# 3.0 ALTERNATIVES

In considering Calhoun Point Comfort's applications, the FERC will review both the environmental and non-environmental record in deciding whether it is in the public convenience and necessity to issue any authorization for the project. The EIS addresses alternatives to the proposed actions before both the FERC and the Coast Guard. The proposed action before the FERC is to consider issuing to Calhoun Point Comfort a Section 3 authorization for the LNG import facilities and a Section 7 Certificate for a new natural gas pipeline. The proposed action before the Coast Guard is to consider issuing Calhoun Point Comfort a LOR finding the waterway suitable for LNG marine traffic, with certain conditions. These measures may include, but are not limited to, security zones around the LNG carriers, a vessel traffic control plan, escorts by armed law enforcement vessels, a variety of waterway and shoreline surveillance measures, and multi-agency cooperation and communication. Specific details of these measures, and where applicable, the resources needed to implement them, are described in the Coast Guard's June 19, 2006 letter to FERC which has been designated Sensitive Security Information as defined in Title 49 CFR Part 1520. Because any unauthorized disclosure of these details could be employed to circumvent the proposed security measures, they are not releasable to the public.

In accordance with NEPA and Commission policy, we have evaluated a number of alternatives to the Calhoun LNG Terminal and Pipeline Project to determine if any are reasonable and environmentally preferable to the proposed actions. Alternatives described in the following sections include no action or postponed action, LNG system alternatives, LNG terminal site alternatives, and pipeline system and route alternatives. Reasonable alternatives to the Coast Guard action of issuing a LOR include: 1) issuance of a Coast Guard LOR finding the waterway suitable for LNG marine traffic without any conditions; 2) issuance of a Coast Guard LOR finding the waterway suitable for LNG marine traffic with conditions; 3) postponing the issuance of a Coast Guard LOR pending further analysis and study; and 4) issuance of a Coast Guard LOR finding the waterway not suitable for LNG marine traffic (no action alternative).

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

- are technically and economically feasible and practical;
- offer significant environmental advantage over the proposed Project or segments of it; and
- meet the project objectives of providing facilities necessary to import, store, and vaporize LNG and deliver natural gas into the existing interstate and intrastate natural gas pipelines near Edna, Texas while providing a competitive supply of natural gas to local industrial customers, such as Formosa Hydrocarbons Company and Formosa Plastics Corporation, and other energy-consuming customers in Texas.

With respect to the first criteria, it is important to recognize that not all conceivable alternatives are technically and economically practical and feasible. Some alternatives may be impracticable because the sites are unavailable and/or incapable of being implemented after taking into consideration costs, existing technologies, constraints of existing system capacities, and logistics in light of the overall project objectives. In conducting a reasonable analysis, it is also important

to consider the environmental advantages and disadvantages of the proposed action and to focus the analysis on those alternatives that may reduce impacts and/or offer a significant environmental advantage.

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

## 3.1 NO ACTION OR POSTPONED ACTION ALTERNATIVE

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

If the Commission denies the proposal (the no action alternative), the short- and long-term environmental impacts identified in section 4.0 of this EIS would not occur. If the Commission postpones action on the application, the environmental impacts identified in section 4.0 of this EIS would be delayed, or if the applicant decided not to pursue the Project, the impacts would not occur.

For the Coast Guard's proposed action, the no action alternative would be issuance of a LOR which finds the waterway not suitable for LNG vessel traffic.

If the Commission selects the no action alternative, the objectives of the proposed Project would not be met and Calhoun Point Comfort would not be able to provide a new source of natural gas supply to markets that can be accessed through the proposed interconnections with the interstate natural gas pipeline grid. Should Calhoun Point Comfort's proposed LNG terminal, along with other proposed LNG terminals and other natural gas pipeline infrastructure, be delayed by a period of two years, the Energy and Environmental Analysis Foundation, Inc. (EEA) study completed in July 2004 for the Interstate Natural Gas Association of America (INGAA) determined that U.S. gas consumers would pay an extra $200 billion (in constant 2003 dollars) by 2020 (INGAA, 2004).

It is purely speculative to predict the reactions of potential end users of the natural gas that would have been supplied by the Project, and the direct or indirect environmental impacts related to their actions, if the Commission selects the no action alternative. Because the demand for natural gas in the U.S. is projected to increase from approximately 22 tcf per year currently to approximately 30 tcf per year in 2020, potential end users may have fewer and more expensive options for obtaining natural gas from traditional supply sources. Additionally, the no action alternative would circumvent the desires of the U.S. Senate Committee on Environment and Public Works.

The National Petroleum Council's (NPC) September 2003 publication, Balancing Natural Gas Policy, determined that traditional North American producing areas will provide 75 percent of long-term U.S. gas needs, but will be unable to meet projected demand. The NPC study found that the overall level of indigenous production will be dependent on the industry's ability to

increase its production of nonconventional gas – gas from tight formations, shales, and coal-bed methane. The NPC study determined that LNG imports and arctic gas (from Alaska's North Slope and Canada's Mackenzie Delta) could meet up to 20 to 25 percent of U.S. demand by 2025. The report concluded that nine new LNG terminals and nine terminal expansions will be needed that could provide up to 15 bcfd or 17 percent of U.S. natural gas supply by 2025. Calhoun Point Comfort could be one of the nine projected LNG terminals.

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

*Alternatives to the Coast Guard Action*

The proposal before the Coast Guard is the issuance of a Coast Guard LOR finding the waterway suitable for LNG traffic with conditions. Similar to the no action alternative to the FERC proposed action, the no action alternative for the Coast Guard would avoid any project-related environmental effects in the waterway; however, it would also prevent LNG vessels from delivering LNG to the proposed import terminal and the project objectives would not be met.

If the Coast Guard postpones issuance of a LOR pending further analysis or study, the effect is expected to be similar to FERC postponing its action. That is, although it is speculative to predict the resulting effects, postponing issuance of a LOR may lead to Calhoun Point Comfort deciding to delay its entire Project.

A reasonable alternative to the Coast Guard action of issuing a LOR which finds the waterway suitable for LNG vessel traffic with certain conditions discussed on the previous page is to issue a LOR without any conditions. This would avoid some of the economic effects related to any moving safety and/or moored vessel security zones, or other related LNG safety and security activities, which the Coast Guard would determine to be necessary prior to the commencement of LNG vessels transiting the waterway. We are unable to quantify the impacts at this time 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; however, we do not anticipate any significant environmental impacts. The Coast Guard would ensure the appropriate NEPA environmental documentation for such actions is completed prior to the commencement of these activities. Also, the Coast Guard would cooperate in any required NEPA environmental analysis initiated by another agency for projects related to the introduction of LNG vessels, such as any prerequisite channel deepening or dredging by the COE.

## 3.2 LNG SYSTEM ALTERNATIVES

System alternatives are options to the proposed action that would make use of other existing or proposed LNG or natural gas facilities to meet the stated objectives of the proposed Project. A system alternative would make it unnecessary to construct all or part of the proposed Project even if some modifications or additions to the existing or proposed facilities are necessary. These modifications or additions would result in environmental impacts that could be less, similar to, or greater than those associated with construction of the proposed Project. Ultimately, the purpose in identifying and evaluating system alternatives is to determine whether potential environmental impacts associated with the construction and operation of the Calhoun LNG Project could be avoided or reduced by using another system. Our analysis of system alternatives considers using existing, authorized, or currently proposed but not yet authorized LNG import and storage facilities (both onshore and offshore) located in the continental U.S. to replace all or part of the proposed Calhoun LNG Project.

### 3.2.1 Existing, Approved, or Proposed Onshore LNG Terminals

Currently, there are four existing onshore LNG import terminals that provide unloading, storage, and delivery services in the United States. These facilities are operated by Tractebel - Distrigas of Massachusetts Corporation (Distrigas, at Everett, Massachusetts); Dominion - Cove Point LNG, L.P. (Cove Point, in Calvert County, Maryland); El Paso - Southern LNG Inc. (Southern, at Elba Island, Georgia); and Southern Union - Trunkline LNG Company, L.L.C. (Trunkline, at Lake Charles, Louisiana). The Cove Point LNG terminal is currently being expanded, and Cove Point LNG, L.P. has filed another expansion proposal (CP05-130-000 *et al*.). Likewise, Trunkline recently filed a proposal to expand its LNG facilities. A fifth LNG import terminal, Excelerate Energy L.L.C., began operations off the coast of Louisiana in March 2005 (see section 3.2.2.1).

The Commission has approved eleven new LNG import terminal projects in the continental United States (see table 3.2.1-1).

In addition, there are seven other proposed LNG import terminal projects located in the continental U.S. that are currently being analyzed by the FERC staff. These include Sound Energy Solutions in Long Beach, California; Broadwater Energy in Long Island Sound, New York; Gulf LNG Energy and Bayou Casotte in the Port of Pascagoula, Mississippi; Northern Star LNG in Bradwood, Clatsop County, Oregon; Quoddy Bay in Pleasant Point, Maine, and Downeast in Robbinston, Maine. We considered whether any of the existing, authorized, or currently proposed LNG import terminal projects in the U.S. could be reasonable system alternatives to the Calhoun LNG Project. To be considered a viable system alternative, the existing, approved, or proposed Project would need to provide similar LNG ship unloading, storage, and sendout capacities to Calhoun Point Comfort's proposal, in addition to that terminal's current or planned expansion capacities. Also, the facilities would need to be in a location with access to both Texas intrastate natural gas pipelines and to interstate natural gas markets.

TABLE 3.2.1-1

**Approved Onshore LNG Facilities in the United States**

| Operator | Project | Location | Commission Authorization Date |
|---|---|---|---|
| Sempra Energy/Cameron LNG L.L.C. | Cameron LNG Terminal Project | Cameron Parish, LA | September 11, 2003 |
| Freeport LNG Development, L.P. | Freeport LNG Project | Brazoria County, TX | June 18, 2004 |
| Cheniere Energy | Sabine Pass LNG Project | Cameron Parish, LA | December 21, 2004 |
| Cheniere Energy | Cheniere Corpus Christi LNG Project | San Patricio County, TX | April 18, 2005 |
| ExxonMobil Corporation | Vista del Sol LNG Project | San Patricio County, TX | June 20, 2005 |
| ExxonMobil Corporation | Golden Pass LNG Project | Jefferson County, TX | July 6, 2005 |
| Weaver's Cove Energy, L.L.C/ Hess LNG | Weaver's Cove LNG Project | Bristol County, MA | July 15, 2005 |
| Occidental Ventures Corporation | Ingleside Energy Center LNG Project | San Patricio County, TX | July 22, 2005 |
| Crown Landing LNG - BP | Crown Landing LNG Project | Logan Township, NJ | June 15, 2006 |
| Port Arthur LNG, L.P. | Port Arthur LNG Project | Jefferson County, TX | June 15, 2006 |
| Creole Trail LNG, L.P. | Creole Trail LNG Project | Cameron Parish, LA | June 15, 2006 |

The Distrigas LNG terminal in Massachusetts, the Cove Point LNG terminal in Maryland, the Southern LNG terminal in Georgia, the Weaver's Cove LNG terminal in Massachusetts, and the Crown Landing LNG terminal in New Jersey are not reasonable alternatives to the proposed Calhoun LNG Project. None of these facilities have the existing available capacity or the physical space to add the capacity necessary to receive the additional storage and delivery volumes proposed by Calhoun Point Comfort. In addition, all of these facilities are on the East Coast and were built mainly to serve the local markets (southeast, mid-Atlantic, and New England). Transportation of natural gas from these LNG import terminals to Texas would require either major construction of new pipeline facilities or restructuring of existing infrastructure. Therefore, we will do no further analysis of these four LNG terminals as system alternatives to the Calhoun LNG Project.

Table 3.2.1-2 identifies the existing and approved onshore LNG terminals along the Texas and Louisiana coast that we analyzed further.

In addition to these existing, approved, or proposed LNG projects, one other planned project has been announced for the Gulf Coast Region. In late September 2004, it was announced that the Port of Galveston approved a 3-year option on a 35-year lease agreement with British Petroleum Energy to develop the Bay Crossing Project. The project would consist of an LNG terminal on about 185 acres of land and water at Pelican Island, Texas, about 5 miles from the center of Galveston. It would have a sendout capacity of 1.2 bcfd. Because of the limited information available on this LNG terminal project, it has not been included in our analysis.

TABLE 3.2.1-2

**Existing and Approved Onshore LNG Facilities Along the Texas and Louisiana Coast**

| Operator | Project | Location | Capacity (bcfd) |
|---|---|---|---|
| Southern Union - Trunkline LNG Company, L.L.C. | Trunkline LNG Terminal Project | Calcasieu Parish, LA | 1.1 |
| Sempra Energy/Cameron LNG L.L.C. | Cameron LNG Terminal Project | Cameron Parish, LA | 1.5 |
| Freeport LNG Development, L.P. | Freeport LNG Project | Brazoria County, TX | 1.5 |
| Cheniere Energy | Sabine Pass LNG Project | Cameron Parish, LA | 2.6 |
| ExxonMobil Corporation | Golden Pass LNG Project | Jefferson County, TX | 1.0 |
| Port Arthur LNG, L.P. | Port Arthur LNG Project | Jefferson County, TX | 1.5 to 3.0 |
| Creole Trail LNG, L.P. | Creole Trail LNG Project | Cameron Parish, LA | 3.3 |
| Cheniere Energy | Cheniere Corpus Christi LNG Project | San Patricio County, TX | 2.6 |
| ExxonMobil Corporation | Vista del Sol LNG Project | San Patricio County, TX | 1.0 |
| Occidental Ventures Corporation | Ingleside Energy Center LNG Project | San Patricio County, TX | 1.0 |

### 3.2.1.1 Existing Onshore LNG Terminals

*Trunkline LNG Terminal Project*

Currently, the largest operational LNG terminal import facility in the U.S. is located in Calcasieu Parish, Louisiana, owned by Southern Union and operated by Trunkline LNG. The Commission approved expansions of the Lake Charles Terminal on December 18, 2002, and March 18, 2003. These expansions were amended again and that amendment was approved by the Commission on October 27, 2003. The expansion project, as amended, includes adding a second berth, a new 880,000-barrel LNG storage tank (in addition to the three existing 600,000-barrel storage tanks), three additional first-stage pumps, four additional second-stage pumps, three additional vaporizers, and appurtenant facilities. Expansion of these facilities would increase the sustainable sendout capacity to about 1.1 bcfd and would increase LNG ship volume from 62 ships per year to about 175 ships per year. In February 2004, applications were filed to further amend the expansion project to increase sendout capacity. This would involve adding additional vaporizers and pumps, facilities to increase the capabilities to unload LNG vessels from the second dock, and a loop of the existing pipeline to increase the take-away capacity from the terminal.

Trunkline currently has signed agreements for the capacity that would be provided by the expanded facilities. After the expansion work is completed, the facility would not have adequate space within its 125-acre fenced site required to accommodate storage tanks and sendout facilities that would be required to add the capacity proposed by the Calhoun LNG Project. Further expansion outside of the existing fenceline is limited by other industrial facilities. In addition, Trunkline does not connect with the Texas intrastate market; therefore, we have eliminated this alternative from further consideration.

### 3.2.1.2 Approved Onshore LNG Terminals

*Cameron LNG Terminal Project*

The Cameron LNG terminal, to be located on the Calcasieu River (ship channel) near Hackberry, Louisiana, was authorized by the Commission on September 11, 2003 and will consist of a ship unloading slip with two LNG ship berths; three 1,006,000-barrel LNG storage tanks; nine first-stage pumps; 10 second-stage pumps; 12 SCVs; a BOG compressor and condensing system; a NGL recovery unit; ancillary facilities; and a 35.4-mile-long, 36-inch-diameter natural gas sendout pipeline. The marine terminal will have the capability of unloading up to 210 LNG ships per year. The proposed facilities will transport up to 1,500,000 dekatherms (dth) per day of imported natural gas.

The Cameron LNG terminal site location has been optimized to provide sufficient space for the proposed LNG terminal facilities while minimizing the filling of on-site wetlands. Consequently, there is not sufficient buildable area for the additional storage tanks and other related facilities that would be needed to increase the proposed throughput of the terminal to meet the additional capacity of the Calhoun LNG Project without similar or greater impacts on wetlands. The design of the Cameron 36-inch-diameter natural gas pipeline was also optimized to handle the output of the originally proposed terminal and does not have sufficient excess capacity to support additional volumes of gas. We anticipate that expansion of the proposed pipeline or looping would be required to add significant volumes equivalent to those proposed by the Calhoun LNG Project. Also, additional pipeline would need to be constructed to connect this facility to the mid Texas intrastate and interstate markets to meet the objectives of the proposed Project. Because of the additional environmental impacts that would result from expansion of the Cameron facility and from a new pipeline, we have eliminated this alternative from further consideration.

*Freeport LNG Project*

On June 18, 2004, the Commission authorized the Freeport LNG Project (CP03-75-000) as proposed by Freeport LNG Development L.P. The terminal is under construction at this time. The terminal will consist of a single LNG ship berth capable of unloading up to 200 ships per year, two LNG storage tanks, and 9.6 miles of 36-inch-diameter sendout pipeline with a nominal output of 1.5 bcfd. The LNG terminal will occupy about 120 acres of land within an approximate 188-acre site on Quintana Island near the City of Freeport, Brazoria County, Texas, about 80 miles northeast from Point Comfort. It will disturb about 69.4 acres of coastal marsh. The project is presently 100 percent committed. On May 26, 2005, Freeport LNG filed an application to expand the terminal by adding a second berth and another LNG tank, increasing the capacity by 2.5 bcfd. A portion of this additional capacity is already committed.

The Freeport LNG Project cannot be considered a viable system alternative to the Calhoun LNG Project. First, Freeport does not provide direct access to the interstate natural gas pipeline network. It was originally designed to only serve the Texas intrastate market, in the Freeport area. Second, all of Freeport's authorized capacity is subscribed through binding agreements with customers. Thus, Freeport, as authorized, could not handle the additional volumes proposed for the Calhoun LNG Project. At this time it is unknown if the Freeport LNG terminal would have excess capacity as a result of its proposed expansion. If sufficient excess capacity (1 bcfd)

is available, natural gas from Freeport could be transported through the intrastate system toward the Katy Hub where it may, in theory, be transported by inter/intrastate pipelines approximately 80 miles to the Point Comfort area. At this time it is unknown if any of the existing pipelines would have sufficient excess capacity to deliver the 1 bcfd of gas from the Freeport LNG terminal to Calhoun LNG's planned customers (Formosa Hydrocarbons Company and Formosa Plastics Corporation). This alternative is at best hypothetical. We do not have sufficient information to conduct an environmental analysis of this alternative. We also do not have sufficient information to determine if this alternative is even feasible. For these reasons, we cannot recommend this alternative.

*Sabine Pass LNG Project*

The Sabine Pass LNG Project (Docket Nos. CP04-47-000, CP04-38-000, CP04-39-000, and CP04-40-000) would be on the Louisiana side of the Sabine Pass Channel, opposite the Town of Sabine Pass, Texas. The project was authorized by the Commission on December 21, 2004 and is currently under construction. The terminal will be located to the east of Sabine Pass, Texas, on the eastern side of the Port Arthur Ship Canal in Cameron Parish, Louisiana. The project will consist of three LNG storage tanks, two marine berths capable of unloading up to 300 LNG ships per year, vaporization and processing facilities, and 16 miles of 48-inch-diameter sendout pipeline with a nominal output of 2.6 bcfd. The LNG terminal would occupy about 237 acres of land. The authorized Sabine Pass LNG Project is 100 percent committed. In addition, Cheniere has applied to expand the terminal's output by an addition 1.4 bcfd by adding three additional tanks. In order to meet its own output requirements, including the expansion, along with the additional output required by the Calhoun LNG Project, Sabine Pass would have to be expanded by adding at least one more berth and additional LNG storage tanks.

We do not consider the Sabine Pass LNG Project to be a viable system alternative to the Calhoun LNG Project. The capacity of the authorized Sabine Pass LNG Project is already committed to dedicated shippers through long-term agreements. An affiliate of ChevronTexaco, Global Gas, has a 20-year agreement for 700 MMcf/d of reserved regasification capacity, while Total LNG USA has a reservation for 1 bcfd for 20 years beginning April 2009. In addition, Total and Chevron have signed precedent agreements for the total initial capacity of the proposed Kinder Morgan Louisiana Pipeline. This pipeline would transport up to 3.2 bcfd of natural gas from the Sabine Pass LNG Terminal to existing interstate natural gas pipelines. Therefore, to provide the additional capacity required by the Calhoun LNG Project, Cheniere Energy would need to expand the proposed facilities at Sabine Pass and potentially construct a new pipeline. It is not clear if there is enough space at the Sabine Pass site for additional storage tanks and vaporization equipment to handle the additional capacity equal to the Calhoun LNG Project. Any expansion at this location may impact more wetlands. Also, it is not clear how natural gas arriving in Louisiana could be delivered to markets in mid Texas, which is one of the goals of the Calhoun LNG Project. Therefore, we have eliminated this alternative from further consideration.

*Golden Pass LNG Project*

The Golden Pass LNG Project (Docket Nos. CP04-386-000 and CP04-400-000), as proposed by Golden Pass LNG L.P. and Golden Pass Pipeline L.P. (affiliates of ExxonMobil Corporation), was authorized by the Commission on July 6, 2005. It will be constructed in two phases and consist of two ship berths, five LNG storage tanks, two 36-inch-diameter sendout pipelines (one

78 miles long and one 43 miles long), and a short (less than 5 miles) lateral. The first phase (three LNG storage tanks) will have a nominal output of 1.0 bcfd, increasing to 2.0 bcfd when all five storage tanks are in operation. One LNG tanker will visit the terminal every four days in the first phase, increasing to one tanker every two days in the second phase. The LNG terminal will be located on approximately 298 acres within a 477-acre site on the Port Arthur Ship Channel.

We do not consider the Golden Pass LNG Project to be a viable system alternative to the Calhoun LNG Project. It is unclear how gas from this terminal in eastern Texas could reach Calhoun Point Comfort's targeted intrastate market in the mid Texas area. The Port Arthur Ship Channel sites are probably large enough to accommodate the additional LNG tanks and could probably accommodate an additional berth and LNG ships. However, take-away capacity would need to be increased because the proposed pipelines are only designed for the proposed sendout volumes. For these reasons, we have eliminated this project alternative from further consideration.

*Port Arthur LNG Project*

The Port Arthur Project (Docket No. CP05-83-000), as proposed by Port Arthur LNG, L.P., was authorized by the Commission on June 15, 2006. It would consist of two LNG unloading ship berths and three LNG storage tanks with a nominal output of 1.5 bcfd for the first phase. Phase 2 would add an additional three storage tanks increasing the total output to 3.0 bcfd. The project would also involve construction of two sendout pipelines (one 3 miles long and one 70 miles long) to existing pipelines northeast and south of the terminal. The LNG terminal would be built on approximately 198-acre site on the Port Arthur Ship Channel, in Port Arthur, Jefferson County, Texas.

*Creole Trail LNG Project*

The Creole Trail Project (Docket Nos. CP05-357-000, CP05-358-000, CP05-359-000, CP05-360-000, CP05-357-001) as proposed by Creole Trail LNG, L.P. and Cheniere Creole Trail Pipeline Company (collectively, Creole Trail) was authorized by the Commission on June 15, 2006. It would consist of two marine berths, four LNG storage tanks, and a total of 123.6 miles of pipeline. The pipeline system includes: 25.3 miles of dual, parallel, and adjacent 42-inch-diameter pipeline; 91.5 miles of dual, parallel, and adjacent 42-inch-diameter pipeline; and 6.8 miles of 20-inch-diameter pipeline (Hackberry Lateral) that would extend across Cameron, Calcasieu, Beauregard, Allen, Jefferson Davis, and Acadia Parishes, Louisiana. The LNG terminal, designed to provide 3.3 bcfd of sendout capacity, would be located on a 1,463-tract of land in Cameron Parish, Louisiana, west of the Calcasieu Ship Channel and northwest of Monkey Island.

Niether the recently approved Port Arthur or Creole Trail LNG Projects could handle the additional volumes proposed by Calhoun Point Comfort without significant expansion at each of the proposed LNG terminals and along proposed pipeline right-of-ways without resulting in greater environmental impacts. In addition, it is unknown if any of the existing pipelines would have sufficient excess capacity to deliver the 1 bcfd of gas from these terminals to Calhoun LNG's planned customers (Formosa Hydrocarbons Company and Formosa Plastics Corporation). For these reasons, we have eliminated these projects from further consideration.

***Authorized LNG Terminals in the Corpus Christi, Texas Area***

*Cheniere Corpus Christi LNG Project*

The Cheniere Corpus Christi LNG Project (Docket Nos. CP04-37-000, CP04-44-000, and CP04-45-000), as proposed by Corpus Christi, LNG L.P. and Cheniere Corpus Christi Pipeline Company (subsidiaries of Cheniere Energy), was authorized by the Commission on April 18, 2005. It will consist of two ship docks, unloading facilities, three LNG storage tanks, and about 23 miles of 48-inch-diameter sendout pipeline with interconnections to eight existing interstate and intrastate pipelines. The marine terminal will be capable of receiving up to 300 LNG ships per year. The project will have an output of 2.6 bcfd and will be located next to the existing Sherwin Alumina Company plant on the northern shoreline of Corpus Christi Bay, east of Portland, Texas. The LNG terminal would occupy a 360-acre site.

*Vista del Sol LNG Project*

The Vista del Sol Project (Docket Nos. CP04-395-000 and CP04-405-000) as proposed by Vista del Sol LNG Terminal L.P. and Vista del Sol Pipeline L.P. (affiliates of ExxonMobil Corporation), was authorized by the Commission on June 20, 2005. The project will consist of two LNG ship berths, three LNG storage tanks, and about 25.3 miles of 36-inch-diameter sendout pipeline. The three LNG storage tanks will have a nominal output of 1.1 bcfd and a peak capacity of 1.4 bcfd. The marine terminal will be capable of receiving up to 100 LNG ships per year. The LNG terminal will be located within a 311-acre site between the communities of Ingleside and Gregory, Texas and adjacent to the Sherwin plant to the north and south, and the Occidental Chemical and DuPont facilities to the east. The terminal will be designed to accommodate further expansion that would include an additional berth and two more LNG tanks, but is not proposed at this time. The expanded facility will be capable of unloading up to 200 LNG ships with a nominal sendout capacity of 2.0 bcfd and peak capacity of 2.7 bcfd.

*Ingleside Energy Center LNG Project*

The Ingleside Energy Center LNG Project (Docket Nos. CP05-11-000, CP05-12-000, CP05-13-000, and CP05-14-000), was authorized by the Commission on July, 22, 2005. As proposed by Occidental Energy Ventures Corporation (Occidental), the project will consist of one ship berth, two LNG storage tanks, regasification facilities, and about 26 miles of 26-inch-diameter pipeline with interconnections to nine existing interstate and intrastate pipelines. The marine terminal will be capable of receiving up to 140 LNG ships per year. The project will have an output of 1 bcfd and will be located on an 82-acre site adjacent to Occidental's chemical manufacturing facility north of Ingleside, Texas. Occidental will integrate its LNG terminal with the adjacent Occidental Chemical manufacturing complex in order for the two facilities to offset the other's respective heating and cooling needs and it will provide an option for NGL.

We do not consider the Cheniere Corpus Christi, Vista del Sol, or Ingleside Energy Center LNG Projects to be a viable system alternative to the Calhoun LNG Project. These sites are likely too small to accommodate a second or third ship berth and an additional two LNG storage tanks. Further, an additional 120 ships per year may be difficult for the Port of Corpus Christi to accommodate. In addition, these projects would be located along the northeastern shoreline of Corpus Christi Bay, about 80 miles southwest from Point Comfort, Texas. It is unclear how the

terminals could meet the project objectives of providing additional, new supplies of imported natural gas to the existing interstate and intrastate natural gas pipelines interconnects near Edna, Texas and local industries near Point Comfort without resulting in greater environmental impacts at the LNG terminal sites and pipeline rights-of-way. For these reasons, we have eliminated Cheniere Corpus Christi, Vista del Sol, and Ingleside Energy Center LNG Projects alternatives from further consideration.

### 3.2.1.3 Proposed Onshore LNG Terminals

Of the proposed LNG import terminal projects currently being reviewed by the FERC, the Sound Energy Solutions in Long Beach, California; Broadwater Energy in Long Island Sound, New York; and Northern Star LNG in Bradwood, Clatsop County, Oregon are not reasonable alternatives to the proposed Calhoun LNG Project given their locations along the east and west coasts of the continental United States. Therefore, we have eliminated them from further analysis.

The two other proposed onshore LNG terminal projects along the shorelines of Texas, Mississippi, and Louisiana which are in closer proximity to markets targeted by Calhoun Point Comfort are summarized in table 3.2.1.3-1 and briefly described below.

TABLE 3.2.1.3-1

**Proposed Onshore LNG Facilities Under Review in Texas, Mississippi, and Louisiana**

| Operator | Project | Location | Capacity (bcfd) |
|---|---|---|---|
| Gulf LNG Energy, L.L.C. | LNG Clean Energy Project | Jackson County, MS | 1.0 |
| Bayou Casotte Energy, L.L.C. | Casotte Landing LNG Project | Jackson County, MS | 1.3 |

*LNG Clean Energy Project*

The LNG Clean Energy Project (Docket Nos. CP06-12-000 and CP06-13-000) as proposed by Gulf LNG Energy L.L.C. would be located at the Bayou Casotte location in the Port of Pascagoula in Jackson County, Mississippi. The terminal would consist of a single LNG ship berth able to accommodate about 115 LNG ships per year; two 160,000 $m^3$ LNG storage tanks with a sendout design of 1.0 bcfd of natural gas; and a 5-mile-long, 36-inch-diameter sendout pipeline. The site offers access to four existing interstate pipeline systems serving the Northeast, and three existing interstate pipeline systems serving the Southeast and Florida.

*Casotte Landing LNG Project*

The Casotte Landing LNG Project (Docket No. CP05-420) as proposed by Bayou Casotte Energy, L.L.C. (Bayou Casotte Energy) would include an LNG import terminal and sendout pipeline at the Bayou Casotte location in the Port of Pascagoula in Jackson County, Mississippi. The LNG terminal would consist of one LNG ship berth and three LNG storage tanks. The three LNG storage tanks would have a nominal output of 1.3 bcfd. The site offers access to four existing interstate pipeline systems serving the Northeast, and three existing interstate pipeline systems serving the Southeast and Florida.

Calhoun Point Comfort is proposing a facility that would have the ability to import and store up to 1.0 bcfd of LNG and deliver up to 1.0 bcfd of natural gas directly to Texas intrastate and interstate markets near Edna, Texas and local industries in Point Comfort, Texas. Niether of the proposed LNG facilities described above could handle the additional volumes proposed by Calhoun Point Comfort without significant expansion at each of the proposed LNG terminals and along proposed pipeline right-of-ways without resulting in greater environmental impacts. For these reasons, we have eliminated the two other proposed onshore LNG terminal projects along the shorelines of Texas, Mississippi, and Louisiana from further consideration.

#### 3.2.1.4 Conclusions on Onshore LNG Terminal System Alternatives

In each case, environmental impacts at an existing, approved, or proposed onshore LNG terminal alternative site, along the Texas, Mississippi, and Louisiana coast, would be similar to those at the proposed site, or greater. Therefore, we do not believe that any of these sites represent a viable system alternative or offer significant environmental advantages over construction of the Project as proposed and have eliminated all of them from further consideration. Because of their location, physical constraints, and lack of additional capacity, we do not believe that using existing, authorized, or proposed LNG import terminals is a reasonable alternative to the proposed action.

### 3.2.2 Existing, Approved, or Proposed Offshore LNG Terminals

There is only one existing offshore LNG facility in the U.S., the Energy Bridge Project. In addition, other companies have begun exploring methods of importing LNG into the U.S. through the use of deepwater ports that would avoid many of the perceived environmental and safety issues associated with onshore LNG facilities. As defined in the Deepwater Port Act of 1974, and as amended by the Maritime Transportation Security Act of 2002 to include natural gas, deepwater ports include a fixed or floating structure (other than a vessel) or a group of structures that are located off the coast of the U.S. and that are used as a port or terminal for the transportation, storage, and further handling of oil or natural gas. This legislation requires that the DOT (Maritime Administration) and the Coast Guard regulate the licensing, siting, construction, and operation of deepwater ports for natural gas.

Although only one offshore LNG import facility has been built in the U.S., offshore LNG terminals have been proposed and are under review in the U.S., Australia, West Africa, Taiwan, and Italy. Because of the demand for natural gas and the potential advantages of offshore unloading and vaporization facilities, two other offshore LNG import terminals in the U.S. have been approved and an additional eight are under review. The four main offshore technologies under development include:

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

- floating storage and regasification units (FSRU) where storage tanks, offloading, and vaporization facilities are placed on a floating structure (or ship) that is moored to the seafloor.

Our review of offshore LNG terminal facility locations included offshore LNG facilities existing, approved, or currently proposed and under review by the Coast Guard as listed in table 3.2.2-1. No FSRUs are currently planned for the Gulf of Mexico. These offshore technologies and projects are discussed in the following sections.

TABLE 3.2.2-1

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

| Operator | Project | Type of Facility | Capacity (bcfd) | Status |
|---|---|---|---|---|
| Excelerate Energy LLC (formerly El Paso Energy Bridge Gulf of Mexico LLC) | Energy Bridge GOM Project | Regasification vessel | 0.5 | a/ |
| Port Pelican LLC | Port Pelican Project | GBS | 1.6 to 2.0 | b/ |
| Gulf Landing LLC | Gulf Landing Project | GBS | 1.0 to 1.2 | b/ |
| TORP Technology Inc. & TORP Technology, AS | Bienvill Offshore Energy Terminal | Regasification vessel | 1.4 | c/ |
| Compass Port LLC | Compass Port Project | GBS | 1.0 | c/ |
| Freeport-McMoRan Energy LLC | Main Pass Energy Hub Project | Platform reuse | 2.5 to 3.1 | c/ |
| ConocoPhillips, Inc. | Beacon Port Clean Energy Terminal | GBS | 1.5 | c/ |

a/ Existing and in operation.
b/ Approved.
c/ NEPA review in process.

### 3.2.2.1 LNG Regasification Vessels

Several companies have proposed the installation of vaporization equipment on conventional LNG ships. These ships would be able to dock at a floating unloading buoy and riser system where LNG could be vaporized onboard the LNG ship and injected directly into offshore pipelines that interconnect with onshore natural gas transmission systems. The vaporization equipment located on the ships would use technology that is similar to land-based LNG terminals. The Energy Bridge GOM is the only existing project of this type and there are currently no other projects of this type planned for the Gulf of Mexico.

*Energy Bridge GOM Project*

In December 2002, El Paso Energy Bridge Gulf of Mexico, LLC submitted an application (Docket No. 14294) for a Deepwater Port License to the Coast Guard and the Administrator of the Maritime Administration to own, construct, and operate a deepwater port approximately 116 miles off the coast of Louisiana in the Gulf of Mexico (LNG Express, 2002a and 2003). The Coast Guard's Final EIS for the Energy Bridge GOM Project was issued in December 2003, and the final license was issued in April 2004. Excelerate Energy LLC acquired rights to the project in December 2003 and the project began operation in March 2005.

The Energy Bridge GOM system will utilize new specially-designed LNG tankers (El Paso Energy Bridge Regasification Vessels [EBRVs]), one of which is now operating, with onboard regasification equipment which directly inputs natural gas into the pipeline grid. Two more EBRVs are on order for this project. This system includes a submerged turret loading (STL) buoy, a flexible riser pipe to carry the natural gas from the STL buoy to a subsea manifold, a metering platform, and about 5.3 miles of undersea pipelines to connect to the existing Sea Robin and Bluewater offshore pipeline systems.

When an EBRV reaches the buoy port, it retrieves and connects to the STL buoy and the mooring system. When not in use, the STL buoy remains submerged about 80 feet below the sea surface in about 298 feet of water. The STL buoy is secured to the EBRV and functions as both the mooring system and the offloading mechanism for transferring the natural gas. After the connection procedures are completed, the LNG is vaporized using the onboard regasification equipment, and natural gas is transferred to the pipeline system through the STL buoy. The EBRV has transport capacity of about 138,000 $m^3$ of LNG. Under optimal operating conditions, the EBRV has the capability to regasify and unload a maximum of 0.69 bcfd of natural gas for an average natural gas delivery rate of about 0.5 bcfd.

One of the tradeoffs for the regasification vessel technology is that it requires a dedicated LNG fleet with vaporization equipment on all of the vessels. Because there is no storage component to the Energy Bridge GOM Project, a significant number of these specialized tankers would be required to avoid any disruption of service to accommodate the additional 1.0 bcfd of natural gas required to meet the objectives of the proposed Project. Because the Energy Bridge GOM Project is not able to meet Calhoun Point Comfort's project objective (*i.e.*, provide a competitive supply of natural gas to local industrial customers, such as Formosa Hydrocarbons Company and Formosa Plastics Corporation and other energy-consuming customers, in Texas and deliver natural gas into existing interstate and intrastate natural gas pipelines near Edna, Texas), we have eliminated this alternative from further consideration.

*Bienville Offshore Energy Terminal Project*

On Janaury 12, 2006, a limited partnership owned by TORP Technology Inc. & TORP Technology AS (TORP), submitted an application (Docket No. 24644) for a license under the Deepwater Port Act to the Coast Guard and the Administrator of the Maritime Administration to build, own and operate an LNG receiving terminal in the Gulf of Mexico. TORP's proposed Bienville Offshore Energy Terminal would be located 63 miles south of Dauphin Island, Alabama, in 425 ft of water, and would utilize the HiLoad Technology for offloading and re-gasifying of LNG offshore. Maximum sendout capacity for the terminal is projected at 1.2 bcfd, and the facility could accommodate LNG carriers up to the largest 250,000 $m^3$ vessels being planned. The terminal would be connected to the existing gas gathering system offshore.

#### 3.2.2.2 GBS

The use of a GBS would be limited to areas with suitable substrates and where water depths range from 55 to 85 feet. Safety zones surrounding these types of offshore LNG facilities would exclude certain ship traffic from operating in the vicinity and the GBS would need to be located outside of shipping lanes. Although designs would vary depending on site-specific

circumstances, offshore GBS facilities could be built to store between 290,000 and 400,000 $m^3$ of LNG with sendout capacities ranging between 0.8 and 2.8 bcfd.

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

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

*Port Pelican Project*

Port Pelican, LLC (an affiliate of the ChevronTexaco Corporation) received approval in November 2003 and a license in January 2004 from the U.S. Maritime Administration (Docket No. 14134) for its Port Pelican Project, an LNG unloading, storage, and vaporization terminal that would be located about 37 miles offshore from Vermillion Parish, Louisiana. A license was issued in January 2004.

As approved, the vaporized natural gas would be transported into the interstate natural gas pipeline system at Henry Hub by constructing a new 42.6-mile-long, 42-inch-diameter pipeline to the existing Tiger Shoal "A" platform, then using the existing pipeline infrastructure to Henry Hub. The Port Pelican Project would have the capability of vaporizing and transporting up to 2.0 bcfd of natural gas to U.S. markets.

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

In June 2004, the Coast Guard announced its intent to prepare an environmental assessment for the fabrication of the GBSs and consideration of two alternative onshore graving dock/fabrication sites. Port Pelican's preferred site, the McDermott site, would occupy 174 acres of land near Port Aransas, Texas, while the alternative site would occupy 67 acres on Pelican Island in Galveston, Texas. Because of the scope of this project, an EIS is now under preparation.

As approved, the Port Pelican Project would require two GBSs to provide unloading, storage, and vaporization facilities for 2.0 bcfd. An additional GBS would be required to accommodate the additional 1.0 bcfd proposed by Calhoun Point Comfort, affecting an additional 150 to

300 acres of shoreline for construction. In addition, while the existing infrastructure (as enhanced by the new 42.6-mile-long Port Pelican pipeline) can accommodate the output from the Port Pelican terminal, it would not be able to accommodate an additional 1.0 bcfd at that location. Overall, the environmental impact associated with construction of the GBSs on land, combined with construction of additional new offshore and onshore pipelines, likely would be equal to or greater than impacts associated with construction of the proposed Project.

*Gulf Landing Project*

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

The Gulf Landing Project would use two GBSs, each approximately 1,110 feet by 248 feet, for the offshore terminal that would be anchored to the sea bottom in about 55 feet of water. Each GBS would consist of a large concrete structure designed and fabricated to provide a secure foundation for the LNG tanks, and a supportive deck for accommodating all of the regasification equipment, utilities, and other related facilities (living quarters, metering, workshops, helicopter access, etc.). Berthing facilities (mooring and breasting dolphins and unloading platforms) would be able to accommodate up to 135 LNG ships per year, ranging in size from 125,000 $m^3$ to 165,000 $m^3$.

The GBSs would be initially built onshore, towed to the site, and installed on the seabed. Onshore graving dock/fabrication sites currently being considered by Gulf Landing are in the Corpus Christi Bay area and include the Welder, McDermott (Port Pelican's preferred site near Port Aransas), Gulf Marine, and Zachry sites. The Coast Guard issued a final EIS for the Gulf Landing Project on February 9, 2005. A final Record of Decision for approval was issued by the Maritimes Administration on February 16, 2005. The terms of the License are now under review.

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

*Compass Port Project*

In March 2004, Compass Port LLC (a wholly owned subsidiary of ConocoPhillips Company) filed an application (Docket No. 17659) with the Coast Guard for a Deepwater Port License for its Compass Port Project in the Gulf of Mexico. The project would consist of two GBSs, with docking facilities for one LNG ship, two LNG storage tanks and regasification facilities, located

in 70 feet of water, approximately 11 miles south of Dauphin Island and about 16 miles off the coast of Alabama. The project would also involve construction of approximately 27 miles of offshore and 5 miles of onshore[5] 36-inch-diameter sendout pipeline to connect the deepwater port with existing natural gas pipelines near Coden, Alabama. It would have the capability of vaporizing and transporting 1.0 bcfd of natural gas to U.S. markets. The application was determined to be complete in May 2004. The draft EIS was issued in February 2005, and meetings to take comments on the EIS were conducted in early March 2005.

The generalized dimensions of the entire terminal facility (including the GBSs; regasification, unloading, and living quarters platforms; mooring, berthing, and support structures; and flare tower) would be 1,350 feet by 1,000 feet (31 acres) and anchored in water depth of 70 feet. However, facility structures would occupy only about 6.2 acres. Construction of the two GBSs would require a total of about 139 acres of land for a graving dock/fabrication site. Compass Port's preferred GBS construction site would be at the Kiewitt Offshore Services (KOS) site near Ingleside, Texas. Construction of the project is expected to take about four years.

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

*Beacon Port Clean Energy Terminal*

On January 19, 2005, Beacon Port, LLC, a wholly owned company of ConocoPhillips, Inc., filed an application with the Coast Guard for a Deepwater Port License for its Beacon Port Clean Energy Terminal. The project would be located in the Gulf of Mexico off the Louisiana mainland, about 45 miles south of High Island and 50 miles east-southeast of Galveston, Texas. ConocoPhillips proposes to construct a new offshore LNG regasification facility to offload, store and regasify LNG and sendout natural gas through a system of pipelines for delivery to consumers in Louisiana and beyond. The facility would have a throughput capacity of 1.5 bcfd and would consist of two GBSs, one for the LNG storage tanks, regasification equipment, docking platforms and unloading/operational equipment, and a second to house the terminal's crew, related equipment, and non-operational facilities. ConocoPhillips would send the natural gas to the mainland through a 46-mile-long pipeline and a riser platform that would connect to existing pipelines about 29.0 miles south-southeast of Johnson's Bayou, Louisiana. Connections to the existing Michigan-Wisconsin, Tennessee Gas, and Underwater-Texas Offshore pipelines are proposed.

To accommodate the volumes proposed by Calhoun Point Comfort, the capacity of this project would need to be approximately doubled, resulting in a minimum of one to two more GBSs in

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

the Gulf of Mexico, and additional offshore and onshore pipelines. Environmental impacts would be similar to, if not greater than, those of the proposed Project.

### 3.2.2.3 Reuse of Existing Platforms

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

*Main Pass Energy Hub Project*

In February 2004, Freeport-McMoRan Energy LLC (a division of McMoRan Exploration Company) (Freeport-McMoRan) filed an application (Docket No. 17696) with the Coast Guard for a Deepwater Port License for its Main Pass Energy Hub, an LNG unloading, storage, and vaporization facility that would be located about 37 miles off the coast of Venice, Louisiana. The Main Pass Energy Hub Project would make use of existing platforms and other infrastructure in the Gulf of Mexico, including a nearby salt dome for underground storage of up to 28 bcf of natural gas and would have the capability of a peak deliverable volume of 3.1 bcfd of natural gas to U.S. markets. The existing offshore platform facility was constructed in 1992 and would be reconfigured to consist of an LNG berth, LNG surface storage of up to 145,000 $m^3$, vaporization and compression facilities, living quarters, and associated facilities. Approximately 192 miles of offshore pipeline and 5.1 miles[6] of onshore pipeline would be constructed to connect the terminal to the existing pipeline infrastructure. The Coast Guard has begun its environmental review of the project.

As proposed, the Main Pass Energy Hub Project would utilize an existing offshore platform and salt cavern to provide unloading, vaporization, and storage facilities for LNG shipments. This project could accommodate storage of the Calhoun Point Comfort's natural gas volumes (320,000 $m^3$), but it may be unable to accommodate the proposed number of LNG ships (up to 120 ships per year) without additional berths, and possibly additional platform construction, or the proposed sendout (1.0 bcfd) without construction of additional, or larger, take-away pipelines.

### 3.2.2.4 Offshore Site Alternatives

It is possible that an offshore LNG terminal with a EBRV, a FSRU, or a gravity-based design (similar to the Port Pelican or Gulf Landing projects) could provide an import service similar to the Calhoun LNG Project and that suitable sites could be located and developed offshore in the Gulf of Mexico. By constructing an LNG terminal offshore, some of the environmental impacts associated with the proposed Calhoun LNG Project may be avoided (*e.g.*, ship traffic in Lavaca Bay and the Point Comfort Channel). For an offshore site alternative, we considered the

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

technologies using a FSRU or a GBS. The regasification vessel (EBRV) would not provide LNG storage, which is provided by the LNG tanks in onshore projects, and therefore would not meet the storage requirement objective of the proposed Project. The EBRV, as well as the FSRU, would need to be located in deeper water to accommodate the STL buoy, thus significantly increasing the length of offshore sendout pipeline and associated environmental impacts. Reuse of existing platforms would involve identifying decommissioned production facilities and determining whether these facilities would be appropriate for conversion to import LNG, both of which are beyond the scope of this analysis. Therefore, our consideration of an offshore site alternative for the Project was limited to use of the GBS offshore technology since this technology can be applied in the shallower waters of the Gulf of Mexico.

In addition to considering the potential technical issues and environmental impacts associated with construction and operation of an offshore LNG storage and vaporization facility, we also considered the relative impacts associated with the need to construct an additional sendout pipeline from an offshore site to allow for market deliveries. We made several assumptions in estimating the length of pipeline that would be required, both on and offshore. First, in order to make deliveries to the energy market proposed by Calhoun Point Comfort, an offshore LNG terminal would require a 36-inch-diameter sendout pipeline that ultimately interconnects with the interstate and intrastate pipeline system southwest of Edna, Texas. Ideally, the cost and environmental impacts associated with construction of a sendout pipeline between an offshore terminal and the interstate and intrastate pipeline system would be avoided or reduced by connecting to and using existing offshore pipelines that have excess capacity available to carry gas from offshore waters to or near interconnect sites onshore in Texas.

Although it may be possible to construct an offshore LNG storage and vaporization facility as an alternative to the Calhoun LNG Project, it is not a reasonable alternative. Construction of an offshore alternative would require the construction of a graving dock, which would impact the shoreline, and a permanent onshore facility for terminal support activities and would involve a longer pipeline. In addition, the evaluation of an offshore facility as an alternative to the Calhoun LNG Project cannot merely transpose the onshore facility to an offshore location. Rather, it represents a complete redesign of the entire facility such that the feasibility of meeting the operational and economic objectives of the proposal is highly questionable. When considering the current level of information and operational experience as well as the level of impacts associated with offshore LNG facilities, we do not consider these facilities to be environmentally preferable and practicable alternatives to the Calhoun LNG Project.

#### 3.2.2.5 Discussion of Offshore Alternatives

There are both operational and environmental tradeoffs associated with offshore LNG terminal technology. Offshore LNG terminals need to be located in areas that are away from shipping fairways and operating oil or gas platforms. In addition, a safety zone would be established that would preclude commercial or recreational fishing within a range of between 1,640 and 3,280 feet of an offshore terminal. An offshore terminal must be self-contained, providing its own power, water, communications, and other utilities. This would translate to additional construction and operational costs associated with provision of these utilities; transportation by boat or helicopter of materials, supplies, and workers; and permanent onshore facilities for these terminal support activities. Although specific numbers are not available, preliminary estimates

indicate that the construction and operational costs for an offshore terminal are higher than a typical onshore facility. For a GBS, the tanks are an internal component of the GBS and form the foundation of the offshore structure. These structures, and consequently the tanks, would be designed to withstand the greater natural forces associated with the offshore location and terminal operation. As a result, the capital expenditures for the GBS would be about double the cost of the onshore Calhoun LNG Terminal. In addition, permanent staffing and personnel requirements for the proposed Calhoun LNG Terminal would be about one-fourth of that needed for an offshore facility.

An LNG import terminal that is located in an offshore setting would be exposed to the effects of meteorological and oceanographic forces such as high winds, waves, and currents. A key technical issue for the successful operation of an LNG terminal in this environment includes designing the LNG transfer system (*i.e.*, unloading arms) to compensate for the relative motion between the terminal and LNG ship during unloading operations. For a GBS, an artificial breakwater must be constructed to protect the docked LNG vessel as well as the terminal itself. This breakwater could be combined with the GBS, however, the GBS must then be much larger to withstand the physical forces of wind, waves, and water currents at the terminal location. This protective function is more easily and economically achieved in a protected harbor onshore.

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

In addition to considering the potential technical issues and environmental impacts associated with construction and operation of an offshore LNG storage and vaporization facility, we also considered the relative impacts associated with the need to construct an additional sendout pipeline from an offshore site to allow for market deliveries. Ideally, the costs and environmental impacts associated with constructing a sendout pipeline between an offshore terminal and the interstate pipeline system could be avoided or reduced by connecting to and using existing offshore pipelines that have excess capacity and could transport the gas from offshore waters to interconnection sites onshore in Texas. However, our analysis indicates that it is likely that no one pipeline system could accommodate all of the 1.0 bcfd proposed by Calhoun Point Comfort and that a new pipeline would need to be constructed to multiple interconnects. With the exception of the Energy Bridge GOM Project, which would only deliver up to 0.5 bcfd, the other proposed offshore projects would require new offshore pipeline.

#### 3.2.2.6 Conclusions on Offshore Technology

In summary, we conclude that, although offshore technologies provide an alternative means for the import of LNG, the proposed offshore technologies would not provide the same capability as the proposed Calhoun LNG Project and would likely result in a similar level of (although

different) environmental impacts. The proposed Project would provide berthing for LNG ships of up to 220,000 $m^3$, storage for approximately 320,000 $m^3$ of natural gas, a sendout capacity of 1.0 bcfd, and a 27.1-mile-long, 36-inch-diameter pipeline to connect to the existing natural gas infrastructure. In comparison:

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

## 3.3 ONSHORE LNG TERMINAL SITE ALTERNATIVES

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

### 3.3.1 U.S. Regional Review

To identify the most suitable region within the U.S. for an LNG terminal that would serve its market objectives, Calhoun Point Comfort considered regions where it could introduce a competitive supply of natural gas to local industrial customers, such as Formosa Hydrocarbons Company and Formosa Plastics Corporation, and deliver natural gas into the existing interstate and intrastate natural gas pipelines near Edna, Texas.

As a result, the east and west coasts, as well as certain Gulf coast states like Florida and Alabama were eliminated due to the lack of pipeline infrastructure capacity that could serve the Texas interstate and intrastate markets. Although Louisiana and Texas have the necessary existing pipeline infrastructure to handle the volumes of natural gas, Calhoun Point Comfort proposes to

import; regions other than Point Comfort would not fully meet Calhoun Point Comfort's project objectives, as described below.

### 3.3.2 Port Review

Calhoun Point Comfort considered the following screening criteria when selecting the location for its LNG terminal site: (1) availability of a petrochemical port; (2) isolated location; and (3) proximity to natural gas transmission systems and end users.

Utilizing an existing petrochemical port, such as the Port of Port Lavaca – Point Comfort, would allow Calhoun Point Comfort to integrate with existing and complimentary safety and security systems. Since the Port has a familiarity with the petrochemical industry, it would have a better understanding of LNG terminal requirements.

Avoiding populated areas would minimize land use conflicts and maximize project safety. Calhoun Point Comfort selected its LNG terminal site because of its industrialized nature and isolation from non-industrialized zones.

Access to the Texas interstate and intrastate natural gas markets and local end users is a critical consideration for the development and long-term viability of the Calhoun LNG Project. Port sites near existing natural gas pipelines would be more desirable than those located in areas without significant take-away capacity.

Our recent analysis of the Cheniere Corpus Christi LNG Project revealed that seven port sites in Texas and one in Louisiana had sufficient channel depth (more than 40 feet deep) and access (more than 180 feet wide) to accommodate LNG ships. Six of the eight port sites were zoned for industrial use and there were no significant route impediments for a sendout pipeline at any of the eight sites (FERC, 2005). Ships that are currently used to transport LNG have capacities that range from 125,000 $m^3$ to 140,000 $m^3$, and future ships may be sized to transport up to 250,000 $m^3$ of LNG. The larger ships range from 950 to over 1,000 feet long, with typical laden drafts of 38 to 40 feet. To ensure that the LNG ships do not easily or frequently run aground, an additional 2 feet of water is required under the keel. This means that LNG tankers require sea-going access and berthing facilities within waterbodies containing depths of a minimum of 40 feet. Although dredging in shallow water areas could provide access for LNG ships, the costs and environmental impacts of significant dredging requirements could be prohibitive.

Calhoun Point Comfort indicated that the class of LNG ships it proposes to use could navigate the existing authorized depth of the Matagorda Ship Channel and the Point Comfort Channel (36 feet) and width (between 200 and 300 feet). A key component of the Calhoun LNG Project is its ability to provide facilities necessary to import, store, and vaporize LNG and deliver natural gas into the existing interstate and intrastate natural gas pipelines near Edna, Texas while providing a competitive supply of natural gas to local industrial customers, such as Formosa Hydrocarbons Company and Formosa Plastics Corporation, and other energy-consuming customers in Texas. Because port locations other than Port of Port Lavaca – Point Comfort would not allow Calhoun Point Comfort to fully meet its project objectives, we eliminated them from further consideration.

### 3.3.3 Alternative Site Review

Based on the above analysis, the Port of Port Lavaca – Point Comfort met Calhoun Point Comfort's criteria of utilizing an existing petrochemical port with an isolated location for its LNG terminal and proximity to natural gas transmission systems and end users. The criteria that were used in the site selection process are outlined in table 3.3.3-1.

Since these criteria were critical components of siting the LNG terminal facility, Calhoun Point Comfort evaluated one alternative location for its terminal site along the north side of the CCND's existing Point Comfort Turning Basin, about 0.3 mile north of its proposed site. However, this alternative was eliminated from further consideration because of its limited size (less than 40 acres) and proximity to Alcoa's existing facilities.

Calhoun Point Comfort selected the site within the CCND's Port on the southeastern shoreline of Lavaca Bay, south of Point Comfort, Texas as its preferred project location. This site offered the following advantages:

- existing and non-congested petrochemical port with existing and complimentary safety and security systems and familiarity with the petrochemical industry;
- available isolated site within an existing industrial area large enough for the proposed facilities and exclusion zones; and
- proximity to natural gas transmission systems and nearby potential industrial customers.

TABLE 3.3.3-1

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

| Criteria | Description |
|---|---|
| **REQUIRED CRITERIA** | |
| U.S. Department of Transportation - LNG Federal Safety Standards (49 CFR 193) | Relevant DOT safety requirements pertain to thermal exclusion and vapor dispersion zones (49 CFR 193.2057 and 193.2059) that must be identified in accordance with NFPA 59A - Standard for the Production, Storage, and Handling of Liquefied Natural Gas (2001 edition). |
| Coast Guard – LNG Waterfront Handling Requirements (33 CFR 127) | Waterfront facilities where LNG is handled must comply with Coast Guard regulations pertaining to layout and spacing of the marine transfer area. These regulations require that each LNG loading flange be located at least 985 feet from general public or railway bridges crossing navigable waterways or entrances to any tunnel under navigable waterways (33 CFR 127.105). |
| **FAVORABLE CRITERIA** | |
| Petrochemical Port | Integration and utilization of an existing, non-congested petrochemical port with existing and complimentary safety and security systems and familiarity with the petrochemical industry. |
| Site in an Industrial Area | Areas previously disturbed or cleared of vegetation were preferable over undisturbed areas. Existing industrial areas were considered to offer an environmental advantage over previously undeveloped or agricultural areas. |
| Isolation from Population Centers/Residences | An effort was made to identify alternative LNG terminal sites in areas that are not in close proximity to population centers and/or residences. Favorable sites would ideally avoid perceived safety conflict issues related to transport and storage of LNG. |
| Distance to Intrastate and Interstate Pipeline Systems and End Users | Sites that were near existing pipeline systems near Edna, Texas and end users near Point Comfort, Texas area would be more favorable. |

### 3.3.4 Conclusions

Because development of an onshore LNG import terminal requires a shoreline site with ocean access, development of new sites having the appropriate characteristics would have a greater environmental impact than use of existing port sites. Therefore, our evaluation of site alternatives was confined to sites within existing ports or within previously disturbed areas (FERC, 2005). The proposed LNG terminal would be located on land that has been historically used for dredge material placement, best fulfills the technical and economic criteria required to meet the project objectives, and has received overwhelming support of the community and elected officials. Since the other viable alternative sites that would meet Calhoun Point Comfort's objectives are not available, we have concluded that there are no practical alternative sites offering a clear environmental advantage to the Calhoun LNG Project. We also note that, if the U.S. is going to use LNG to meet rising energy demand and replace declining domestic production of natural gas, multiple LNG import terminals will be required.

## 3.4 LNG VAPORIZATION ALTERNATIVES

Calhoun Point Comfort evaluated five alternative LNG vaporization technologies: SCVs, open rack vaporizers (ORVs), shell and tube vaporizers (STVs), intermediate fluid exchangers (IFEs), and ambient air vaporizers (AAVs). Vaporizers are used to convert LNG into gas.

SCVs are composed of stainless steel tubes that are submerged in a water bath containing a submerged combustion chamber. The combustion chamber burns a low-pressure natural gas and is supplied with air via an electric air blower. The heated exhaust from the combustion chamber is sent to the water bath containing the stainless steel tubes with the LNG flowing inside and transfers the heat needed to vaporize the LNG. Condensate water is produced from the combustion process. The primary advantages of the SCV technology are its compact size, high thermal efficiency, and ease of operation and maintenance. Releases of regulated air emissions that would be generated during the combustion process and potential discharges of condensate water if it is not reused are its primary disadvantages. This vaporization technology and process would be used by Calhoun Point Comfort.

ORVs are widely used where seawater is abundant and readily available. They are made of aluminum alloy and use seawater as a sole source of heat. Pumps are used to move the seawater from an overhead distributor over long-finned aluminum panels with the LNG flowing inside. Vaporization of the LNG is accomplished by transferring heat from the seawater to the LNG. As the seawater passes over the aluminum panels, it is cooled and collected in troughs at the bottom of the ORV before it is discharged back into the ocean. The primary advantages of ORV technology are its operational flexibility, ease of maintenance, stable heat transfer, and limited fuel consumption. The primary disadvantage of this technology would be the required use of large volumes of seawater for a maximum sendout of 1.0 bcfd. Calhoun Point Comfort rejected this vaporization technology from further consideration because of its use of seawater and potential impacts on marine organisms during seawater intake and on sessile organisms during the discharge of cooler seawater.

STVs are compact vaporizers with a high heat transfer coefficient. LNG would be vaporized by passing the LNG through a series of tubes that are surrounded by an external fluid. This external fluid could consist of seawater in a single-pass seawater system or an intermediate fluid

consisting of a water and glycol mix, propane, or ammonia in a closed loop system (see the discussion on IFEs below). In a single-pass seawater system, the seawater would be contained within the shell. The LNG would enter vaporizer tubes at a bottom channel cover, pass through an exchanger, and exit at a top channel cover. Seawater would enter through the side of the exchanger at an upper and lower inlet where it would be circulated over the tubes with the LNG flowing inside and warming it to a gaseous state where it would exit at the top of the shell. The primary advantage of the STV technology using a single-pass seawater system is the immediate and abundant supply of seawater. The primary disadvantages of this technology are fouling and maintenance of the shell and tube exchangers, frequent periods of downtime for maintenance, potential freezing of the shell and tubes, and impingement and entrainment of marine organisms. Calhoun Point Comfort rejected this vaporization technology from further consideration for these reasons.

During 2005, we analyzed a proposed LNG project that would use heated wastewater from a nearby manufacturing complex as a source of vaporization heat. In this case, the LNG would enter vaporizer tubes and an intermediate fluid would be circulated over the tubes with the LNG flowing inside and warming it to a gaseous state. As the heated wastewater circulates over the STVs it would be cooled by the LNG. Cooled water would then be returned to the nearby manufacturing complex for reuse. The primary advantages of the STV technology using heated wastewater from a nearby manufacturing complex are its conservation or avoidance of the release of regulated air emissions and conservation of water. There are no disadvantages with this vaporization technology if heated wastewater from a nearby manufacturing complex is used and each facility offsets the other's respective heating and cooling needs. Since Calhoun Point Comfort's LNG facility design would use the SCV vaporization technology and process described above, this vaporization technology was rejected from further consideration.

IFEs use forced draft ambient air heaters to indirectly warm the LNG. Ambient air would be forced through the top of a fin-fan heater and would vaporize an intermediate fluid such as propane, ammonia, or a water and glycol mix. IFEs have a high heat transfer coefficient and are designed to condense moisture from the air and work in a wet call mode. On cooler days, an auxiliary closed-loop glycol heater would provide additional heat, as required. The intermediate fluid vapor would be condensed and the LNG would be vaporized in a second heat exchanger. The condensed intermediate fluid would be collected in a surge tank and pumped back into the fin-fan heaters and revaporized. The primary advantage of the IEF technology is the use of ambient air in the heating process. The primary disadvantages with this vaporization technology are the noise generated from the fin-fan heating units, production and disposal of water, and air emissions for supplemental heating sources. In addition, this process has not been used at a commercial LNG vaporization facility. Calhoun Point Comfort rejected this vaporization technology from further consideration for these reasons.

AAVs take heat from the surrounding air and transfer it to vaporize LNG as it passes through an exchanger. The natural convection of air and subsequent heat transfer rate would be enhanced by the height of the exchanger. AAVs would be set up in trains and each train would be equipped with four vaporizers. The primary advantages of the AAV technology are the use of surrounding air in the heating process, little to no emissions during the warmer months, no noise generation from heating fans, and no use of intermediate fluids or secondary exchangers. The primary disadvantages with this vaporization technology are its sensitivity to changes in air

temperature, humidity, and wind speed; potential to create fog on warm days; production and disposal of water; and the need for a backup system during cooler months. Calhoun Point Comfort rejected this vaporization technology from further consideration for these reasons.

We conclude that, although alternative LNG vaporization technologies provide an alternative means for the vaporization of LNG, the ORV, STV, IFE, and AAV technologies could provide the same vaporization potential as the proposed Calhoun LNG Project but would likely result in a similar level of (although different) environmental impacts.

## 3.5 ALTERNATIVE DREDGED MATERIAL DISPOSAL AREAS

Construction of the Calhoun LNG Project would require dredging of approximately 4,200,000 cubic yards of material (3,500,000 and 700,000 cubic yards would be for the CCND's turning basin and Calhoun Point Comfort's LNG ship berth, respectively). As discussed in sections 2.2.1.1 and 2.4.1.2, CCND's preferred primary disposal area would be at five DMPAs within Lavaca Bay and Cox Bay, located between 0.6 and 1.9 miles of the LNG terminal site.

As part of Calhoun Point Comfort's DMMP (see appendix D), the CCND and Calhoun Point Comfort' five proposed DMPAs include: Dredge Island Expansion North, Dredge Island Expansion South, Dredge Island Marsh, Enhanced Recovery Project Area, and Central Cox Bay Marsh and Shoreline Protection Area (see figure 2.4-2). In total, the DMPAs have the capacity to accommodate the 4.2 mcy of material that would be dredged for the turning basin and the ship berth (table 2.4.1.2-1).

We believe that the five DMPAs within Lavaca Bay and Cox Bay are the best initial placement location for the dredge material, and maintenance material that would be generated from CCND's turning basin and Calhoun Point Comfort's ship berth.

## 3.6 PIPELINE AND ASSOCIATED ABOVEGROUND FACILITY LOCATION ALTERNATIVES

### 3.6.1 Pipeline System Alternatives

Our analysis of pipeline system alternatives includes examining the use of existing interstate pipeline systems to meet the objectives of the proposed Project. As discussed in section 1.0 of this EIS, the overall purpose of the Project is to provide facilities that would allow imported LNG to be vaporized and transferred to U.S. markets via the existing interstate and intrastate natural gas pipeline systems located southwest of Edna, Texas and introduce a competitive supply of natural gas to local industrial customers, such as Formosa Hydrocarbons Company and Formosa Plastics Corporation, and other energy-consuming customers in Texas. If proposed, an expansion of an existing interstate or intrastate pipeline to connect with the proposed LNG terminal would result in the construction of a pipeline similar to that proposed by Calhoun Point Comfort. The environmental impacts of an expanded interstate or intrastate pipeline would also be similar to the Point Comfort Pipeline. Therefore, a pipeline system alternative would provide no environmental advantage over the proposed Project, and we have conducted no further analysis of pipeline system alternatives.

### 3.6.2 Pipeline Route Alternatives and Route Variations

In evaluating pipeline alternatives, we reviewed both route alternatives and route variations. We examined route alternatives that could reduce or avoid impact on environmentally sensitive resources such as waterbodies or specific landowner concerns. Route variations differ from route alternatives in that they are identified to avoid or reduce construction impacts on specific, localized resources that may include wetlands, residences, or significant terrain conditions.

#### 3.6.2.1 Route Alternatives

We identified one pipeline route alternative (Point Comfort Residential Alternative) and evaluated two pipeline route alternatives proposed by Calhoun Point Comfort (Alcoa Tailing Ponds and Lavaca-Navidad River Alternatives) to determine if impacts associated with the proposed route could be avoided or reduced by following a different alignment. The Alcoa Tailing Ponds Alternative route was evaluated to avoid Alcoa's existing tailing ponds. The Point Comfort Residential Alternative route was evaluated to determine the benefits and drawbacks of locating the pipeline further east of a residential area while the Lavaca-Navidad River Alternatives route was evaluated to assess the differences between an east and west pipeline route along the Lavaca-Navidad River valley (see appendix C, figures C-6 and 7). In examining these route alternatives, we assumed the point of origin would be in the vicinity of the proposed pipeline. Also, the alternative routes must interconnect with the interstate and intrastate pipeline near Edna to provide delivery capacity and the flexibility required by Calhoun Point Comfort.

*Alcoa Tailing Ponds Alternative*

The Alcoa Tailing Ponds Alternative would deviate from the proposed route at about MP 0.0 and continue northeast and east for about 1.0 mile as it crosses an electric transmission right-of-way and parallels the southern boundary of an existing retention pond. It would turn in a northeast and northerly direction for about 1.3 miles. Within this stretch, it would cross a levee between two tailing ponds for about 0.3 mile and the Huisache Creek dam for about 0.7 mile. It would then continue in a northerly direction and cross about 1.7 miles of open land before turning in a southwesterly direction. From this point, the Alcoa Tailing Ponds Alternative would be south of and parallel to State Route 35 for about 2.0 miles crossing the Huisache Creek and other waterbodies. It would then continue south for about 0.4 mile along the east side of FM 1593 and rejoin the Point Comfort Pipeline at about MP 1.8, near MP 0.0 of the Formosa Lateral. Table 3.6.2.1-1 compares significant environmental factors of the proposed route with the Alcoa Tailing Ponds Alternative.

The Alcoa Tailing Ponds Alternative would be 4.3 miles longer than the corresponding segment of the proposed route. It would be adjacent to existing rights-of-way for 25 percent of its length, whereas the corresponding segment of the proposed route would be adjacent to existing rights-of-way for 90 percent of its length. The primary disadvantage of this alternative is that it would affect 52.8 acres more land, 5.8 acres more wetlands and five more waterbodies. Although five more residences would be within 0.1 mile of the corresponding segment of the proposed route, impacts on these residences would be minimized by Calhoun Point Comfort's proposed use of a HDD. In addition, this alternative would cross a levee between two tailing ponds and the Huisache Creek dam. We believe that the Alcoa Tailing Ponds Alternative does not offer an

environmental advantage over the corresponding segment of the proposed route, and therefore, we do not recommend use of this alternative.

TABLE 3.6.2.1-1

**Environmental Comparison of Calhoun Point Comfort's Preferred Pipeline Route with the Alcoa Tailing Ponds Alternative**

| Environmental Factor | Proposed Route | Alcoa Tailing Pond Alternative |
|---|---|---|
| Total Length (miles) | 2.1 | 6.4 |
| Length Adjacent to Existing Rights-of-Way (miles) | 1.9 | 1.7 |
| Construction Disturbance (acreage) a/ | 24.8 | 77.6 |
| NWI Wetlands Crossed (acreage) b/ | 0 | 5.8 |
| Waterbodies Crossed (number) | 0 | 5 |
| Road Crossings (number) | 3 | 3 |
| Residences within 0.1 mile of Construction Work Area (number) | 5 | 0 |

a/ Based on nominal right-of-way width of 100 feet.
b/ Based on nominal right-of-way width of 75 feet.

*Point Comfort Residential Alternative*

The Point Comfort Residential Alternative would deviate from the proposed route at about MP 2.3. It would continue in a north direction for about 0.4 mile following existing right-of-way along the east side of FM 1593. It would then continue in a westerly direction and cross FM 1593 before it rejoins the corresponding segment of the proposed route at about MP 2.7. Table 3.6.2.1-2 compares significant environmental factors of the proposed route with the Point Comfort Residential Alternative.

TABLE 3.6.2.1-2

**Environmental Comparison of Calhoun Point Comfort's Preferred Pipeline Route with the Point Comfort Residential Alternative**

| Environmental Factor | Proposed Route | Point Comfort Residential Alternative |
|---|---|---|
| Total Length (miles) | 0.4 | 0.4 |
| Length Adjacent to Existing Rights-of-Way (miles) | 0.4 | 0.1 |
| Construction Disturbance (acreage) a/ | 4.8 | 4.8 |
| NWI Wetlands Crossed (acreage) b/ | 0 | 0 |
| Waterbodies Crossed (number) | 0 | 0 |
| Road Crossings (number) | 1 | 3 |
| Residences within 0.1 mile of Construction Work Area (number) | 87 | 48 |

a/ Based on nominal right-of-way width of 100 feet.
b/ Based on nominal right-of-way width of 75 feet.

The Point Comfort Residential Alternative would be the same length and affect as much land during construction than the corresponding segment of the proposed route. It would be adjacent to existing rights-of-way for 25 percent of its length whereas the corresponding segment of the proposed route would be adjacent to existing rights-of-way for it entire length. The primary advantage of this alternative is that 39 fewer residences would be within 0.1 mile of the

construction work area than the corresponding segment of the proposed route. The primary disadvantage of this alternative is that it would cross FM 1593 and State Route 35 twice using a conventional bore and be within an area congested with industrial pipelines and local utilities. A greater amount of temporary workspace would be required at the bore locations. Although more residences would be near the corresponding segment of the proposed route, Calhoun Point Comfort would install its pipeline using the HDD method and use an existing 50-foot-wide pipeline easement abandoned by Teppco Pipeline. This easement is located between two existing easements along a congested pipeline corridor. Since Calhoun Point Comfort would minimize impacts on residences near its pipeline route with its use of the HDD method, we believe that the Point Comfort Residential Alternative does not offer an environmental advantage over the corresponding segment of the proposed route, and therefore, we do not recommend use of this alternative.

*Lavaca-Navidad River Alternative*

The Lavaca-Navidad River Alternative would deviate from the proposed route at about MP 12.3 and continue in a northwesterly direction for about 1.0 mile and then turn west-southwest for about 3.5 miles. At this point, it would turn northwest for about 10.1 miles before it rejoins the corresponding segment of the proposed route at about MP 26.1. It would cross the Lavaca River on the north side of FM 616, just below its confluence with the Navidad River. It would remain west of the Lavaca-Navidad River system and follow FM 616 and FM 234 through cultivated fields. Thirty-two residential structures would be within 0.1 mile of the construction right-of-way and it would pass by many oil/gas well heads, pumps, and tanks. Table 3.6.2.1-3 compares significant environmental factors of the proposed route with the Lavaca-Navidad River Alternative.

TABLE 3.6.2.1-3

**Environmental Comparison of Calhoun Point Comfort's Preferred Pipeline Route with the Lavaca-Navidad River Alternative**

| Environmental Factor | Proposed Route | Lavaca-Navidad River Alternative |
|---|---|---|
| Total Length (miles) | 13.8 | 14.6 |
| Length Adjacent to Existing Rights-of-Way (miles) | 13.5 | 6.0 |
| Construction Disturbance (acreage) a/ | 167.3 | 176.9 |
| NWI Wetlands Crossed (acreage) b/ | 0.1 | 3.8 |
| Waterbodies Crossed (number) | 6 | 9 |
| Road Crossings (number) | 31 | 19 |
| Residences within 0.1 mile of Construction Work Area (number) | 21 | 32 |

a/ Based on nominal right-of-way width of 100 feet.
b/ Based on nominal right-of-way width of 75 feet.

The Lavaca-Navidad River Alternative would be 0.8 mile longer than the corresponding segment of the proposed route. It would be adjacent to existing rights-of-way for 41 percent of its length, whereas the corresponding segment of the proposed route would be adjacent to existing rights-of-way for 98 percent of its length. The primary disadvantage of this alternative is that it would affect 9.6 acres more land, 3.7 acres more wetlands and three more waterbodies. Eleven more residences would be within 0.1 mile of the Lavaca-Navidad River Alternative than the

corresponding segment of the proposed route. Calhoun Point Comfort indicated that a 2.0-mile-long HDD would be required to cross the Lavaca River and its associated floodplain wetlands north of FM 616. To reach the HDD entry and exit points, a barge canal would be dredged or an access road would be constructed through the floodplain wetlands. We believe that the Lavaca-Navidad River Alternative does not offer an environmental advantage over the corresponding segment of the proposed route, and therefore, we do not recommend use of this alternative.

### 3.6.2.2 Route Variations

During the development of the pipeline route, Calhoun Point Comfort evaluated five minor route variations to minimize potential impacts to specific localized resources such as wetlands and terrain conditions. These route variations are evaluated below in comparison to the corresponding segment of the proposed route and summarized in tables 3.6.2.2-1 through 3.6.2.2-5 and are shown in appendix C, figures C-6 and C7.

*Route Variation A*

Route Variation A was evaluated to determine the benefits and drawbacks of paralleling Formosa Plastics Corporation's existing pipeline corridor. Route Variation A would deviate from the proposed route at about MP 0.0 and continue in a northerly direction for about 0.9 mile paralleling the east side of FM 1593. At this point, it would cross FM 1593 and tie into Formosa Hydrocarbons Company facility and rejoin the corresponding segment of the preferred route near MP 0.9. Table 3.6.2.2-1 compares significant environmental factors of the proposed route with Route Variation A.

TABLE 3.6.2.2-1

**Environmental Comparison of Calhoun Point Comfort's Preferred Pipeline Route with Route Variation A**

| Environmental Factor | Proposed Route | Route Variation A |
|---|---|---|
| Total Length (miles) | 0.9 | 1.0 |
| Length Adjacent to Existing Rights-of-Way (miles) | 0.9 | 1.0 |
| Construction Disturbance (acreage) a/ | 10.9 | 12.1 |
| NWI Wetlands Crossed (acreage) b/ | 0 | c/ |
| Waterbodies Crossed (number) | 6 | 6 |
| Road Crossings (number) | 0 | 1 |
| Residences within 100 feet of Construction Work Area (number) | 0 | 0 |

a/ Based on nominal right-of-way width of 100 feet.
b/ Based on nominal right-of-way width of 75 feet.
c/ Calhoun Point Comfort indicated that wetlands occur along the route variation alignment.

Route Variation A would be 0.1 mile longer than the corresponding segment of the proposed route and similar to the corresponding segment of the proposed route, would be adjacent to existing rights-of-way for its entire length. The primary disadvantage of this variation is that it would affect 1.2 acres more land and cross one additional roadway. In addition, Calhoun Point Comfort indicated that wetlands do occur along the Route Variation A alignment. Because Route Variation A would affect more land, wetlands, and cross FM 1593, we believe that it does not offer an environmental advantage over the corresponding segment of the proposed route, and therefore, we do not recommend use of this variation.

*Route Variation B*

Route Variation B was evaluated to avoid a parcel of land owned by the Port that is scheduled for development. It would deviate from the proposed route at about MP 0.1 and continue in a northerly direction for about 0.8 mile where it would rejoin the proposed route near MP 0.9. Route Variation B would be west of and parallel to FM 1593 for its entire length. It would cross through similar land uses to that crossed by the proposed route. Table 3.6.2.2-2 compares significant environmental factors of the proposed route with Route Variation B.

TABLE 3.6.2.2-2

**Environmental Comparison of Calhoun Point Comfort's Preferred Pipeline Route with Route Variation B**

| Environmental Factor | Proposed Route | Route Variation B |
|---|---|---|
| Total Length (miles) | 0.8 | 0.8 |
| Length Adjacent to Existing Rights-of-Way (miles) | 0.8 | 0.8 |
| Construction Disturbance (acreage) a/ | 9.6 | 9.6 |
| Waterbodies Crossed (number) | 6 | 6 |
| NWI Wetlands Crossed (acreage) b/ | 0 | 0 |
| Road Crossings (number) | 0 | 0 |
| Residences within 100 feet of Construction Work Area (number) | 0 | 0 |

a/ Based on nominal right-of-way width of 100 feet.
b/ Based on nominal right-of-way width of 75 feet.

Route Variation B would be the same length as the corresponding segment of the proposed route and affect the same amount of land. From the LNG terminal site, the alignment of this route variation to the Point Comfort Pipeline would cross land owned by the Port; however, the Port plan to develop this stretch of land. Since Route Variation B does not offer an environmental advantage over the corresponding segment of the proposed route and would not interfere with existing plans by the Port to develop land in the vicinity of the route variation, we do not recommend its use.

*Route Variation C*

Route Variation C was evaluated to assess the differences between crossing two, large diameter water lines and paralleling these lines, and avoiding a communication tower. Route Variation C would deviate from the proposed route at about MP 11.4 and continue in a northerly direction for about 0.4 mile. It would turn west for about 0.1 mile to the southeast corner of the KM-Tejas interconnect, rejoining the corresponding segment of the preferred route at MP 12.0. Route Variation C would parallel existing roadway and utility rights-of-way for its entire length and would cross through similar land uses to that crossed by the proposed route. Table 3.6.2.2-3 compares significant environmental factors of the proposed route with Route Variation C.

Route Variation C would be 0.1 mile longer than the corresponding segment of the proposed route and would be adjacent to existing rights-of-way for its entire length the corresponding segment of the preferred route would not parallel existing right-of-way. The primary disadvantage of this route variation is that it would affect 1.3 acres more and cross two shallow large diameter water lines owned by the Lower Colorado River Authority. In addition, it could potentially affect a communication tower. Because of these potential impacts, we believe that

Route Variation C does not offer an environmental advantage over the corresponding segment of the proposed route, and therefore, we do not recommend use of this variation

TABLE 3.6.2.2-3

**Environmental Comparison of Calhoun Point Comfort's Preferred Pipeline Route with Route Variation C**

| Environmental Factor | Proposed Route | Route Variation C |
|---|---|---|
| Total Length (miles) | 0.4 | 0.5 |
| Length Adjacent to Existing Rights-of-Way (miles) | 0.0 | 0.5 |
| Construction Disturbance (acreage) a/ | 4.8 | 6.1 |
| Waterbodies Crossed (number) | 0 | 0 |
| NWI Wetlands Crossed (acreage) b/ | 0 | 0 |
| Road Crossings (number) | 1 | 1 |
| Residences within 100 feet of Construction Work Area (number) | 0 | 0 |

a/ Based on nominal right-of-way width of 100 feet.
b/ Based on nominal right-of-way width of 75 feet.

*Route Variation D*

Route Variation D was evaluated to assess wetland crossing impacts associated with the crossing the Navidad River. It would deviate from the proposed route at about MP 12.3 and continue in a northwesterly direction for about 3.5 miles before it rejoins the proposed route at MP 15.9. Route Variation D would parallel Valero's existing pipeline right-of-way from the Valero interconnect to a point just east of the Navidad River. It would cross about 2.3 miles of estuarine and palustrine floodplain wetlands that consist of emergent, shrub-scrub, and forested wetland cover types. Table 3.6.2.2-4 compares significant environmental factors of the proposed route with Route Variation D.

TABLE 3.6.2.2-4

**Environmental Comparison of Calhoun Point Comfort's Preferred Pipeline Route with Route Variation D**

| Environmental Factor | Proposed Route | Route Variation D |
|---|---|---|
| Total Length (miles) | 3.6 | 3.5 |
| Length Adjacent to Existing Rights-of-Way (miles) | 2.9 | 3.5 |
| Construction Disturbance (acreage) a/ | 43.6 | 42.4 |
| Waterbodies Crossed (number) | 12 | 5 |
| NWI Wetlands Crossed (acreage) b/ | 2.4 c/ | 2.6 |
| Road Crossings (number) | 2 | 2 |
| Residences within 100 feet of Construction Work Area (number) | 0 | 0 |

a/ Based on nominal right-of-way width of 100 feet.
b/ Based on nominal right-of-way width of 75 feet.
c/ Based on field delineations along the proposed route.

Route Variation D would be 0.1 mile shorter than the corresponding segment of the proposed route and it would be adjacent to existing rights-of-way for its entire length. The corresponding segment of the preferred route would parallel existing right-of-way for 80 percent of its length. The primary disadvantage of this variation is that it would affect 0.2 acres more wetland. The

majority of wetlands that would be impacted along Route Variation D occur within the Navidad River floodplain system and are composed of estuarine and palustrine marshes. Although the corresponding segment of the preferred route would affect about the same amount of wetlands, they occur between MP 12. 3 and MP 12.8 and consist primarily of palustrine scrub-shrub and emergent wetlands. The Navidad River floodplain wetlands would not be affected by the corresponding segment of the proposed route. Because of the potential impacts to the Navidad River floodplain wetlands, we believe that Route Variation D does not offer an environmental advantage over the corresponding segment of the proposed route, and therefore, we do not recommend its use

*Route Variation E*

Route Variation E was evaluated to determine the benefits and drawbacks of paralleling an existing pipeline corridor through a forested wetland. It would deviate from the proposed route at about MP 22.3 and continue in a northwesterly direction for about 0.4 mile before it rejoins the proposed route at about MP 22.7. Route Variation E would parallel the Valero and CrossTex existing pipeline right-of-way through a forested wetland. Table 3.6.2.2-5 compares significant environmental factors of the proposed route with Route Variation E.

TABLE 3.6.2.2-5

**Environmental Comparison of Calhoun Point Comfort's Preferred Pipeline Route with Route Variation E**

| Environmental Factor | Proposed Route | Route Variation E |
|---|---|---|
| Total Length (miles) | 0.5 | 0.4 |
| Length Adjacent to Existing Rights-of-Way (miles) | 0 | 0.4 |
| Construction Disturbance (acreage) a/ | 6.1 | 4.8 |
| Waterbodies Crossed (number) | 0 | 0 |
| NWI Wetlands Crossed (acreage) b/ | 0.2 c/ | 2.4 |
| Road Crossings (number) | 0 | 0 |
| Residences within 100 feet of Construction Work Area (number) | 0 | 0 |

a/ Based on nominal right-of-way width of 100 feet.
b/ Based on nominal right-of-way width of 75 feet.
c/ Based on field delineations along the proposed route.

Route Variation E would be 0.1 mile shorter the corresponding segment of the proposed route and affect 1.3 acre less land. It would be adjacent to existing rights-of-way for its entire length. The corresponding segment of the preferred route would not parallel existing right-of-way. The primary disadvantage of Route Variation E is that it would affect 2.4 acres of palustrine forested wetland. The corresponding segment of the proposed route would affect 0.2 acre of primarily palustrine emergent marsh wetlands. Because of the amount of construction and operation al impacts to forested wetlands, we believe that Route Variation E does not offer an environmental advantage over the corresponding segment of the proposed route, and therefore, we do not recommend its use.

### 3.6.3 Aboveground Facility Site Alternatives

Calhoun Point Comfort proposes to construct ten delivery points/interconnects including two delivery points with Formosa Hydrocarbons Company and Formosa Plastics Corporation and eight interconnect points for nine pipeline companies (two of which would be collocated) as part of the proposed Project. Our review of the revised proposed sites raised no issues (*i.e.*, proximity to residences, impacts to wetlands) that warrant the identification of alternative sites. Therefore, we have not conducted further alternatives analysis of other potential sites for aboveground facilities associated with the proposed pipeline.