3.2 specifies the thermal exclusion zone and

Sections 2.2.3.3 and 2.2.3.4 specify the flammable vapor exclusion zone based on the design spill.

- Six intermediate fluid 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 a "leakage source" rather than a full pipe rupture; however, the spill duration must be 10 minutes unless the authority having jurisdiction (*i.e.,* DOT's Office of Pipeline Safety [OPS]), determines that a shorter time is acceptable. Again, given the confusion in applying the two requirements, the FERC staff will continue to utilize the 10-minute spill criteria at the maximum flow possible for containment sizing. This will ensure that impoundments are sized for a catastrophic failure, while recognizing that less conservative spill scenarios may be appropriate for exclusion zone calculations. In giving recognition to the integrity of all-welded transfer piping, the determination of the single accidental leakage source should be based on an evaluation of all small diameter attachments to the transfer piping for instrumentation, pressure relief, recirculation, etc., and any flanges that may be used at valves or other equipment, in order to determine the largest spill rate. This approach is the result of discussions with DOT OPS concerning the basis for design spills and application to exclusion zone determinations for proposals before the Commission.

4.12.4.2 Impoundment Systems and Design Spills

Part 193.2181 specifies that the impoundment system serving a single LNG storage tank must have a volumetric capacity of 110 percent of the LNG tank's maximum liquid capacity. Bayou Casotte Energy proposed a full containment storage tank design, which consists of a primary inner container and a secondary outer container. Each LNG storage tank's maximum liquid capacity would be 45,674,277

gallons. The volumetric capacity of the concrete wall would be 52,228,786 gallons, which would exceed the 110 percent requirement by 1,987,081 gallons.

Bayou Casotte Energy proposes to install two insulated concrete impoundment basins, the Jetty Impoundment Basin and the Impoundment Basin, at the LNG terminal site. The Jetty Impoundment Basin would be located approximately 500-feet east of the marine unloading berth and would measure 60-feet wide by 60-feet wide with a depth of 30-feet, a usable capacity of 807,896 gallons. The maximum flow in the docking area would be from the guillotine rupture of the 20-inch-diameter unloading line that connects to the unloading arm, a 30,800 gpm flow rate equating to a 10-minute spill volume of 308,000 gallons. The 20-inch-diameter unloading lines would feed two underground 32-inch-diameter vacuum-jacketed LNG transfer lines to the LNG storage tanks. The Impoundment Basin would be located south of the LNG storage tanks, within the hurricane protection levee, and be sized for a full rupture of the above ground section of the 32-inch-diameter LNG transfer line, a 10-minutes spill volume of 793,000 gallons. The Impoundment Basin would measure 60-feet-wide by 60-feet-wide with a depth of 30-feet, a usable capacity of 807,896 gallons. Bayou Casotte Energy sized both impoundment basins with volumes larger than the current proposal for LNG transfer capacities due to the anticipation of adding another 16-inch unloading arm in the future.

The Impoundment Basin would also contain spills from the in-tank pump withdrawal header and the LNG process area. Each LNG storage tank would be equipped with three in-tank pumps, each rated at 4,211 gpm. With three pumps operating, the volume for a 10-minute spill from the in-tank pump withdrawal header would be 12,633 gpm, which equates to a 10-minute spill volume of 126,330 gallons. The maximum flow from the LNG process area would be from the high pressure pump suction header. A 10-minute spill from the high pressure pump suction header would release 133,670 gallons of LNG.

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. A rupture of the in-tank pump withdrawal header would result in a spill rate of 12,633 gpm, a 10-minute spill volume of 126,330 gallons. Section 2.2.3.5 of NFPA 59A also states that the design spill for the impounding areas serving only vaporization, process, or LNG transfer areas is the flow from any single accidental leakage source for a 10-minute duration. Staff considered that credible LNG spill for the LNG process area could result from breaks from a broken 6-inch recycle line downstream of each single high pressure pump. This spill would generate a 10-minute spill volume of 27,300 gallons. Each of these individual spills would be contained by the Impoundment Basin.

Design spill from the unloading dock would be contained by the Jetty Impoundment Basin. Staff considered the design spill at the unloading dock could result from an accidental release of the 2-inch drain line. The design spill size for this accidental release would be 14,990 gallons.

Table 4.12.4-1 presents the impounding areas and spill size volumes used to determine adequate impounding capacity and the associated design spills. The largest design spill collected by a given sump would be used to calculate exclusion zones for that sump.

TABLE 4.12.4-1 Impoundment Areas			
Source	**Spill Size (gallons)**	**Impoundment System**	**Impoundment Size (gallons)**
Impoundment sizing spills:			
LNG Storage Tank	50,241,705	Concrete Wall	52,228,786
In-tank pump withdrawal header	126,330	Impoundment Basin	807,896
High pressure pumps suction header	133,670	Impoundment Basin	807,896
20-inch loading arm line	308,000	Jetty Impoundment Basin	807,896
Design spills:			
In-tank pump withdrawal header	126,330	Impoundment Basin	807,896
High pressure pump – 6-inch connection	27,300	Impoundment Basin	807,896
Unloading dock – 2-inch connection	14,991	Jetty Impoundment Basin	807,896

4.12.4.3 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 five percent of the time based on recorded data for the area. For its analysis, Bayou Casotte Energy selected highly conservative ambient conditions that occur less than 5 percent to produce the maximum distances: wind speed of 25 mph; ambient temperature of 32°F; and 30 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. We agree with Bayou Casotte Energy's selection of atmospheric conditions.

Thermal radiation distances were calculated for 1,600 to 10,000 British thermal units per square foot per hour (Btu/ft2-hr) incident flux levels for an LNG storage tank impoundment fire. The model was run for a full containment tank with roof failure and fire at a diameter of 264 feet and a height of 155 feet. Target height was set at ground level (0 feet). In addition, the thermal radiation distances were determined for the 1,600-Btu/ft2-hr incident flux level centered on both the Impoundment Basin and the Jetty Impoundment Basin.

Table 4.12.4-2 presents the calculated maximum distances for incident flux levels ranging from 1,600 to 10,000-Btu/ft2-hr, as verified by the FERC staff. Since all thermal exclusion zones remain completely on the proposed plant site, Bayou Casotte Energy's proposed terminal would satisfy the thermal exclusion zone requirements of 49 CFR 193.2057.

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)**
Jetty Impoundment Basin	Property line that can be built upon.	1,600	325
Impoundment Basin	Property line that can be built upon.	1,600	325
LNG Storage Tank Impoundment	Outdoor assembly area occupied by 50 or more people.	1,600	962
LNG Storage Tank Impoundment	Off-site structures used for occupancies or residences.	3,000	759
LNG Storage Tank Impoundment	Property line that can be built upon.	10,000	416

NOTE:

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.

4.12.4.4 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. For its vapor dispersion analysis, Bayou Casotte Energy selected the following ambient conditions: stability Class F, 4.5 mph wind speed, 50 percent relative humidity, and an average regional temperature of 70 °F.

In accordance with Section 2.2.3.3 of NFPA 59A, an average concentration of methane in air of 50 percent of the LFL cannot cross the property line from a design spill into each tank impoundment. In this case, compliance with Section 2.2.3.3 would also meet the requirements of Section 2.2.3.4 of NFPA 59A. According to Table 2.2.3.5 of NFPA 59A, the design spill is the largest flow from the container (i.e., storage tank) withdrawal pumps for a 10-minute duration at full-rated capacity. This would be a guillotine rupture of the discharge header for the in-tank LNG pumps.

Based on Table 4.12.4-1, the largest design spill that would be directed to the Impoundment Basin would come from the LNG tank withdrawal header, a 10-minute spill volume of 126,330 gallons. Using this spill and the specifications provided by Bayou Casotte Energy for the Impoundment Basin, staff calculated a distance of 340 feet to the 2.5 percent average gas concentration isopleth. Based on this distance, the vapor exclusion zone associated with the Impoundment Basin would remain on-site. For the

Jetty Impoundment Basin, the FERC staff performed vapor dispersion analyses modeled as continuous 10-minute spills from a rupture of the 2-inch drain line at the unloading dock, a 10-minute spill volume of 14,991 gallons. In calculating vapor dispersion from the Jetty Impoundment Basin, SOURCE5 and DEGADIS predict 155 feet to the edge of the ½ LFL concentration envelope. This exclusion zone would not extend beyond the terminal property line. Since the vapor exclusion zones from the Impoundment Basin and the Jetty Impoundment Basin remain on site, Bayou Casotte's proposed terminal would satisfy the vapor exclusion zone requirements of 49 CFR 193.2057.

4.12.5 Marine Safety[3]

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 carriers and the marine transfer area as well as the security of the LNG carriers 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 4.12.5.4). 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 ship casualties such as:

- a vessel colliding with an LNG carrier in transit;
- an LNG carrier alliding[4] with the terminal or a structure in the waterway;
- a vessel alliding with an LNG carrier while moored at the terminal; or
- a grounding sufficiently severe to puncture an LNG cargo tank.

Since the attacks on September 11, 2001, additional risks are considered due to the possibility of 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 carrier's double hull and cargo tanks. Previous incidents with LNG marine traffic have primarily involved grounding, and none of these have resulted in the breach of the double hull and subsequent release of LNG cargo.

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[3] This section was written with the cooperation and assistance of the Coast Guard, Sector Mobile.

[4] "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.

The following discussion provides a chronology of a conceptual LNG carrier 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 Carriers and Ocean Voyage

Imported LNG could be obtained from exporting terminals throughout the world and delivered by LNG carriers 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, Bayou Casotte Energy has not confirmed the source(s) of LNG supplies.

The LNG carriers 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 Equipments of Ships Carrying Liquefied Gases in Bulk, the International Convention for the Safety of Life at Sea (SOLAS), and 46 CFR Part 154, which contain the U.S. safety standards for vessels carrying bulk LNG. Foreign flag LNG carriers are required to possess a valid IMO Certificate of Fitness and a Coast Guard Certificate of Compliance.

In 1993, amendments to the IMO's Code for the Construction and Equipments of Ships Carrying Dangerous Chemicals in Bulk require all tankers to have monitoring equipment with an alarm facility which is activated by detection of over-pressure or under-pressure conditions within a cargo tank. In addition, the cargo tanks are heavily instrumented, with gas detection equipment in the hold and inter-barrier spaces, temperature sensors, and pressure gauges. Fire protection must include the following systems:

- a water spray (deluge) system that covers the accommodation house control room and all main cargo valves;
- a traditional firewater system that provides water to fire monitors on deck and to fire stations found throughout the ship;
- a dry chemical fire extinguishing system for hydrocarbon fires; and
- a carbon dioxide system for protecting machinery, including the ballast pump room, emergency generators, and compressors.

As a result of September 11, 2001, the IMO agreed to new amendments to the 1974 SOLAS addressing port facility and ship security. The International Ship and Port Facility Security 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 marine traffic, 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 as follows:

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:

- Port facility security plan;
- 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 the 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 Carrier Transit in Port of Pascagoula

LNG marine traffic in route to the proposed LNG terminal would transit about the 12.6 nautical miles from the Horn Island "HI" sea buoy to the berth under the direction of a Pascagoula Pilot. The Pascagoula 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. Pilots meet ships, day or night, at the sea buoy located at the southern end of the Horn Island Pass Channel.

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 with the conditions referenced in Section 2.0, LNG marine traffic would access the proposed LNG terminal via the Pascagoula Bar Channel starting at the "HI" sea buoy and traveling approximately 3.3 nautical miles to buoys 11 and 12, which mark the beginning of the Horn Island Pass Channel. From there, vessels would travel northeast for about 1.2 nautical miles, through Horn Island Pass, at which point they would turn north and continue along the Lower Pascagoula Channel for about 3.7 nautical miles to the Bayou Casotte Channel, which branches off from the Lower Pascagoula Channel at a junction commonly referred to as the "Y." From this junction, LNG marine traffic would continue north approximately 4.4 nautical miles to the LNG terminal. Bayou Casotte Energy's ships would require three tractor tugs with the appropriate bollard pull to handle an LNG ship. The berth would be designed such that the LNG vessels could be turned by the tugs and backed onto berth or pulled in bow first.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the LNG marine traffic would normally transit arrive and enter the waterway during early daylight hours. Docking, LNG offloading, and undocking would take about 24 hours. The LNG marine traffic 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 Pascagoula Pilots, the Coast Guard may monitor 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 at the sea buoy, at which time, Coast Guard personnel may board the LNG vessel for an inspection of the ship safety systems, a security sweep, and review of the manifest. Other Coast Guard requirements may include: establishment of a moving safety zone around the vessel while in en route; a Coast Guard escort through the channel and to the dock; a fixed security zone around the vessel 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 4.12.6).

LNG Carrier Casualties

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic with the conditions referenced in Section 2.0, the operational controls that may be imposed by the Coast Guard and the Pascagoula Pilots, as well as the characteristics of the Pascagoula Bar, Horn Island Pass, Lower Pascagoula, and Bayou Casotte Channels, would minimize the possibility of an LNG cargo spill from groundings, collisions, and allisions. The Coast Guard may enforce a moving safety zone around the LNG ship that would clear the channel of all vessels in the vicinity of the LNG ship to reduce the likelihood of any collisions, including those of the tonnage and speed required to cause an LNG spill (see Section 4.12.5.4).

The Pascagoula Bar Channel is maintained at a width of 450 feet and a depth of 44 feet. The Horn Island Pass Channel is 600 feet wide and 44 feet deep. The Lower Pascagoula and Bayou Casotte Channels are both maintained at a width of 350 feet and a depth of 42 feet. The channels are bordered by shallow water approximately 5 to 18 feet deep, thereby constraining the LNG ships, which have drafts of 38 feet, to operating within the dredged channels. However, the soft nature of the sea bottom in the Mississippi Sound makes an LNG spill from cargo tanks highly unlikely in a grounding incident.

Deliberate Attack on an LNG Carrier

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 is would be the responsibility of the owner/operator and the master of the vessel. Security of the LNG facility would be the responsibility of the owner/operator of the facility. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic with conditions, the Coast Guard may establish a moving safety zone around the LNG marine traffic in transit and a security zone around the LNG vessels while docked. Protection of the LNG vessel and the import terminal would involve personnel from the Coast Guard, Bayou Casotte Energy security staff, and state and local law enforcement. The Coast Guard may also conduct random shoreside and waterside security patrols to include visits/passes of the LNG facility. Only personnel or vessels authorized by the Captain of the Port (COTP) or the District Commander would be permitted in the safety and security zone.

Bayou Casotte Energy 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 and approved by the Coast Guard COTP (see Section 4.12.6). 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, and screen visitors and contractors. The security staff may also assist in maintaining security of the marine terminal during cargo unloading. Bayou Casotte Energy would be required to submit their Facility Security Plan to the COTP for approval 60 days prior to commencement of operations. In order to ensure that the responsibilities of Bayou Casotte Energy's security staff enhance overall security, **we recommend that**:

- **<u>Prior to Commissioning</u>, Bayou Casotte Energy coordinate, as needed, with the Coast Guard to define the responsibilities of Bayou Casotte Energy's security staff in supplementing other security personnel and in protecting the LNG tankers and the terminal.**

The Department of Energy (DOE) released a study by Sandia National Laboratories entitled 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 square meters 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 square meters. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 square meters, 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 and 3-meter diameter hole to range from 4,182 to 4,652 feet for a thermal radiation of 1,600 Btu/ft2-hr, the level which is hazardous for persons located outdoors and unprotected; from 3,232 to 3,591 feet for 3,000 Btu/ft2-hr, an acceptable level for wooden structures; and from 1,934 to 2,143 feet for 10,000 Btu/ft2-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 waterway, as well as in establishing potential impact areas for emergency response and evacuation planning. The majority of the transit from the Gulf of Mexico through the Pascagoula Bar, Horn Island Pass, Lower Pascagoula, and Bayou Casotte Harbor Channels to the LNG berth, has no development or communities adjacent to the channel or within the 4,652 feet transient hazard area. The last 0.5-mile of the transit would pass by currently undeveloped land to the east, but a portion of which is the site of the proposed Gulf LNG Energy LLC terminal (Docket No. CP06-12-000). LNG vessels at Gulf LNG Energy LLC's proposed marine berth would be over 600 feet from the channel edge and the LNG storage tanks would be about 2,200 feet from the channel edge. Assuming an LNG vessel would transit through the channel between 3 and 10 knots, areas adjacent to the channel would be exposed to a potential transient hazard for less than 20 minutes. In addition, a temporary hazard would exist around the slip during part of the 24-hour period while the LNG vessel is maneuvering into the slip and at the dock unloading cargo.

If the Coast Guard issues a LOR with conditions finding the waterway suitable for LNG marine traffic, the operational restrictions that would be imposed by the Pascagoula Pilots on LNG vessel movements through the area, as well as the requirements that the Coast Guard would impose in its *LNG Vessel Transit Management 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

Prior to commencing operations, Bayou Casotte Energy would be required to prepare 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 Section 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 will determine what area needs to be evacuated, if any, rather than a worst-case maximum zone. It is anticipated that the emergency evacuation plans will 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, as added by Section 311 of the Energy Policy Act of 2005, stipulated that in any order authorizing an LNG terminal the Commission shall require 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:**

- **Bayou Casotte Energy develop emergency evacuation routes/methods for the areas along the route of the LNG carrier transit in conjunction with the local emergency planning groups and town officials and file the routes/methods with the Secretary for review and written approval by the Director or OEP <u>prior to initial site preparation.</u>**

In addition, **we recommend that:**

- **Bayou Casotte Energy <u>should</u> 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/methods 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 carrier to activate sirens and other warning devices.

  The Emergency Response Plan should be filed with the Secretary for review and written approval by the Director of OEP <u>prior to initial site preparation</u>. Bayou Casotte Energy should notify FERC staff of all meetings in advance and should report progress on the development of its Emergency Response Plan at <u>3-month</u> intervals.

The 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 near 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 <u>prior to initial site preparation.</u>**

4.12.5.1 Pascagoula Bar, Horn Island Pass, Lower Pascagoula, and Bayou Casotte Channels

The Port of Pascagoula in Mississippi Sound has two principal harbor areas: the Bayou Casotte (East) Harbor and the Pascagoula River (West) Harbor. Cargoes handled at the Port of Pascagoula include general, roll on-roll off, break bulk, and dry bulk, as well as bulk chemicals and crude oil in bulk. The East Harbor has ship repair and drill rig repair facilities, along with general cargo and liquid cargo terminals. The West Harbor has shipbuilding, drill rig repair, and general cargo facilities, along with U.S. Navy, NOAA, and Coast Guard activities.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic with conditions (e.g., daylight transit, one way LNG vessel traffic), all LNG shipping would enter and depart the Mississippi Sound area by the Pascagoula Bar Channel, Horn Island Pass Channel, Lower Pascagoula Channel, and Bayou Casotte Channel. The length of each segment of the channel that would be traversed, and channel characteristics as they relate to marine safety, are summarized in Table 4.12.5-1.

TABLE 4.12.5-1
Channel Characteristics for Route that Would be Used by LNG Carriers Calling on the Proposed LNG Terminal

Channel Segment	Length (NM)	Width (ft)	Depth (ft)
Pascagoula Bar Channel	3.3	450	44
Horn Island Pass Channel	1.2	600	44
Lower Pascagoula Channel	3.7	350	42
Bayou Casotte Channel	4.4	350	42
Total Length	**12.6**		

Upon reaching the LNG terminal, tugs would assist in slowing, turning, and maneuvering the LNG carrier into the mooring basin. Bayou Casotte Energy coordinated the design of this mooring basin using simulation studies with input from the Pascagoula Pilots and Chevron ship captains. Once the LNG carrier is turned with tug assistance, the ship would be maneuvered back and onto the LNG berth. The ship would be moored so that it points outward towards the Bayou Casotte Channel. This would allow ships to depart the LNG terminal without turning, which would provide for a more rapid emergency evacuation from the berth should this be required.

Current Ship Traffic

Vessel movements in Mississippi Sound are heavily dominated (numerically) by barge traffic, much of which transits to and from Pascagoula ports. Between 2000 and 2003, an average of 5,065 vessels transited the Bayou Casotte Channel each year. Approximately 93 percent of these vessels consisted of vessels with a draft less than 18 feet: tug/tow, tanker, cargo, dry cargo barge, and tanker barge. The number of inbound large vessel transits in the Port of Pascagoula from July 2002 to June 2003 and July 2003 to June 2004 was 485 and 556, respectively, or an average of 521 ships per year. About 80 percent of that traffic went to Bayou Casotte, or an average of about 426 vessels per year. The dominant cargo commodity for vessels entering the port was crude oil calling at Chevron's Pascagoula Refinery, with 303 and 397 ships, respectively, for those periods. Chevron's refinery is located adjacent to the proposed Bayou Casotte Energy terminal. One of the refinery berths would be relocated into and on the north side of the proposed slip off the Bayou Casotte Channel. The next largest component was bulk carriers calling at the Mississippi Phosphates terminal located just north of the refinery, with 55 and 42 vessel calls, respectively, for the two time periods.

Future Ship Traffic

The Marine Traffic Study performed by Moffatt & Nichol International for Bayou Casotte Energy provided data on existing vessel traffic that show a variable pattern of shipping volume. Assuming that future vessel traffic remains steady, the addition of up to 170 LNG carriers per year that would call on the proposed Casotte Landing LNG Terminal would result in an 47 percent increase in large vessel traffic (drafts greater than 18 feet), and a three percent increase in total vessel traffic.

Examining the shipping situation in the Port of Pascagoula with the combined impact of the proposed project (170 ships per year) and the Gulf LNG Project (150 ships per year, based on preliminary information available from Gulf LNG Energy LLC, Docket No. CP06-12-000), the total number of LNG carriers expected to call on the Port of Pascagoula would be is 320 ships per year. This would result in roughly one LNG carrier per day to one of the respective LNG terminals with a minimum of one transit per day and a maximum of two transits per day. Other shipping activities would be moderately affected by this increase in traffic; however, based on the relatively modest level of shipping activity in the Port of Pascagoula, the impact is not expected to be substantial.

Ship Traffic in the Navigation Channels

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

- *Cross-Current* – The COE-designated entrance channel extends from the end of the Horn Island Pass to the sea buoy. The cross-current is variable and can reach a velocity of 4 knots. However, the Pilots indicate a velocity of approximately 1.5 knots flowing commonly from west to east. The Pilots have to hold as much as 6 degrees of "leeway" on the vessel to counter the current.
- *Day Transit* – Existing practice is for vessels with drafts greater than 36 feet to transit the channel only during daylight hours. According to the Pascagoula Pilots and the Coast Guard, LNG ship transit would only be allowed during daylight hours since the proposed LNG traffic would exceed the draft length restrictions.
- *One-way Traffic* – One-way traffic is currently enforced within the channels that would be transited by the LNG vessels. In addition, a moving safety zone around LNG vessels would prohibit any passing of these vessels.
- *Reduced Visibility* – Fog has the potential to eliminate all vessel movements. Visibility must be at least 2 nautical miles for vessels to travel inbound or outbound. Visibility is below the operational limits about six percent of the time; therefore, resulting in delays.
- *Tidal Range* – The maximum annual tidal range is approximately 3.6 feet. That maximum range is most common in the face of very strong north winds or when there is a major storm in the Gulf of Mexico. The Pascagoula Pilots consider any conditions that create a tide range of 1.5 feet as something to take seriously.
- *Flood Tide/Ebb Tide* – In general, flood tides typically set ships to the west, and ebb tides typically set them to the east. However, the set direction is not necessarily constant during the transit. The current changes directions several times as it flows around the islands and along the channel banks.
- *Wind* – Inside the barrier islands of Mississippi Sound, the current is predominantly wind-driven, often flowing across the channel. The current creates a moderate challenge to holding a ship in the channel, although at a lesser degree than what is experienced at the pass between the barrier islands.
- Prevailing winds are anecdotally reported as being from south/southeast, although long-term wind data do not indicate a single overarching pattern. The Pascagoula Pilots have indicated that wind does not present a significant concern except during strong northers or coastal storms. Strong east or west winds, which have the most adverse impact on transit through the Pascagoula Channel, occur less than 10 percent of the time; however, when they do occur,

they could potentially create a challenging navigation situation in the relatively narrow channel. Under those conditions, large vessel transits would be delayed.

- The Pascagoula Pilots have established a 15-knot wind speed limit for drill rig transits. Each transit of self-propelled vessels is evaluated individually and no cutoff has been established.
- *Pilot Availability* – The Pascagoula Pilots operate with six fully-qualified, Coast Guard-licensed pilots and two apprentices. Apprentice pilots take up to 1 year to be qualified. The Pascagoula Pilots have two pilot boats. The Pascagoula Pilots have stated that their workforce would have to grow by at least two pilots to accommodate the traffic generated by Bayou Casotte Energy's operations and that a larger more modern pilot boat would be necessary to allow them to continue to board the LNG vessels offshore under a wider range of operating conditions.
- *Tugs* – If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, it is anticipated that LNG ships delivering cargo to the proposed terminal would have tug support for all maneuvering and berthing operations, at a minimum, and potentially have tug support for other phases of ship arrival and departure as well as standby and fire fighting duties during LNG unloading operations if so dictated by the Coast Guard COTP. There are currently five harbor tugs provided by Colle Towing Company. Two of these are tractor tugs rated at 4,000 hp and the remaining three are conventional tugs, one rated at 5,600 hp and two rated at 3,600 hp. In addition, a 5,600 hp tug is scheduled to join the fleet in the near future. Three tractor tugs, each with 5,300 hp, would be needed for the movement of LNG marine traffic within the shipping channel. The current fleet of tugs would not be able to safely accommodate the transit of LNG vessels to the proposed facilities. Bayou Casotte Energy has indicated that it would arrange for three tractor tugs to be readily available to prioritize the LNG marine traffic coming to port. These tugs would have adequate bollard pull to service the inbound and outbound movements expected at the proposed Bayou Casotte Energy LNG terminal.

4.12.5.2 Requirements for LNG Carrier Operations in Port of Pascagoula

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 the communications, emergency shutdown, gas detection, and fire protection, must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, Bayou Casotte Energy would be required to submit two copies of its Operations and Emergency Manual to the COTP 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 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;
- Environmental impacts of LNG marine traffic from territorial waters to the LNG facility berthing docks; 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, Bayou Casotte Energy submitted a LOI to the Coast Guard on February 10, 2005 (see Appendix F). On November 17, 2005, the Coast Guard issued a notice in the Federal Register, requesting comments pertaining specifically to the maritime safety and security aspects of the proposed LNG facility. In preparation for issuance of a LOR and the completion of certain other regulatory mandates, the comments received were incorporated into a formalized risk assessment process to assess the safety and security aspects of the facility, adjacent port areas, and navigable waterways. The Coast Guard held a public meeting on December 7, 2005, pursuant to the notice. The Coast Guard's comment period ended on December 14, 2005.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic with the conditions referenced in Section 2.0, the arrival, transit, cargo transfer, and departure of LNG marine traffic in the waterway would be required to adhere to the procedures of a LNG Vessel Transit

Management Plan to be developed by the Coast Guard Sector Mobile. In addition, Bayou Casotte Energy 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 LNG Vessel Transit Management 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 Mobile would monitor each LNG ship in accordance with the *LNG Vessel Transit Management Plan*.

Some of the anticipated key provisions of the *LNG Vessel Transit Management Plan* would be 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.

Bayou Casotte Energy Waterway Suitability Assessment (WSA)

On February 13, 2006, Bayou Casotte Energy submitted a WSA for the proposed project to the Captain of the Port for Coast Guard Sector Mobile. The Coast Guard, with input from the Area Maritime Security Committee, has completed a review of Bayou Casotte Energy'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 April 1 and September 5, 2006, the Coast Guard sent WSR letters to the 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 made a preliminarily determination that the Pascagoula Bar, Horn Island Pass, Lower Pascagoula and Bayou Casotte Channels may be suitable for the LNG marine traffic associated with this project with conditions. The Coast Guard also stated that these waterways can accommodate the proposed traffic and there is sufficient capability within the port community to responsibly manage the safety and security risks of this project. With the completion of this final EIS, the Coast Guard will complete its review and issue an LOR with conditions to address the suitability of the waterways for LNG transport.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic with the conditions referenced in Section 2.0, the necessary security measures would be further developed into a detailed LNG Vessel Transit Management 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 Pascagoula Bar, Horn Island Pass, Lower Pascagoula and Bayou Casotte Channels up to the proposed Bayou Casotte Energy 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 LNG Vessel Transit Management 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 *LNG Vessel Transit Management 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:**

- **Bayou Casotte Energy should annually review its waterway suitability assessment relating to LNG marine 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 marine traffic; and provide a copy to FERC staff.**

Impact of Vessel and Facility Security Requirements

The potential impacts of the proposed LNG marine traffic for the Bayou Casotte Energy Project on other commercial and recreational boaters can be addressed in relation to several general security requirements: 1) a moving safety zone for inbound LNG marine traffic; 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 marine traffic would transit about the 12.6 nautical miles from the entrance of the "HI" sea buoy to the proposed Bayou Casotte Energy terminal. For the majority of this trip, an LNG vessel would travel at an average speed of 10 knots. Based on these assumed speeds, it would take about 1 to 1.5 hours for LNG marine traffic to complete the trip from the sea buoy 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 170 LNG ships for the Bayou Casotte Energy terminal could potentially move in and out of the Pascagoula Bar, Horn Island Pass, Lower Pascagoula and Bayou Casotte Channels every year. This is an increase in vessel traffic of 47 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 level of shipping activity in the Port of Pascagoula, 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 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 marine traffic 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 marine traffic. The notification system includes broadcasts on radio frequencies used by mariners. These practices and impacts currently occur in other waterways during LNG vessel transits.

The Coast Guard made a preliminarily determination that if appropriate resources were available to implement certain necessary security measures, the Pascagoula Bar, Horn Island Pass, Lower Pascagoula and Bayou Casotte Channels could accommodate the number of LNG carriers that would supply the proposed Bayou Casotte Energy LNG terminal. This determination is preliminary because the required NEPA analysis has not yet been completed. This determination is also contingent upon the port security community having the appropriate resources to implement all the measures necessary to responsibly manage the safety and security risks of LNG marine traffic in this area. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, in addition to the moving safety and security zones around the LNG marine traffic, the *LNG Vessel Transit Management Plan* to be developed by the Coast Guard Sector Mobile, would minimize impact to other ship traffic, escorts by armed law enforcement officials, and waterway and shoreline surveillance measures.

The 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 Bayou Casotte Energy to the extent called for by the Cost-Sharing Plan to be developed with the pertinent state and local agencies. In order to precisely determine the additional resources that would be necessary to provide the additional security to ensure safe transit of the LNG marine traffic, it would be necessary to develop and finalize the Coast Guard's *LNG Vessel Transit Management Plan*. Funding for security and management costs are discussed further in Section 4.12.5 "Emergency Response and Evacuation Planning".

While the LOR would address the suitability of the Pascagoula Bar, Horn Island Pass, Lower Pascagoula and Bayou Casotte Channels 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 *LNG Vessel Transit Management Plan*, as well as other possible conditions discussed in Section 2.0. 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.

4.12.5.3 Environmental Impacts Associated with Coast Guard Actions

The Coast Guard's issuance of a LOR is a federal action that 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 marine traffic 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 from LNG marine transit, including support vessels and any required Coast Guard or other law enforcement security escort or patrol vessels, on wildlife and aquatic resources are discussed in Sections 4.5 and 4.6. The potential impacts that result from LNG carriers in transit would be similar to those resulting from other ships using the navigation channel. Impacts include those related to prop wash, invasive species, and water withdrawal for ballast and cooling. Although no significant impacts on wildlife or aquatic resources a result of LNG marine traffic is expected, we recommend in Section 4.5.2.2 that Bayou Casotte Energy continue to consult with federal and state agencies to determine the need for mitigative measures to avoid or minimize impacts on aquatic resources as the result of LNG ship ballast and cooling water intakes.

LNG marine traffic, support vessels, and security escort and patrol vessels would emit criteria pollutants, VOCs and HAPS during transit. We have identified the magnitude of these emissions in Section 4.11.1.4. The proposed project would be located in an attainment area. Therefore, the General Conformity requirements do not apply.

The LNG carrier would be operating in the federally approved channels en route to the terminal. We believe the use of these channels is consistent with the Mississippi CMP; however, consistency with this plan would be determined by the State of Mississippi. The coastal effects associated with the proposed Project, including coastal effects resulting from LNG carrier transit, are addressed in Section 4.7.3 to the extent this statute is applicable. As such, consistency with the CZMA is required as appropriate. We have recommended as a condition in Section 4.7.5 that Bayou Casotte Energy submit documentation of concurrence from the MDMR that the project is consistent with the Mississippi CMP.

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 4.7.3.4). However, we do not expect these zones to have a significant effect on environmental resources.

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

The transit corridor for the LNG marine traffic would traverse open water and estuarine habitats. Approximately 8.6 miles of the transit corridor are within confined waters between the barrier islands and the mainland, where shoreline could be affected by accidental spills. The aquatic and shoreline habitats

support a variety of wildlife which are described in Section 4.5 and 4.6. Figure 4.12.5-1 shows the potential extent of hazard distance from an accidental spill, the locations of significant parks, refuges, and other public recreation areas along the transit corridor.

LNG is less dense than fresh or seawater, 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. A LNG vapor cloud cannot explode in the open atmosphere, but it could burn.

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 4.12.5.4 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 Table 4.12.5-3 is approximately 48 minutes. For an ignited intentional LNG spill, the duration is approximately 11 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 along the Port of Pascagoula Channels, 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. Furthermore, the shoreline areas nearest the transit channels are generally vacant or industrial. If more populated areas were to be exposed to higher pollutant concentrations for the short duration of the fire, the effects would be short term.

The pool formed from an unignited accidental LNG spill would completely evaporate in approximately 94 minutes. For an ignited intentional LNG spill, the pool would completely evaporate in approximately 7 minutes. As natural gas is not a criteria pollutant, no air quality impacts would be expected from the evaporation of the LNG spill. However, methane, the primary component of LNG, is considered a greenhouse case 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

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Figure 4.12.5-1 Proposed Casotte Landing Project
Potential Sensitive Resources Along Ship Route

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

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 that may be 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 a 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 a LNG pool fire would be of short duration (i.e., from 1 to 2.5 hours). If an LNG spill occurred along the transit route, ship traffic may be temporarily interrupted 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, structures 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[5] 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 a LNG spill in greater detail.

In accordance with Section 3A(e) of the Natural Gas Act, added by Section 311 of the Energy Policy Act of 2005, we recommend in Section 4.12.5 that Bayou Casotte Energy 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 impacts related to emergency evacuation of communities would be expected.

As discussed in Section 4.12.5, "Deliberate Attack on an LNG Vessel," the December 2004 Sandia Report 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 these types of accidents would be environmentally significant.

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 Sandia Report determined that the most significant impact on 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 Pascagoula Bar, Horn Island Pass, Lower Pascagoula, and Bayou Casotte Channels would be approximately 2,790 feet.

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

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[5] At 3,000 Btu/ft2-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.

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 on shoreline habitats as a result of an accidental LNG spill are unlikely to occur. A spill would be unlikely to result in significant impacts on 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 an LOR finding the waterway suitable for LNG marine traffic with the conditions referenced in Section 2.0, the Coast Guard may establish a moving safety zone, moored vessel security zone, and/or a regulated navigation area around the transiting LNG vessels and provide some level of escort as part of finalizing the *LNG Vessel Traffic Management Plan*. The LNG vessels would also undergo safety and security inspections to ensure compliance with United States 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.

4.12.5.4 LNG Carrier 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, an estimated total of 631 billion cubic feet (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 marine traffic, 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 carrier 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 fracturing of some of the plating.
- ***Mostafa 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 not 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 United States, 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 carriers 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 carriers 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 the U.S. waters must also be constructed in accordance with the IMO Code for the Construction and Equipments of Ships Carrying Liquefied Gases in Bulk. This standard requires that the vessel inner hull adjacent to the cargo tanks be protected against contact from liquid cargo through a combination of proper material selection, adequate insulation, and use of heating systems.

As required by the IMO conventions and design standards, hold spaces and insulation areas on an LNG ship 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 carriers 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 carrier. An earlier Federal Power Commission (FPC, predecessor to the FERC) study estimated that the double-bottom of an LNG carrier 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 carrier sustaining cargo tank damage in a collision would depend on several factors – the displacement and construction of both the struck and striking vessels, the velocity of the striking vessel and its angle of impact with the struck vessel, and the location of the point of impact. The previous FPC study estimated the additional protection afforded by the double-hull would be effective in low energy collisions, and 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 carrier at berth (FERC, 1996).

The analysis assumed a 125,000 cubic meter LNG carrier 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 carrier for a range of potential collision angles. The resulting minimum striking speeds are presented in Table 4.12.5-2 for the two principal cargo systems.

TABLE 4.12.5-2
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 or the release of LNG.

In December 2004, the DOE release a study by Sandia National Laboratories, Sandia Report. 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 from contact with 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 (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.

In the 2001 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 carrier 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 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 carrier 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. As discussed in greater detail in staff's responses, various components of the consequence assessment methodologies were revised based on comments received. In addition, the model was updated to include a lower limit on the characteristic wind speed. The revised study provides the methodology for calculating: (1) the rate of release of LNG from a cargo tank penetration for various sized holes; (2) the spreading of an unconfined LNG pool on water for both continuous spills and rapid (nearly instantaneous) releases; (3) the rate of vapor generation from an unconfined spill on water; (4) thermal radiation distances for LNG pool fires on water; and (5) and flammable vapor dispersion distances.

A detailed evaluation of the consequences of a terrorist attack on a modern membrane LNG tanker was prepared by Lloyds Register North America for the Weaver's Cove LNG Project and filed under CEII. The study evaluated the consequences of attacks on an LNG tanker by missiles and

explosives. Finite element analysis was used to evaluate the effect of various sized charges on both the outer and inner hulls. A 1-meter diameter hole of the inner hull at the waterline was found to be the average most probable "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.

The December 2004 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 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-square meter 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 square meters. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 square meters, 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 or 6,300 to 6,825 feet), but would increase the expected fire duration. RPTs 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 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 typical 140,000 m^3 LNG carrier, a potential spill of 23,000 m^3 is estimated for the volume of LNG above the waterline. The estimated pool spread results and thermal radiation hazard distances are identified in Table 4.12.5-3 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.

However, Bayou Casotte Energy proposes the potential use of up to a 200,000 cubic meter LNG ship. The limited information available regarding the design of future 200,000 cubic meter LNG ships suggests that the draft of the larger ships would remain the same due to the limited draft of the channel, 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 no change the hydrostatic head. Preliminary information shows that the larger class ships would have five cargo tanks instead of four as on the 140,000 cubic meter ships. For a 200,000 cubic meter LNG ship compared to the results for a 140,000 cubic meter LNG ship, the estimated distance to the 1,600 Btu/ft2-hr zone would be less than 2 percent farther and the fire duration would be extended by about 13 percent.

TABLE 4.12.5-3 LNG Spills on Water					
LNG Release and Spread					
Hole Diameter	1.0 m	1.4 m	2.5 m	3.0 m	3.9 m
Hole Area	0.8 m^2	1.5 m^2	5 m^2	7 m^2	12 m^2
Spill Time	94.0 min	48.0 min	15.0 min	10.4 min	6.2 min
Pool Fire Calculations					
Maximum Pool Radius	341 ft	476 ft	817 ft	938 ft	1,102 ft
Fire Duration	94.1 min	48.1 min	15.2 min	10.7 min	6.5 min
Distance to:					
1,600 Btu/ft^2-hr	2,164 ft	2,790 ft	4,182 ft	4,652 ft	5,250 ft
3,000 Btu/ft^2-hr	1,690 ft	2,169 ft	3,232 ft	3,591 ft	4,047 ft
10,000 Btu/ft^2-hr	1,031 ft	1,312 ft	1,934 ft	2,143 ft	2,409 ft

Although Bayou Casotte Energy would design the terminal and unloading berth for LNG ships with capacities up to 200,000 cubic meters, 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 cubic meters in capacity, Bayou Casotte Energy should provide the necessary information to demonstrate that the transient hazard areas identified in the final EIS are applicable. Bayou Casotte Energy 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 in a new LOI and a new LOR would need to be evaluated.**

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.

The entire from the Gulf of Mexico through the Pascagoula Bar, Horn Island Pass, Lower Pascagoula, and Bayou Casotte Channels to the LNG berth, has no development or communities adjacent to the channel or within the 4,652 feet transient hazard area. Assuming an LNG vessel would transit through the channel between at 3 and 10 knots, areas adjacent to the channel would be exposed to a potential transient hazard for less than 20 minutes. In addition, a temporary hazard would exist around

the slip during part of the 24-hour period while the LNG vessel is maneuvering into the slip and at the dock unloading cargo.

In addition, the potential impact on the infrastructure and industrial development was also evaluated. A thermal radiation level of 10,000 Btu/ft2-hr is associated with potential damage to equipment and infrastructure. A fire associated with a potential spill resulting from a nominal cargo tank hole of an intentional event could expose the following infrastructure and industry within approximately 2,143 feet to a thermal radiation level of 10,000 Btu/ft2-hr for 10- to 15-minutes: the marine berth of the proposed Gulf LNG Energy LLC terminal currently under FERC review; and a portion of Chevron's Pascagoula refinery (marine berths and crude storage tanks). In addition, a fire associated with a potential spill in the vicinity of Bayou Casotte Energy's berth resulting from a nominal cargo tank hole of an intentional event could expose the process area and the proposed LNG storage tanks to a thermal radiation level of 10,000 Btu/ft2-hr for 10- to 15-minutes.

The operational restrictions that would be imposed by the Pascagoula Pilots on LNG vessel movements through this area, as well as requirements that the Coast Guard would impose in its LNG Vessel Transit Management Plan, would minimize the possibility of a hazardous event occurring along the vessel transit.

By focusing on the "worst case" intentional breach scenarios 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 "worst case" intentional breach scenarios should not be misconstrued as defining an exclusionary zone. Rather the average most probable "worst case" scenarios provide guidance in developing the operating restrictions for LNG vessel movements in the Port of Pascagoula Channels, as well as in establishing potential impact areas for emergency response and evacuation planning.

4.12.5.5 Conclusions on Marine Traffic Safety

The operational safety of LNG marine traffic is under the jurisdiction of the Coast Guard. LNG carriers have safely transited another Gulf Coast Waterway, the Calcasieu Ship Channel in Louisiana, for the past 20 years and worldwide for 50 years. If the Coast Guard issues an LOR determining suitability of the waterway for LNG marine traffic with conditions, operational restrictions that may be imposed by the Coast Guard and the Pascagoula Pilots would minimize the potential for a hazardous event occurring along the waterway from the berthing area to the territorial sea and affecting the safety of the nearby public.

The operation of LNG marine traffic should have a minimal impact on other vessel traffic in the Port of Pascagoula channels. With the mitigation measures discussed above, 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.

4.12.6 Terrorism and Security Issues

The security requirements for the onshore component of the proposed project are governed by 49 CFR Part 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 the Coast Guard's regulations in 33 CFR Part 127. Requirements for maintaining security of the marine terminal are in 33 CFR Part 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's OPS issued non-public guidelines to LNG operators that direct them to develop new security procedures for onshore facilities. Operators were required to prepare a security plan within 6 months that responds to the five threat levels defined by the Office of Homeland Security. The OPS conducts subsequent on-site reviews of the security procedures.

On October 22, 2003, the 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; Outer 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 Part 105 were required to submit a *Facility Security Assessment and Facility Security Plan* to the Coast Guard COTP 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 3 months; and
- reporting of all breaches of security and security incidents.

Increased security awareness has occurred throughout the industry and the nation. President Bush established the Office of Homeland Security with the mission of coordinating the efforts of all executive departments and agencies to detect, prepare for, prevent, protect against, respond to, and recover from terrorist attacks within the 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 United States 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 Facilities

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 degrees Fahrenheit 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.

4.12.7.1 Safety Standards

The DOT is mandated to provide pipeline safety under Title 49, U.S.C. Chapter 601. The 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. The 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 Casotte Landing Project must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR Part 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 on at least 5 days a week for 10 weeks in any 12-month period.

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.

Class locations also specify the maximum distance to a sectionalizing block valve (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 proposed pipeline interconnect routes would cross open land that is sparsely populated. Project natural gas laterals are 1.5 miles or less and no high consequence areas are located within 220 yards. Due to the industrial location and proximity to the Pascagoula Refinery, the Project's natural gas pipeline laterals would be in Class 1 areas.

If a subsequent increase in population density adjacent to the right-of-way indicates a change in class location for the pipeline, Bayou Casotte Energy would be required to 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 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. No later than December 17, 2004, gas transmission operators must develop and follow a written integrity management program that contains all the elements described in §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 Federal Register 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 §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 U.S.C. 60109 for OPS to prescribe standards that establish criteria for identifying each gas pipeline facility in a high-density population area.

The HCAs 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[6] is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle[7]; or

[6] 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.

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

- any area in Class 1 or 2 where the potential impact circle includes an identified site.[8]

In the second method an HCA includes any area within a potential impact circle which contains:

- 20 or more buildings intended for human occupancy; or
- an identified site.

Once a pipeline operator has determined the HCAs on its pipeline, it must apply the elements of its integrity management program to those segments of the pipeline within HCAs. The DOT regulations specify the requirements for the integrity management plan at § 192.911.

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. 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. Bayou Casotte Energy 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.

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[8] An identified site is an outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12-month period; a building that is occupied by 20 or more persons on at least 5 days a week for any 10 weeks in any 12-month period; or a facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

4.12.7.2 Pipeline Accident Data

Since February 9, 1970, 49 CFR Part 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.[9]

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.

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[9] 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.

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 (*for example*, 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 show that the portion of incidents caused by outside forces has decreased to 38.5 percent.

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 4.12.7-1 vary widely in terms of age, pipe diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline.

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

4.12.7.3 Impact 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 shows 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]

NOTE:

[a] 1970 through June 1984 - American Gas Association, 1986.

[b] DOT Hazardous Materials Information System.

[c] Employee/nonemployee breakdown not available after June 1984.

[d] Without 18 offshore fatalities occurring in 1989 -- 11 fatalities resulted from a fishing vessel striking an offshore pipeline and 7 fatalities resulted from explosion on an offshore production platform.

The nationwide totals of accidental fatalities from various manmade and natural hazards are listed in Table 4.12.7-5 in order to provide a relative measure of the industry-wide safety of natural gas pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. Nevertheless, the average of 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, and earthquakes.

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 Casotte Landing Project might result in a public fatality every 66,667 years. This would represent a slight increase in risk to the nearby public.

TABLE 4.12.7-5
Nationwide Accidental Deaths[a]

Type of Accident	Fatalities
All accidents	90,523
Motor vehicles	43,649
Falls	14,985
Drowning	3,488
Poisoning	9,510
Fires and burns	3,791
Suffocation by ingested object	3,206
Tornado, flood, earthquake, etc. (1984-93 average)	181
All liquid and gas pipelines (1978-87 average) [b]	27
Gas transmission and gathering lines Nonemployees only (1970-84 average)[c]	2.6

[a] All data, unless otherwise noted, reflects 1996 statistics from the U.S. Department of Commerce, Bureau of the Census, "Statistical Abstract of the U.S. 118th Edition."

[b] U.S. Department of Transportation, "Annual Report on Pipeline Safety - Calendar Year 1987."

[c] American Gas Association, 1986.

4.12.8 Conclusions on Safety Issues

Much of the recent safety debate has centered on the perceived size of worst case scenarios; the distance to various thermal radiation heat levels for LNG fires; the range of potentially flammable vapors; and the population and infrastructure that are located within the various hazard areas. These are components of a consequence analysis.

However, the evaluation of safety is more than an exercise in calculating the consequences of worst case scenarios. Rather, safety is a determination of the acceptability of risk which considers: (1) the probability of events; (2) the effect of mitigation; and (3) the consequences of events.

- *Accidental Causes* - Based on the extensive operational experience of LNG shipping, the structural design of an LNG carrier, and the operational controls that may be imposed by the Coast Guard and the local pilots, the likelihood of a cargo containment failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision – is highly unlikely. For

similar reasons, an accident involving the onshore LNG import terminal is unlikely to affect the public. As a result, the risk to the public from accidental causes should not be considered significant.

- *Intentional Attacks* - Unlike accidental causes, historical experience provides little guidance in estimating the probability of a terrorist attack on an LNG carrier or onshore storage facility. For a new LNG import terminal proposal, having a large volume of energy transported and stored near populated areas, the perceived threat of a terrorist attack may be considered as highly probable to the local population.

  However, at the national level, potential terrorist targets are plentiful, many having national significance, while others with a large concentration of the public (for example, major sporting events or skyscrapers) or critical infrastructure facilities. Currently, the U.S. has over 500 chemical facilities operating near large populations. U.S. waterways also transport over 100,000 annual shipments of hazardous marine cargo, including LPG, ammonia, and other volatile chemicals. Many of these substances pose a similar hazard to that of LNG.

- *Risk Management* - While the risks associated with the transportation of any hazardous cargo can never be entirely eliminated, they can be managed. For potential targets where the threat is perceived to be high, resources can be directed to mitigate possible attack paths. Such efforts may deter potential attacks on one target, but shift efforts to those that are less protected. As a result, the issue is how to best direct finite resources.

For the proposed project, it may be possible to apply risk management resources to manage realistic threats; however, an even greater level of resources may be required to manage the threats as perceived at the local level. The issue for the decision makers is whether the resources required to manage the risks are justified by the benefits, while recognizing that the risks cannot be entirely eliminated.

4.13 CUMULATIVE IMPACTS

Cumulative impacts may result when the environmental effects associated with a proposed project are superimposed on, or added to, either temporary (construction related) or permanent (operation related) impacts associated with past, present, or reasonably foreseeable future projects. Although the individual impact of each separate project may be minor, the additive or synergistic effects of multiple projects would be significant. The proposed Casotte Landing LNG terminal and pipeline interconnects would be constructed on Bayou Casotte in Jackson County, Mississippi. The environmental effects of construction and operation of the proposed Project are described in Sections 4.1 through 4.11 of this EIS. However, we are aware of other major projects that are being proposed for construction in the immediate vicinity of Bayou Casotte and Jackson County. This section describes the estimated impact associated with each of these projects and the cumulative impact if all projects were constructed.

The impact from Hurricane Katrina would also lead to several rebuilding and restoration projects in the Pascagoula and Jackson County area. These projects consist primarily of home and business construction on sites that were previously developed. The COE, through Task Force Hope has been responsible for restoring levees and floodwalls, debris removal, and emergency response in the area since Hurricane Katrina (COE 2006). Additionally, the COE is also conducting restoration activities along the Gulf Coast as a result of the hurricane. These projects have already begun and would be expected to continue into the unknown future. These projects were not considered in our cumulative impact assessment. More distant projects are not assessed because their impacts would be localized elsewhere and would not contribute significantly to impacts in the immediate Project area.

Chevron is planning to expand its Pascagoula Refinery to raise output of gasoline by approximately 500,000 gallons per day, a 25 percent increase. This increase in output would result from an upgrade of the Refinery's Fluid Catalytic Cracking Unit (FCCU) which currently processes 65,000 barrels of crude each day. The upgrade of the FCCU would also require other process equipment within the Refinery to either be replaced or upgraded, as well. This $150 million expansion project was scheduled to begin in July 2005 and be completed in late 2006. However, in the aftermath of Hurricane Katrina, the completion date has been delayed. At the peak of project construction in 2006, some 1,000 contractors are expected to be employed on the project (MDEQ 2005).

As described in Section 3.3.1.2, Gulf LNG Energy also has proposed an LNG import terminal, which would be constructed south of the proposed Casotte Landing Project at the mouth of Bayou Casotte. Should it be approved, the timing of the Gulf LNG Energy Project, as currently proposed, would be similar to the Casotte Landing Project.

Aside from the Pascagoula Refinery expansion and the Casotte Landing LNG and LNG Clean Energy Projects, no significant commercial or industrial developments associated with shipping and related port activities are planned in the Port of Pascagoula area (McAndrews 2005). The closest foreseeable development to the west would be casino projects approximately 20 miles away. Land use between the Port of Pascagoula and the casinos is primarily residential and would be unlikely to include any industrial or major commercial development. The impacts associated with the casino development are primarily related to population growth and would extend only as far eastward as the Ocean Springs area (COE 2005). Because of the area and types of impacts associated with the casinos, they were not considered as part of the cumulative impacts associated with the Casotte Landing LNG Project. The Grand Bay Preserve extends along the coast to the east from the Destin and Gulfstream pipeline rights-of-way to beyond the Mississippi State Line. The designation of this area for preservation would preclude any development in the foreseeable future. More geographically distant projects were not assessed because their impact would generally be localized and therefore, would not contribute significantly to cumulative impacts in the proposed project area.

In addition to development projects, dredging activities may have a cumulative or additive impact on some of the same resources affected by the Casotte Landing Project, particularly soils, sediments, surface water, and aquatic resources. Aside from the dredging associated with the proposed LNG import terminal projects, the primary dredging expected to take place in the project area within the foreseeable future would be maintenance dredging of the ship channels and turning basins.

Table 4.13-1 summarizes the present or reasonably foreseeable future projects or activities that may have a cumulative or additive impact on resources that would be affected by construction and operation of the Casotte Landing LNG Project. Although it is reasonable to expect that over the next 25 years various industrial, commercial, recreational, or residential developments would occur in the Pascagoula area, without specific proposals to evaluate, the impacts of these developments are not reasonably foreseeable. Therefore, these unplanned projects cannot be included in this EIS.

TABLE 4.13-1 Existing or Proposed Activities Cumulatively Affecting Resources of Concern for the Casotte Landing Project		
Activity/Project	**Description**	**Timeframe**
Past and Present Activities/Projects		
Channel and Harbor Dredging	Maintenance dredging of the Pascagoula and Bayou Casotte Channels and the Inner Harbor.	Ongoing
Pascagoula Refinery Expansion	Expand refinery's gasoline production capacity by 500,000 gallons per day.	Through late 2006 [a]
Future Activities/Projects		
LNG Clean Energy Project	LNG import terminal, and associated natural gas pipeline interconnects.	2006-2009
Channel and Harbor Maintenance Dredging	Maintenance dredging of the Pascagoula and Bayou Casotte Channels and the Inner Harbor.	Ongoing

NOTES:

[a] The completion date for the Pascagoula Refinery may be delayed due to impacts caused by Hurricane Katrina.

4.13.1 Geology

Because no significant paleontological or mineral resources have been identified in the Project area, the proposed projects would not have a cumulative impact on geological resources. Shoreline erosion is a concern along the Mississippi Coast. In general, shoreline erosion can be caused by ship traffic or by engineered structures, such as levees along beaches or rivers, up to hundreds of miles away from where the erosion problems occur. Natural processes such as tide-induced currents, sea level changes, wind waves, and hurricanes or other extreme storms also contribute to shoreline erosion. Because the proposed LNG terminal site would contain an angled slip off the Bayou Casotte Channel, the LNG marine traffic associated with the Project would not contribute measurably to shoreline erosion along the channel or waterway from the territorial seas to the berthing facility. Rock or concrete units would be installed on the slope parallel to the shoreline of the ship berth area to protect it from erosion.

The Pascagoula Refinery expansion will not affect shoreline erosion because it will not disturb the coastline. The proposed LNG Clean Energy Project would be located along the Bayou Casotte Channel just before it enters the harbor, rather that being located within the harbor where the shoreline is close to the channel. Therefore, the LNG carrier traffic associated with the Project would not contribute measurably to shoreline erosion along the channel.

4.13.2 Soils and Sediments

Clearing and grading associated with construction of the proposed LNG terminal projects and the Refinery expansion would accelerate the erosion process and, without adequate protection, would result in discharge of sediment to adjacent waterbodies and wetlands. Soil loss due to erosion would also reduce soil fertility and impair revegetation. The proposed LNG terminal projects would adopt the FERC staff's Plan or develop comparable measures approved by the FERC to establish a baseline for minimizing the potential for erosion as a result of water or wind action and to aid in reestablishing

vegetation after construction. In addition, a site-specific SWPPP would be required as part of the general permit for construction stormwater discharges. The SWPPP would incorporate various BMPs, as well as guidance established in documents developed for erosion control and stormwater management in the State of Mississippi.

None of the land within the proposed Project area is currently under active cultivation, and no prime farmland would be permanently converted as a result of the proposed LNG terminal projects.

Except for the Refinery expansion, the primary activities considered for this cumulative impacts analysis involve dredging activities. Estimated dredging volumes and proposed dredge placement sites for the projects are provided in Table 4.13.2-1.

TABLE 4.13.2-1
Estimated Volumes of Dredged Material for Current and Proposed Projects

Project	Estimated Volume for Construction (million cubic yards)	Proposed Dredged Material Placement Site(s)
Construction of Casotte Landing LNG Project	3.5	ODMDS
Maintenance Dredging for Casotte Landing LNG Project over 20 years	up to 5.0	ODMDS
Construction of LNG Clean Energy Project	2.96	ODMDS
Maintenance Dredging for LNG Clean Energy Project over 20 years	up to 1.2	BCDMMS
Maintenance Dredging of Bayou Casotte Inner Harbor and Turning Basin over 20 years	3.46	BCDMMS
Maintenance Dredging of Bayou Casotte Channel over 20 years	undetermined	BCDMMS
Maintenance Dredging of Bayou Casotte Harbor Public Ship Berths over 20 years	0.30	BCDMMS
Maintenance Dredging of Existing Bayou Casotte Harbor Private Industry Ship Berths over 20 years	0.27	Private placement sites
Maintenance Dredging of Pascagoula Channel and Turning Basin over 20 years	undetermined	undetermined

NOTES:
ODMDS Pascagoula Ocean Dredged Material Disposal Site
BCDMMS Bayou Casotte Dredged Material Management Site

Construction and maintenance dredged material associated with the proposed Casotte Landing LNG Project is proposed to be placed in the Pascagoula ODMDS. Beneficial use sites have also been investigated as a possible dredged material disposal option, which would be an environmental benefit to the project area. However, at this time no beneficial use sites are available for use by Bayou Casotte Energy. All of the dredged material derived from construction of the proposed LNG Clean Energy Project is proposed for placement in the ODMDS. This material would not have a significant effect on the capacity of the ODMDS.

The ship berth and maneuvering area associated with the LNG Clean Energy Project would be owned by the Jackson County Port Authority after it is constructed and the Port Authority would be

responsible for the maintenance dredging. The material associated with maintenance dredging at the proposed facility is proposed to be placed at the BCDMMS. Gulf LNG calculated that the additional material associated with maintenance dredging for the LNG Clean Energy Project would reduce the life of the BCDMMS from 50 years to approximately 39 years, assuming the maximum potential shoaling rate.

4.13.3 Water Resources

Construction of the proposed LNG terminal would involve the dredging of a ship berth. The primary impacts of dredging on water quality are increased turbidity and sedimentation, the release of nutrient-bound contaminants, and decreased dissolved oxygen.

Initial dredging activities during construction and maintenance dredging during operation would result in increased turbidity and sedimentation that would temporarily decrease water quality. If dredging associated with the proposed LNG terminal were to occur concurrently with other dredging projects, the reduction in water quality would be exacerbated. However, because the Mississippi Sound and Bayou Casotte are naturally turbid, noticeable increases in TSS associated with dredging activities for the proposed project would be relatively localized. Dredge modeling for the Proposed Casotte Landing Project indicated that dredging would not increase TSS levels above current background levels in Bayou Casotte. As a result, even if other dredging occurs concurrently, the regions affected by elevated turbidity would not likely overlap and additive affects would not be expected to occur. In addition, if the dredging projects were undertaken concurrently, the time period of increased turbidity would be shortened. In any case, the negative effects of dredging in this substrate would be temporary and water quality would be expected to return to ambient conditions after completion of these activities. No long-term cumulative impacts on water quality, either in the marine terminal area or along the LNG vessel transit route, would result from the dredging activities.

Propeller wash from LNG marine traffic, oil tankers, and tugboats associated with the LNG terminals and Chevron's Pascagoula Refinery expansion could temporarily increase suspended sediments within the waterway. However, given the naturally high turbidity levels within the Mississippi Sound, such impacts would not be significant.

The area comprising both proposed LNG terminal projects was originally used for dredge material placement. Aside from the Mississippi Sound and Bayou Casotte, the existing waterbodies within the Project area consist of shallow intermittent drainage ditches, dredged canals, and retention ponds. The quality of these waterbodies is generally low because of their artificial origin and use for industrial stormwater conveyance. The pipeline interconnects for the proposed Casotte Landing Project would traverse canals and ditches using the open cut method. The construction of the proposed natural gas sendout pipeline associated with the proposed LNG Clean Energy Project would also require the crossing of two manmade canals. One canal would be crossed by the horizontal directional drill (HDD) construction method and the other would be crossed using the open cut method. Impacts on the canals would be minor and short term.

Runoff from construction activities near waterbodies would also result in cumulative impacts, although this effect would be relatively minor and would be controlled during each project by implementation of erosion and sediment control measures and by compliance with federal, state, and local requirements. Because the potential impacts on waterbodies would be limited to the period of construction, and each project would be required to implement erosion and sediment control measures to reduce impacts, the collective effects on surface water resources are expected to be minor.

4.13.4 Vegetation and Wetlands

4.13.4.1 Vegetation

The proposed Casotte Landing Project site is a previously developed industrial area and the few existing plants are fast-growing, hardy pioneer species. About 115 acres of upland scrub-shrub habitat and 119.3 acres of wetlands (scrub-shrub and emergent) would be affected at the proposed terminal site. The proposed interconnect and NGL pipeline routes would affect about 27.6 acres of wetlands consisting of scrub-shrub, emergent and forested. Because the Casotte Landing pipeline interconnects would be collocated to the extent possible with existing structures, permanent impacts on vegetation would be minor.

Construction of the proposed LNG Clean Energy terminal facilities would permanently remove about 43 acres of vegetation communities consisting of scrub-shrub uplands, intertidal mudflats, and coastal brackish marsh. Construction of the proposed pipeline and associated aboveground facilities would disturb 67 acres of upland vegetation and 16 acres of wetland vegetation. Operation of the proposed pipeline facilities would require that about 26 acres of vegetation be converted to permanently maintained pipeline right-of-way (25 acres) and aboveground facilities (1.2 acres).

Although implementation of the proposed LNG terminal projects would permanently remove native vegetation, these impacts are not expected to be significant on a regional scale because areas with similar vegetation characteristics are found on surrounding lands. Because the Refinery expansion would be within the existing, previously disturbed portion of the refinery, no significant impacts on vegetation are anticipated.

The only potential impacts on vegetation along the LNG ship transit route would occur if LNG were released from an LNG ship near Petit Bois and Horn Islands. The resulting vapor could burn and affect seagrass beds and beach dune vegetation along the western edge of Petit Bois Island and the eastern edge of Horn Island. Because these effects would be short-term and fairly limited in area, there would be no significant long-term cumulative impacts on vegetation along the transit waterway.

4.13.4.2 Wetlands

There would be a permanent loss of some existing wetlands as a result of constructing and operating the proposed LNG terminal projects. However, the projects would require, by the terms and conditions of their respective CWA permits, compensatory mitigation for wetland damage or destruction. Therefore, creation of new wetlands, as required by the CWA, is anticipated to result in a net increase in the regional coastal marsh resource. Table 4.13.4-1 summarizes the acres of wetlands impacted by the proposed projects.

TABLE 4.13.4-1
Wetland Impacts Associated with the Proposed LNG Terminal Projects (acres)

Project	LNG Terminal Facilities [a]		Pipeline/Interconnects		Total Impacts	
	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
Casotte Landing LNG Project	119.3	119.3	15.3	7.9	134.6	127.2
LNG Clean Energy Project	5.8	4.9	14.1	2.6	20.0	7.4

[a] Impacts associated with any nonjurisdictional facilities are not included.

As discussed in Section 4.4.3, none of the wetland impacts associated with proposed Casotte Landing pipeline interconnects would be permanent and only a small fraction of the wetland impacts associated with construction of Gulf LNG's natural gas sendout pipeline would be permanent. Neither waterbodies nor wetlands would be affected by Chevron's refinery expansion because the expansion would occur within the established limits of the existing refinery.

4.13.5 Wildlife and Aquatic Resources

4.13.5.1 Wildlife

Because Bayou Casotte Energy's proposed LNG terminal would be located on a former industrial site adjacent to a refinery, the existing wildlife habitat at the site is not of high quality and only minor impacts on wildlife are anticipated. Compensatory replacement of wetland habitat would be required. No natural fresh waterbodies would be affected by the proposed Project, rather all of the waterbodies located within the footprint of the proposed terminal site are constructed canals, ditches, or ponds that offer minimal habitat for aquatic species.

Habitat within the footprint of the proposed LNG Clean Energy Project terminal would be permanently lost to wildlife. Some smaller, less mobile wildlife, such as small mammals, amphibians and reptiles, would likely experience direct mortality during clearing and grading activities. Other wildlife, such as birds and larger mammals, would likely leave the immediate construction area when construction activities approach, perhaps relocating to the Grand Bay Preserve, which would provide similar and ample habitat to the east of the proposed project area. Gulf LNG would mitigate for the permanent loss of coastal brackish marsh associated with the LNG terminal facilities through compensatory replacement of habitat.

The proposed Casotte Landing Project may encompass habitat for or involve interaction with the following federally-listed species: sperm whale, blue whale, sea whale, fin whale, humpback whale, North Atlantic right whale, Florida manatee, Gulf sturgeon, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead turtle, bald eagle and brown pelican. However, suitable habitat was not identified for federal or state protected species on the proposed LNG terminal site.

Compensatory replacement of wetland habitat would be required. Because ample similar upland habitat is available in the area and wetland habitat would be compensated, no adverse cumulative impacts on wildlife would be associated with the proposed LNG terminals.

Most of the pipeline construction areas associated with the proposed LNG terminal projects would revert to preconstruction conditions, and therefore, impacts on most wildlife habitat would be temporary and short term. Because the majority of the pipeline routes for both LNG terminal projects is currently maintained right-of-way or other industrial areas, the cumulative impacts on wildlife and wildlife habitat in the area would likely be negligible. Since the Refinery expansion would be within the existing, previously disturbed portion of the refinery, no significant impacts on wildlife are anticipated.

None of the projects considered for this cumulative impacts analysis is anticipated to affect wildlife habitats along the LNG ship transit route. No significant cumulative impacts on wildlife along the transit route would be expected.

4.13.5.2 Aquatic Resources

The ship berth for the proposed Casotte Landing Project would be constructed in an upland area and existing aquatic habitat would not be affected. Maintenance dredging in the Bayou Casotte Channel would be within existing dredged areas that have already been disturbed. The Pascagoula Refinery expansion would not affect aquatic resources. Dredging of the ship berth and maneuvering area for the proposed LNG Clean Energy Project would result in the permanent conversion of 61.3 acres of shallow, primarily sandy softbottom habitats to deeper, silty-sand softbottom habitats. Many of the aquatic species that currently inhabit shallow water habitat in the project area also inhabit the deeper water of the adjacent Bayou Casotte Channel. These species are not likely to be negatively affected by the alteration in habitat. Aquatic species that prefer the shallow water habitat would experience a loss of habitat due to dredging; however, the large amount of similar habitat in the vicinity of the project area would provide ample habitat for individuals displaced by construction activities

As discussed in Section 4.13.3, construction dredging for the proposed Casotte Landing LNG Project and the LNG Clean Energy Project and maintenance dredging for the two LNG terminal projects and the Port of Pascagoula would result in temporary increases in turbidity, which would have impacts on aquatic resources. These impacts would be mostly temporary and localized, and mitigation measures would be required to reduce turbidity. Because the dredging activities for the projects would be unlikely to occur at the same time and in close proximity, they would not cause cumulative impacts on aquatic resources.

LNG ships and crude oil tankers would take on water during offloading for ballast and for engine cooling while they are at the berth at the proposed LNG terminals and the Chevron Pascagoula Refinery. Water used for engine cooling would be quickly discharged, and the resulting increase in water temperature is expected to be minor. Intake of water could also result in the entrainment of aquatic resources. The majority of species identified by the NOAA Fisheries occur in low densities in the project area. In contrast, blue crab and penaeid shrimp occur in high densities in the project area; however, they exhibit naturally high mortality rates. These combined effects account for the negligible impact to these species. The resulting low numbers removed from these species populations would be expected to have a minimal impact on the ecology in the project area and the surrounding Mississippi Sound, including food chain relationships.

Several federally-listed threatened or endangered aquatic species, including whales, sea turtles and Gulf sturgeon are potentially present in the area affected by the proposed LNG terminal projects and the maintenance dredging activities, including the LNG ship transit route. The proposed Casotte Landing project would affect 6.3 acres of Gulf sturgeon critical habitat and the proposed LNG Clean Energy Project marine facilities would be within Gulf sturgeon critical habitat and the ship channels servicing the Port of Pascagoula also pass through this critical habitat. To minimize impacts on Gulf sturgeon and its critical habitat, Bayou Casotte Energy would implement agency dredging requirements, concurrent scheduling of future maintenance dredging, and its SPCC Plans. In addition, Gulf LNG has agreed to perform a 3-year post-construction prey and habitat assessment survey of the ship berth and maneuvering area and adjacent areas. With the implementation of the above measures, we have determined that the Gulf sturgeon and its designated critical habitat would not likely be adversely affected by construction and operation of the Casotte Landing LNG Project. The other listed aquatic species also would not likely be adversely affected by the proposed projects.

Both of the proposed LNG projects would implement the Strike Avoidance Procedures to minimize potential impacts from LNG marine traffic on whales and sea turtles. For these reasons, we anticipate minimal adverse cumulative impacts on special status aquatic species.

Impacts on EFH from construction of the proposed Casotte Landing Project include disturbance of 6.3 acres of unvegetated benthic habitat needed to connect the proposed marine slip to the ship channel. However, the permanent creation of 26 acres of similar unvegetated benthic habitat in the marine slip area would likely offset this temporary disturbance. The proposed LNG Clean Energy Project would also have an impact on habitat types that function as EFH. Species with EFH designated in the Mississippi Sound would potentially be impacted by loss/alteration of habitat, dredging, permanent loss of 9 acres of intertidal wetland, entrainment of benthic invertebrates, and the temporary resuspension of sediments into the water column during construction. Although there would be permanent impacts on EFH as the result of project construction, Gulf LNG's proposed mitigation, in combination with mitigation for intertidal wetland losses, would compensate for these impacts through the creation of habitats. Maintenance dredging activities would cause a temporary increase in turbidity, but not significantly above background levels and mitigation measures would be implemented to reduce turbidity. With mitigation, we do not believe cumulative impacts on EFH associated with construction or operation of these projects would have a substantial adverse effect on managed fisheries in the area.

4.13.6 Land Use, Recreation, and Visual Resources

4.13.6.1 Land Use

The proposed project and the other foreseeable future projects would result in minor changes to current land uses. The proposed Casotte Landing Project would be constructed on a former manufacturing site adjacent to the Chevron Pascagoula Refinery. The Pascagoula Refinery expansion would take place within the existing refinery property and would not involve land use changes. The land use surrounding these projects consists primarily of industrial properties. Gulf LNG's terminal would be constructed on a tract of land located in an area that was previously used for dredged material placement, has no current structures or access, and is designated for water-dependent industrial use. The conversion of the site from an undeveloped, open area to an industrial use would be consistent with its designated use, as well as with other industrial facilities in the area. There is no agricultural or residential land in the vicinity that would be affected by the projects. No residential or other developed land is present along the LNG ship transit route. Material generated during maintenance dredging for the port would be placed in approved, previously used placement areas.

4.13.6.2 Recreation

Recreational fishing and boating occur in Bayou Casotte and Mississippi Sound, although existing recreational boating and fishing use in the immediate vicinity of the proposed project is limited. The construction of the marine berth for the proposed Casotte Landing Project would be within an existing upland area and would have minimal impacts on recreational boating and fishing. The relatively shallow water depths in the vicinity of the proposed LNG Clean Energy Project (ranging from 0 to 8 feet but generally less than 4 feet deep) preclude many recreational boaters from utilizing this area. The proposed projects would potentially negatively affect recreation, primarily during the period of active construction and dredging. However, recreational boating and fishing activities are not expected to be significantly affected during construction of the marine facilities because of the nature of the work site (i.e., shallow water) and the fact that recreational boaters who do currently operate in the area are accustomed to avoiding existing vessel movements similar to those that would be experienced during construction of the project. Operation of the proposed Casotte Landing Project would affect recreational boating and fishing in the Bayou Casotte during the arrival, unloading, and departure of LNG marine traffic. Bayou Casotte Energy anticipates 170 LNG ship visits per year. 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 of LNG marine traffic. These effects would be temporary while the boat is in transit or moored at the ship unloading facility. The maximum

delay expected due to the transit of an LNG vessel would be 1.5 hours. The security zone typically would extend 2 miles ahead and 1 mile behind the ship during transit. The extent of the security zone around the LNG carrier while it is unloading would be established by the Coast Guard but is not expected to interfere with traffic along the adjacent Bayou Casotte Channel.

Operation of the LNG Clean Energy Project would affect recreational boating and fishing in the Mississippi Sound during the arrival, unloading, and departure of LNG marine traffic. Gulf LNG anticipates that approximately 150 ships would unload at the LNG terminal each year. Docks in the Port of Pascagoula currently accommodate commercial ships. As a result, marine traffic associated with the project would not introduce any significant new type of impacts on recreational boating or fishing. Security zone restrictions similar to those applied to Casotte Landing would apply.

The potential increase of up to 320 LNG ships per year from the two proposed LNG terminal projects would have a minimal affect on recreational activities in the area; however, neither of these projects is located in an area of high recreation usage. Recreational vessels that are not constrained to the dredged channel would not be adversely affected by the additional shipping traffic because these smaller vessels can operate outside the confines of the channel and remain clear of the LNG marine traffic. In addition, the LNG terminal projects are located on lands dedicated to industrial uses and are not near recreation areas.

Maintenance dredging for the LNG terminal projects or for other port activities would not have cumulative impacts on recreational boating or fishing because the disturbance associated with a given area would be localized and temporary in nature.

4.13.6.3 Visual Resources

The visual characteristics of the existing landscape are defined by historic and current land uses such as agriculture, recreation, conservation, and development. The visual qualities of the landscape are further influenced by existing linear installations such as highways, railroads, pipelines, and electrical transmission lines, and by the industrial facilities located along the Bayou Casotte Harbor. Within this context, the LNG storage tanks at the proposed LNG terminals would have the most impact on visual resources in the area. The pipeline portions of the proposed LNG terminal projects would be visually subordinate to the existing landscape character and would contribute only incrementally to overall visual conditions, particularly because the pipeline routes would primarily be within existing rights-of-way. The LNG terminal facilities would be located in an area with several existing industrial facilities, which would lessen their visual impact because their presence would be generally consistent with the current viewshed in the area. Likewise the refinery expansion would be within the limits of the existing refinery. Maintenance dredging activities would not have an impact on visual resources. The LNG ships and oil tankers would be operating within established federal navigation channels used by other commercial vessels. Therefore, the proposed projects would not significantly contribute to cumulative effects on visual resources.

4.13.7 Socioeconomics

With the exception of the maintenance dredging activities, present and reasonably foreseeable future projects and activities would have a cumulative impact on socioeconomic conditions in the project area. Employment, housing, infrastructure, and public services would experience both beneficial and detrimental impacts. Based on letters of support that the proposed project has received from state and local officials (i.e., Mayor of the City of Pascagoula, President of the Jackson County Port Authority, Governor of the State of Mississippi) the Pascagoula area has a need for projects such as the proposed LNG terminals to aid in its economic recovery after Hurricane Katrina. Therefore, the present and

reasonably foreseeable future projects and activities considered for this analysis are likely to have a positive net socioeconomic impact. None of the projects appear to have environmental justice issues, given the industrial nature of the sites (i.e., away from residential areas).

4.13.7.1 Economy and Employment

The projects considered in this section would have cumulative effects on employment during construction if construction schedules overlap. During construction, the proposed Casotte Landing Project would employ 50 to 100 workers during non-peak construction periods with 400 to 600 workers during peak periods, which would occur about 50 percent of the time. The proposed LNG Clean Energy Project would employ an average workforce of 259, with a peak workforce of 556 at the beginning of the third year of construction. Bayou Casotte Energy estimates that 30 percent of the workforce would be local and Gulf LNG estimates that 64 percent of the workforce would be local. Currently, the proposed schedules for the two proposed LNG terminal projects are similar.

The Pascagoula Refinery expansion is expected to employ 1,000 workers at the peak of construction. Based on the original schedule before Hurricane Katrina, the refinery expansion would have been entirely or largely completed before construction of the proposed LNG terminal projects began. The hurricane delayed the construction schedule, possibly resulting in more overlap between the project schedules. In this event, more non-local workers may need to be hired temporarily. However, the impacts of this relatively small number of workers temporarily relocating to the area would be minor.

As discussed in Section 4.8.2, the Hurricane Katrina reconstruction effort and the specialized construction requirements of the proposed LNG terminal projects are expected to draw from different sectors of the construction workforce. Therefore, construction employment for the proposed LNG terminal projects should not conflict with hurricane reconstruction efforts.

While most of the jobs created by the proposed LNG terminal projects and the refinery expansion are temporary construction jobs, permanent employment would also increase in the project area. The LNG terminal projects would each employ 50 permanent workers. The refinery currently employs about 300 permanent workers.

In addition to impacts on local employment, these projects would provide an increase in revenue for the State of Mississippi, Jackson County, and the local economies through the payment of payroll tax, sales tax, property tax, and other taxes and fees. During operation, The proposed Casotte Landing Project would have an annual payroll of about $3,000,000 and would pay $13,606,000 annually in taxes and fees to the county. Payroll for the LNG Clean Energy Project would be $4,000,000 annually; and annual ad valorem taxes, lease fees, and port fees are anticipated to be $14,809,000. Cumulatively, these projects would have a beneficial impact on Jackson County and local economies and governments.

4.13.7.2 Housing

Temporary housing for the construction workers would be needed for the portion of the workforce not drawn from the local area. During the two years of peak construction activity, 180 units would be required to house temporary construction workers. If the LNG Clean Energy Project were under construction at the same time, the demand would be as much as double that amount.

Although Hurricane Katrina has caused a temporary shortage in supply of temporary housing, area motels are expected to be fully operational in 2006. The peak construction period for the proposed Casotte Landing Project is expected to occur in 2008 when additional temporary housing facilities would be available if required by project personnel. If adequate temporary housing is not available in

Pascagoula or the immediate surrounding area, some workers may be required to commute from areas further away.

4.13.7.3 Infrastructure and Services

Infrastructure and services may be affected when population increases if existing infrastructure lacks spare capacity. The small incremental demands of several construction projects occurring at the same time would place extra demands on police, fire, and emergency service personnel. However, this problem would be temporary, and would be somewhat offset by addressing additional service staff and shifts. In addition, cumulative impacts to disposal and waste management services would also be minimal, as sufficient space is available in the landfills near the project area and given that the majority of waste generated at the construction site would be Class 3 industrial waste.

The permanent impact of the proposed Casotte Landing Project on the emergency response services (i.e., police, fire, and medical) is discussed in Section 4.12. Both of the proposed LNG terminal projects would be required to develop an Emergency Response Plan in coordination with local emergency service providers and municipal, county, and local specialized units located within other nearby industries. These plans are anticipated to be developed in conjunction with one another. Furthermore, the plan for the proposed Casotte Landing Project would likely be coordinated with the existing Pascagoula Refinery emergency response plans due to the close relationship (i.e., proximal and operational) between the two facilities.

4.13.8 Transportation

4.13.8.1 Marine Transportation

The current volume of ship traffic for the Port of Pascagoula, as a whole, is an average of about three one-way transits per day. The average number of ship transits per day for Bayou Casotte Harbor is two, most of which are oil tankers calling at the Pascagoula Refinery.

The two proposed LNG terminals and the Pascagoula Refinery expansion would result in an increase in ship traffic in the port. The combined number of LNG ships for the two facilities would be about 320 vessels. Based on an increased output of about 500,000 gallons of gasoline per day at the refinery, and assuming 2.1 gallons of crude oil per gallon of refined gasoline (Energy Information Administration, 2004) and an oil tanker capacity of 22 million gallons, 17 additional oil tankers would visit the refinery. For all three projects, the annual increase would be 337 vessels (see Table 4.13.8-1), or approximately two one-way transits per day. Each transit would take approximately 2 hours and multiple inbound or outbound ships would use different portions of the Port of Pascagoula channels at the same time. The realistic maximum delay that one ship transiting the channels would pose on another ship transiting the GIWW is roughly 30 minutes. If two ships were traveling one right after another along the Port of Pascagoula channels (an unlikely scenario), the maximum delay for a ship transiting the GIWW would be 1 hour.

Small vessel traffic (e.g., commercial fishing vessels and recreational vessels that are not constrained to the dredged channel) would not be adversely affected by the additional shipping traffic because these smaller vessels can operate outside the confines of the channel and remain clear of the LNG marine traffic.

TABLE 4.13.8-1 Estimated Number of Ship Calls for the Proposed LNG Terminal Projects and the Refinery Expansion Project	
Project	**Estimated Number of Ship Calls per Year**
Casotte Landing LNG Project	170
LNG Clean Energy Project	150
Pascagoula Refinery Expansion	17
Total	**337**

In most ports, the greatest constraint on traffic management is the availability of tugs. The Pascagoula Pilots consider the current tug fleet operating in the port to be adequate for current operations; however, additional tugs would likely be required to accommodate the proposed LNG projects. Bayou Casotte Energy and Gulf LNG would provide needed information for ship-assist tug companies to determine the requirement for adequate tugs, with sufficient power rating, to meet the needs of the LNG terminals. The Pascagoula Pilots have also indicated that they would need to add at least two pilots to their workforce to accommodate the increased ship traffic associated with operation of the proposed LNG terminals. Although it takes up to 1 year to become a fully qualified and licensed Pascagoula Pilot, the timeframe involved in permitting and constructing of the LNG terminals would provide ample opportunity to make the necessary workforce adjustments. Overall, the cumulative increase in ship traffic would have minimal impacts on port and waterway operations.

In addition to the Pascagoula Pilots, the Coast Guard would control the transit of the LNG carrier through the harbor and while unloading LNG. Typical Coast Guard requirements for other LNG import terminals include 96- and 24-hour advance notification of the LNG carrier arrival. Upon arrival at the sea buoy, Coast Guard personnel may board the LNG carrier 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 LNG carrier while in transit and during unloading operations; an inspection of the dock safety systems prior to commencing LNG transfer; monitoring of all operations until the LNG carrier departs; and maintaining security of the dock and LNG carrier.

4.13.8.2 Land Transportation

Bayou Casotte Energy has not quantitatively assessed the impacts of construction of the proposed Casotte Landing Project on traffic; however, given its similar location and nature, we assume the impacts would be comparable to the impacts associated with the proposed LNG Clean Energy Project. Given the similar schedules, the two projects combined would increase traffic on State Highway 611 by 27 to 35 percent. Bayou Casotte Energy proposes to schedule deliveries to the site during off-peak hours to avoid congestion as well as have construction personnel arrive and leave during off-peak times for commuters. Bayou Casotte Energy has also proposed to have the majority of its deliveries made via marine transport. Gulf LNG has proposed similar mitigation (workers would be ferried from off-site parking to the project site via tugs and other small boats) as well as staggering shift startup to minimize traffic congestion and reduce potential cumulative impacts to a level that is not significant.

At the peak of construction associated with the Pascagoula Refinery expansion construction, about 1,000 workers would be employed, resulting in about 2,000 individual vehicle trips per day. Although the completion of the refinery expansion may be delayed due to Hurricane Katrina, the majority

of the work is likely to be completed before either of the proposed LNG terminal projects would begin. Therefore, any construction period overlap for all three projects would be brief and the peak workforce would not be present for any of the projects.

Operation of the proposed LNG terminals would each require an estimated 50 employees. The additional traffic generated by these employees on a daily basis would not result in a significant increase in local traffic volume, and would not adversely affect traffic on area roadways. Likewise, the number of employees associated with operation of the expanded Pascagoula Refinery is not likely to generate a significant volume of additional traffic. In addition, the varied work schedules of the employees would reduce any potential for additional traffic congestion.

It is unlikely that each project would reach peak traffic conditions simultaneously. Also, because construction workers frequently share rides and travel to and from work during off-peak hours, potential cumulative impacts on traffic from pipeline construction are expected to be temporary and short term. Once pipeline construction is complete, there would be negligible impacts on traffic during operation and maintenance of the facilities.

4.13.9 Air Quality and Noise

Construction of the proposed project and the reasonably foreseeable projects and activities listed in Table 4.13.9-1 would involve the use of heavy equipment that produces noise, air contaminants, and dust. Operation of the proposed Project (including the LNG terminal and ships delivering LNG to the terminal) and the reasonably foreseeable projects would also contribute cumulatively to ongoing air emissions and noise.

Table 4.13.9-1 lists the air emissions associated with construction and operation of the two proposed LNG terminal projects and the Pascagoula Refinery expansion in relationship to existing air emissions in Jackson County. Although the region is currently in attainment with air quality standards, increases in point industrial sources would have a deleterious effect on local and regional air quality. If all of the proposed projects are built, there would be slight increases in CO, SO_2, VOC, and NO_x emissions during construction and operation and PM_{10} during construction. Each of the individual projects would be required to obtain an air quality permit from the MDEQ, which may specify controls to limit the emission of certain criteria pollutants or HAPs. Increases in PM_{10} during construction would be mitigated by BMPs. The permit process would ensure that air emissions from operation of the proposed Project and other foreseeable future projects would not cause air quality to deteriorate beyond acceptable levels as specified by air quality regulations (see Section 4.11.1.3).

During operation of the LNG terminals, air emissions from LNG marine traffic and other project-related vessels would occur along the entire waterway from the territorial seas to the ship berths. The NAAQS do not apply to mobile sources. Because of the transitory nature of these sources and the large area covered, these emissions would not have a significant cumulative impact on air quality along the waterway.

As discussed in Section 4.11.1, detailed modeling was performed to quantitatively evaluate the impacts from operation of the proposed project by its self against Class I and Class II area SILs and the NAAQS. The results of the analysis showed predicted concentrations from the project, which included stationary sources at the terminal, LNG carrier unloading and hotelling emissions while berthing at the terminal, as well as the emissions associated with operation of other marine vessels (i.e., Coast Guard boats and tug boats) supporting the facility, to be below the Class I area SILs and below the Class II area NAAQS. Since the Class I area impacts were predicted to be below the SILs, the project is not considered to be significant and no further Class I area analysis is required.

TABLE 4.13.9-1
Proposed LNG Terminal Projects and the Refinery Expansion Project Emissions Summary

Project	Air Emissions				
	CO	NO_x	VOC	PM_{10}	SO_2
Existing Sources in Jackson County [a]	68,609	35,596	28,262	12,643	38,190
Construction of Projects (total tons)					
Casotte Landing LNG Project (2006-2009)	2,464.4	488.6	146.4	62.2	39.5
LNG Clean Energy Project (2006-2009)	436.9	822.6	69.8	2,721.1	124.2
Pascagoula Refinery Expansion (2006)	NA	NA	NA	NA	Na
Total construction (percent of existing sources)[b]	**1.4**	**1.2**	**0.3**	**7.3**	**0.1**
Operation of Projects (tons per year)					
Casotte Landing LNG Project (>2009) [c]	309.93	493.8	47.4	37.6	118.1
LNG Clean Energy Project (>2009) [c]	389.6	670.0	50.9	22.1	605.1
Pascagoula Refinery Expansion (>2006)	98.2	39.8	31.1	14.6	38.4
Total operation (percent of existing sources)	**1.2**	**3.4**	**0.5**	**0.6**	**2.0**

NOTES:

[a] Area sources plus point sources; from EPA AIRDATA: http://www.epa.gov/air/data/geosel.html
[b] Based on a 3-year construction period for both the Casotte Landing LNG and LNG Clean Energy Projects.
[c] Air emissions from mobile and stationary sources.
CO carbon monoxide
NO_x nitrogen oxides
VOC volatile organic compound
PM_{10} particulate matter less than 10 microns in diameter
SO_2 sulfur dioxide
NA not available

In order to provide a more thorough evaluation of the potential impacts on air quality, an additional Class I and Class II area modeling analysis was conducted for the Casotte Landing LNG Project and LNG Clean Energy Project combined. The results of this analysis were filed with the Commission on November 8, 2006 under the Casotte Landing LNG Project. Although further Class I area analysis was not necessary, Class I area impacts (including visibility and deposition) were predicted from both projects and were found to be below the NAAQS and applicable air quality-related values. Because the Casotte Landing Project impacts were expected to exceed several Class II SILs, an additional cumulative analysis was conducted. The results of the modeling analysis of the two LNG projects combined showed that emissions of PM_{10}, SO_2, and NO_x would exceed Class II area SILs. However, with the background concentrations included, the emissions were predicted to be below the NAAQS. The modeled Class II area impacts resulting from both projects are presented in Table 4.13.9-2.

TABLE 4.13.9-2
Summary of Class II Area Impacts Resulting From the Casotte Landing LNG and LNG Clean Energy Projects

Pollutants	Averaging Period	Highest Modeled Impact [a] ($\mu g/m^3$)	Significant Impact Level ($\mu g/m^3$)	Background Value [b] ($\mu g/m^3$)	Total Impact (including background) [c] ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
SO_2	3-hour	199.0	25	121	320.0	1,300
	24-hour	99.0	5	52	151.0	365
	Annual	4.1	1	8	12.1	80
CO	1-hour	756.2	2,000	2,290	3,046.2	40,000
	8-hour	193.9	500	1,947	2,140.9	10,000
PM_{10}	24-hour	24.5	5	51	87.6	150
	Annual	1.3	1	20	21.3	50
NO_2	Annual	12.6	1	15	48.1	100

NOTES:

[a] Highest impacts presented in Table 3-8 of the "Joint Air Dispersion Modeling Analysis for The Casotte Landing Natural Gas Import Terminal Project and Gulf LNG Clean Energy Project" dated November 7, 2006.

[b] Based on background values presented in Table 4.12.1-8.

[c] Total Impact = Highest Modeled Impact + Background Value.

$\mu g/m^3$ micrograms per cubic meter

At the time of the above modeling analysis, the appropriate data from the Pascagoula Refinery expansion was not available for inclusion. Therefore, to evaluate the impacts of all three projects combined for the pollutants that exceeded the Class II area SILs for the LNG Casotte Landing Project alone, the modeled results from both the Casotte Landing LNG Project and the LNG Clean Energy Project (presented in Table 4.13.9-2) were conservatively scaled up to include the emissions from operation of the Pascagoula Refinery expansion (presented in Table 4.13.9-1). Table 4.13.9-3 presents the scaled cumulative impacts for comparison to the NAAQS. As shown, the total scaled cumulative impacts are well below the NAAQS for all pollutants and averaging times. Based on the modeled results and scaled cumulative values, we do not believe there would be a significant cumulative impact on air quality.

Noise sources during construction of the LNG terminal projects and the Pascagoula Refinery expansion would create temporary impacts, but they would be localized and would attenuate quickly as the distance from the noise source increases. There are no sensitive noise receptors such as residences or schools nearby. Therefore, cumulative noise impacts associated with construction of all of the projects are not anticipated to be significant. No long-term cumulative noise impacts are anticipated from the facilities or associated ships along the waterway during operation.

Table 4.13.9-3
Summary of Class II Area Impacts Resulting From the Casotte Landing LNG and LNG Clean Energy Projects

Pollutants	Averaging Period	Highest Modeled Impact [a] ($\mu g/m^3$)	Emission Rate Scaling Ratio [b]	Scaled Cumulative Impact [c] ($\mu g/m^3$)	Background Value [a] ($\mu g/m^3$)	Total Scaled Cumulative Impact [d] ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
SO_2	3-hour	199.0		209.0	121	330.0	1,300
	24-hour	99.0	1.05	104.0	52	156.0	365
	Annual	4.1		4.3	8	12.3	80
PM_{10}	24-hour	24.5	1.24	30.4	51	81.4	150
	Annual	1.3		1.6	20	21.6	50
NO_2	Annual	12.6	1.03	13.0	15	28.0	100

NOTES:

[a] Based on values listed in Table 4.14.8-2.

[b] Emission ratio estimated by dividing the sum of the operating emissions associated with LNG Clean Energy Project, Casotte Landing LNG Project, and the Pascagoula Refinery Expansion by the sum of the operating emissions from the Casotte Landing LNG Project and the LNG Clean Energy Project listed in Table 4.14.8-2 for the pollutant of interest.

[c] Estimated by multiplying the highest modeled impact by the listed emission rate scaling ratio.

[d] Total scaled cumulative impact = Scaled Cumulative Impact + Background Value.

$\mu g/m^3$ micrograms per cubic meter

4.13.10 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 proposed LNG Project would be designed, constructed, operated, and maintained in accordance with DOT Minimum Federal Safety Standards in Title 49 CFR Part 192. The Coast Guard would assess the suitability of the waterway for LNG marine traffic by issuing an LOR.

Several of the present or reasonably foreseeable future projects, including the proposed Project, would involve cargo terminals that would 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 or the LNG facility. The addition of the LNG facility and its associated LNG marine traffic would not significantly change the risk of an intentional attack in the Horn Island, Pascagoula and Bayou Casotte 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 would cumulatively increase the risk of an accident having an impact on public safety. As discussed in Section 4.13.8, the Pascagoula Pilots manage vessel traffic to insure safe transit in the Horn Island, Pascagoula, and Bayou Casotte Channels. The Coast Guard would also enforce any moving safety zone and moored vessel security zone around LNG marine traffic which may be established. These and other operational controls by the Coast Guard and Pascagoula Pilots would minimize the risk of accidents involving LNG marine traffic. 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 carrier 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 4.12.5.5 includes our recommendation that Bayou Casotte Energy prepare an Emergency Response Plan and coordinate procedures with local emergency planning groups fire departments, state and local law enforcement, the Coast Guard, and other appropriate federal agencies to be used in the event of an incident. Bayou Casotte Energy 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.

4.13.11 Conclusions

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 Casotte Landing 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. Construction of the two LNG terminal projects, if done more or less concurrently, would place pressure on local temporary housing supplies for temporary workers. However, these impacts are expected to be minor. The Project would cumulatively contribute to increased ship traffic in the Port of Pascagoula and increased air emissions. Although the LNG terminal projects would result in the degradation and loss wetlands and other habitats, compensatory mitigation programs for each of these projects would be designed to provide a net benefit to the ecosystem. The Project would also 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.