3.0 ALTERNATIVES

We have evaluated a number of alternatives to the Ingleside Energy Center LNG Project to determine if any would be reasonable and environmentally preferable to the proposed action. Alternatives discussed below include the no action or postponed action alternative, LNG terminal system and site alternatives, offshore review, LNG facility design review, dredge material disposal site alternatives, and pipeline system and route alternatives.

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

- are technically and economically feasible and practical;
- offer significant environmental advantage over the proposed Project or segments of it; and
- meet the project objectives of providing facilities necessary to import, store, and vaporize LNG and deliver natural gas into the existing interstate and intrastate natural gas pipelines north of Sinton, Texas while introducing a competitive supply of natural gas to Ingleside San Patricio affiliates (Occidental Chemical and ICLP) and other large energy-consuming industries in the Corpus Christi area.

With respect to the first criteria, it is important to recognize that not all conceivable alternatives are technically and economically practical and feasible. Some alternatives may be impracticable because 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 at all. However, if the Commission selects the no action alternative, the objectives of the proposed Project would not be met and Ingleside San Patricio 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 Ingleside San Patricio'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 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. Ingleside San Patricio 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.

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 Ingleside Energy Center LNG Project could be avoided or reduced by using another system. Our analysis of system alternatives considers using existing, recently 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 Ingleside Energy Center LNG Project.

3.2.1 Existing, Recently Approved, or Proposed Onshore LNG Terminals

As discussed previously (see section 1.1.2), 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 recently approved four new LNG import terminal projects in the continental United States. On September 11, 2003, the FERC authorized an LNG import terminal located near Hackberry, Louisiana, to be constructed and operated by Sempra Energy (Cameron, formerly Hackberry LNG). On June 18, 2004, the FERC authorized an LNG import terminal located in Brazoria County, Texas, to be developed by Cheniere/Freeport LNG Development, L.P. (which is partly owned by Cheniere Energy). On December 21, 2004, the Commission authorized the Sabine Pass LNG Project, located in Cameron Parish, Louisiana, proposed by subsidiaries of Cheniere Energy. On April 13, 2005, the Commission authorized the Cheniere Corpus Christi LNG Project, located near Portland, Texas, proposed by subsidiaries of Cheniere Energy. These projects are scheduled to be in operation during the same timeframe as the Ingleside Energy Center LNG Project.

In addition, there are thirteen other proposed LNG import terminal projects located in the continental U.S. that are currently being analyzed by the FERC staff. These include Weaver's Cove in Fall River, Massachusetts; Keyspan in Providence, Rhode Island; Crown Landing in New Jersey; Sound Energy Solutions in Long Beach, California; Golden Pass in Sabine, Texas; Sempra near Port Arthur, Texas; Vista del Sol near Portland, Texas; Broadwater, proposed by TransCanada and Shell in Long Island Sound, New York; Gulf LNG Energy and Bayou Casotte Energy in the Port of Pascagoula, Mississippi, Creole Trail in Cameron Parish, Louisiana; Calhoun LNG in Port of Port Lavaca-Point Comfort, Texas; and Northern Star LNG in Bradwood, Clatsop County, Oregon. Weaver's Cove, Keyspan, Sound Energy Solutions, Crown Landing, Vista del Sol, Golden Pass, Sempra, and Calhoun are filed applications before the FERC. Broadwater, Gulf LNG Energy, Bayou Casotte Energy, Creole Trail, and Northern Star

are pre-filing proposals.[7] We considered whether any of the existing, recently authorized, or currently proposed LNG import terminal projects in the U.S. could be reasonable system alternatives to the Ingleside Energy Center 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 Ingleside San Patricio'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.

The Distrigas LNG terminal in Massachusetts, the Cove Point LNG terminal in Maryland, and the Southern LNG terminal in Georgia are not reasonable alternatives to the proposed Ingleside Energy Center 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 Ingleside San Patricio. 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 three LNG terminals as system alternatives to the Ingleside Energy Center LNG Project.

Table 3.2.1-1 identifies the existing and recently approved onshore LNG terminals along the Texas and Louisiana coast that we analyzed further.

TABLE 3.2.1-1

Existing and Recently Approved Onshore LNG Facilities along the Texas and Louisiana Coast

Operator	Project	County, State	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
Cheniere Energy /Freeport LNG Development, L.P.	Freeport LNG Project	Brazoria, TX	1.5
Cheniere Energy	Sabine Pass LNG Project	Cameron Parish, LA	2.6
Cheniere Energy	Cheniere Corpus Christi LNG Project	San Patricio, TX	2.6

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 an expansion of the Trunkline LNG terminal on December 18, 2002. The expansion project, as amended, includes adding a second berth, a new 880,000-barrel LNG storage tank

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

(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.

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 Ingleside Energy Center 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 Recently Approved Onshore LNG Terminals

Cameron LNG Terminal Project

The Cameron LNG terminal, to be located on the Calcasieu River (ship channel) near Hackberry, Louisiana, would consist of a ship unloading slip with two LNG ship berths; three 1,006,000-barrel LNG storage tanks; nine first stage pumps; 10 second stage pumps; 12 submerged combustion vaporizers (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 would have the capability of unloading up to 210 LNG ships per year. The proposed facilities would transport up to 1,500,000 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 Ingleside Energy Center 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 Ingleside Energy Center LNG Project. Also, additional pipeline would need to be constructed to connect this facility to the south 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 Terminal Project

The Freeport LNG import terminal (CP03-75-000) would be located on Quintana Island, outside of the City of Freeport, Texas, about 188 miles northeast from Corpus Christi. The project would consist of a single LNG ship berth and unloading dock; two transfer lines and a vapor return line; two LNG storage tanks with a combined volume of 2,012,000 barrels; six in-tank

pumps; seven booster pumps; three BOG compressors and a gas condensing system; six vaporizers; and an associated 9.6-mile-long, 36-inch-diameter natural gas pipeline with a nominal output of 1.5 bcfd. The Freeport LNG terminal would occupy about 120 acres.

The Freeport LNG terminal project cannot be considered a viable system alternative to the Ingleside Energy Center LNG Project. First, Freeport does not provide access to the interstate natural gas pipeline network. It is designed to only serve the Texas intrastate market. Second, all of Freeport's capacity is subscribed through binding agreements with customers. Thus, Freeport could not handle the additional volumes proposed for the Ingleside Energy Center LNG Project. In its response to the COE's comments on the draft EIS for this project (see appendix H), Ingleside San Patricio noted that the COE indicated that Freeport LNG has filed a request with the Commission for authorization to increase the diameter of its send-out pipeline from 36- to 42- inches to facilitate future expansion of its LNG terminal facilities. We are currently not reviewing any proposed expansion at the Freeport LNG terminal. Should the Freeport LNG terminal have additional capacity in the future, being located about 188 miles northeast of the Corpus Christi area, it is unclear how this terminal could meet the Project objectives of providing new supplies of imported natural gas to the U.S. interstate pipeline market and introduce a competitive supply of natural gas to Ingleside San Patricio's affiliates and other large energy-consuming industries in the Corpus Christi area. This would result in greater environmental impacts at the Freeport LNG Terminal site and a pipeline right-of-way that would extend from the Freeport LNG terminal to Sinton, Texas. In addition, it would defeat Ingleside San Patricio's objective to use land owned by Occidental Chemical and combine its facilities with the Occidental Chemical manufacturing complex, to offset each others respective heating and cooling needs. For these reasons, we have eliminated this alternative from further consideration.

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 would 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 42-inch-diameter sendout pipeline with a nominal output of 2.6 bcfd. The LNG terminal would occupy about 237 acres of land.

We do not consider the Sabine Pass LNG Project to be a viable system alternative to the Ingleside Energy LNG Project. The majority of the capacity of the 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. Therefore, to provide the additional capacity required by the Ingleside Energy Center LNG Project, Cheniere Energy would need to expand the proposed facilities at Sabine Pass. 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 Ingleside Energy Center LNG Terminal 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 south Texas, which is one of the goals of the Ingleside Energy Center LNG Project. Therefore, we have eliminated this alternative from further consideration.

Cheniere Corpus Christi LNG Project

The recently authorized 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), would 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 would be capable of receiving up to 300 LNG ships per year. The project would have an output of 2.6 bcfd and would 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. See section 3.2.1.4 for our conclusion on the Cheniere Corpus Christi LNG terminal alternative.

3.2.1.3 Proposed Onshore LNG Terminals

Of the proposed LNG import terminal projects currently being reviewed by the FERC, the Weaver's Cove and Keyspan terminals in Massachusetts and Rhode Island, Crown Landing in New Jersey, Broadwater in New York, Sound Energy Solutions in California, and Northern Star in Oregon are not reasonable alternatives to the proposed Ingleside Energy Center 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 seven other proposed onshore LNG terminal projects along the shorelines of Mississippi, Louisiana, and Texas which are in closer proximity to markets targeted by Ingleside San Patricio 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 Mississippi, Texas, and Louisiana

Operator	Project	County, State	Capacity (bcfd)
Golden Pass LNG L.P.	Golden Pass LNG Project	Jefferson, TX	1.0 to 2.0
Sempra Energy LNG	Port Arthur LNG Project	Jefferson, TX	1.5 to 3.0
Gulf LNG Energy, L.L.C.	LNG Clean Energy Project	Jackson, MS	1.0
Bayou Casotte Energy, L.L.C	Casotte Landing LNG Project	Jackson, MS	1.3
Creole Trail LNG, L.P. and Cheniere Creole Trail Pipeline Company	Creole Trail LNG Project	Cameron Parish, LA	3.3
Calhoun LNG, L.P.	Calhoun LNG Project	Calhoun, TX	1.0
Vista del Sol LNG Terminal L.P.	Vista del Sol LNG Project	San Patricio, TX	1.0 to 1.4

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), would 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) would have a nominal output of 1.0 bcfd, increasing to 2.0 bcfd when all five storage tanks are in operation. One LNG tanker would visit the terminal every four days in the first phase, increasing to one tanker every two days in the second phase. The LNG terminal would be located on approximately 298 acres within a 477-acre site on the Port Arthur Ship Channel.

Port Arthur LNG Project

The Port Arthur Project (Docket No. CP05-83-000), as proposed by Sempra Energy LNG, would consist of two LNG unloading ship berths and three LNG storage tanks with a nominal output of 1.5 bcfd for the first phase and 3.0 bcfd after the second phase. The project would also involve construction of two sendout pipelines (one 3 miles long and one 70 miles long) to interconnections with several existing pipelines northeast and south of the terminal. The LNG terminal would be built on approximately 250 acres within a 3,000-acre site on the Port Arthur Ship Channel, in Port Arthur, Jefferson County, Texas.

LNG Clean Energy Project

On December 16, 2004, the FERC accepted the Gulf LNG Energy L.L.C. proposal for its pre-filing process in Docket No. PF05-5-000. Gulf LNG Energy proposes to construct its LNG import terminal 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

On March 2, 2005, the FERC accepted the Bayou Casotte Energy, L.L.C. (Bayou Casotte Energy) proposal for its pre-filing process in Docket No. PF05-9-000. Bayou Casotte Energy proposes to construct 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.

Creole Trail LNG Project

On March 18, 2005, the FERC accepted the Creole Trail LNG, L.P. and Cheniere Creole Trail Pipeline Company (collectively, Creole Trail) proposal for its pre-filing process in Docket No. PF05-8-000. Creole Trail proposes to construct its LNG import terminal in Cameron Parish, Louisiana, about 3.0 miles inland of the Gulf of Mexico, west of the Calcasieu Ship Channel, and northwest of Monkey Island. The proposed project would consist of two LNG ship berths, four LNG storage tanks, and two parallel and adjacent 42-inch-diameter sendout pipelines that would originate at the LNG terminal site and extend approximately 118 miles. The initial processing capacity of the LNG terminal would be 3.3 bcfd.

Calhoun LNG Project

The Calhoun LNG Project (Docket No. CP05-91-000) as proposed by Calhoun LNG, L.P. (Calhoun LNG) and Point Comfort Pipeline, L.P. would consist of a single marine berth, two LNG storage tanks, a NGL Recovery System, and 12 miles of 30-inch-diameter sendout pipeline in Port of Port Lavaca-Point Comfort. The Calhoun LNG Terminal would be designed for an installed gas sendout capacity of 1.0 bcfd. The marine terminal would be capable of receiving up to 120 LNG ships per year. The LNG terminal would be located on about 89 acres of land owned by the Port of Port Lavaca-Point Comfort and created from area dredged material.

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), would consist of two LNG ship berths, three LNG storage tanks, and about 25.3 miles of 36-inch-diameter sendout pipeline. The three LNG storage tanks would have a nominal output of 1.1 bcfd and a peak capacity of 1.4 bcfd. The marine terminal would be capable of receiving up to 100 LNG ships per year. The LNG terminal would be located within a 311-acre site between the communities of Ingleside and Gregory, San Patricio County, Texas and adjacent to the Sherwin plant to the north and south, and the Occidental Chemical and DuPont facilities to the east. The terminal would 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 would 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. The final EIS was published in April 2005.

3.2.1.4 Conclusions on Onshore LNG Terminal System Alternatives

Ingleside San Patricio 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. None of the other existing, recently approved, or proposed LNG facilities could handle the additional volumes proposed by Ingleside San Patricio without significant expansion and the associated environmental impact.

We considered Golden Pass in Sabine, Texas; Sempra near Port Arthur, Texas; Gulf LNG Energy and Bayou Casotte Energy in the Port of Pascagoula, Mississippi; Creole Trail in Cameron Parish, Louisiana; and Calhoun LNG in Port of Port Lavaca-Point Comfort, Texas as system alternatives but it is unclear if these LNG terminal locations would easily allow natural gas to reach the markets Ingleside San Patricio has targeted in the Corpus Christi, 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, takeaway capacity would need to be increased because the proposed pipelines are only designed for the proposed sendout volumes. For these reasons, we have eliminated these alternatives from further consideration.

We considered combining the proposed Ingleside Energy Center terminal facilities with the other proposed locations for LNG terminals along the northeastern shoreline of Corpus Christi Bay, at either Cheniere Corpus Christi or Vista del Sol's LNG terminal sites. It is unclear if there is

enough space for additional facilities at the proposed Vista del Sol LNG terminal, which is adjacent to the existing DuPont and Occidental Chemical plants. There may be enough space for additional facilities at Cheniere's Corpus Christi LNG terminal. However, moving the location of the Ingleside Energy Center's proposed LNG facilities to the area west of the Sherwin Alumina Company plant would defeat Ingleside San Patricio's stated purpose of combining its facilities with the Occidental Chemical manufacturing complex, to offset each others respective heating and cooling needs. As described above, the proximity of the Occidental Chemical manufacturing complex would allow for Ingleside San Patricio's use of heated wastewater from Occidental Chemical's and/or ICLP cooling water system as a source of vaporization heat for the LNG. Water that would be cooled during the vaporization process would be returned to these facilities for reuse. This process would conserve or avoid the release of about 300 tons of regulated air emissions per year and conserve about two million gallons of water per day. Also, Ingleside San Patricio would use land owned by Occidental Chemical to operate its LNG facility.

In each case, environmental impacts at an alternative site would be similar to those at the proposed site. Therefore, we do not believe that any of these sites represent a viable system alternative or offer significant environmental advantages over construction of the 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

To avoid many of the environmental issues and safety concerns associated with locating an LNG facility onshore, many companies have considered locating LNG import terminals at ports located offshore. As defined in the Deepwater Port Act of 1974 (as amended by the Maritime Transportation Security Act of 2002 to include natural gas facilities), 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.

Currently, there is one existing offshore LNG terminal, and several proposed or planned offshore LNG import terminals in the United States (FERC, June 2004). The four main offshore technologies under development include:

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

Our review of 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	2.0	b/
Gulf Landing LLC	Gulf Landing Project	GBS	1.0 to 1.2	b/
Compass Port LLC	Compass Port Project	GBS	1.0	c/
Pearl Crossing LNG LLC	Pearl Crossing Port Project	GBS	2.0 to 2.8	c/
Freeport-McMoRan Energy LLC	Main Pass Energy Hub Project	Platform reuse	3.1	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 deliver the volumes of natural gas as proposed by Ingleside San Patricio and because it does not serve the south Texas markets, we have eliminated this alternative from further consideration.

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 two proposed projects that would use the GBS technology in the Gulf of Mexico.

Port Pelican Project

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

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 (see section 4.13), while the alternative site would occupy 67 acres on Pelican Island in Galveston, Texas.

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 Ingleside San Patricio, 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 (see section 4.13).

The Coast Guard issued a final EIS for the Gulf Landing Project in December 2004.

For this project to accommodate the volumes proposed by Ingleside San Patricio, 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 April 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[8] 36-inch-diameter sendout pipeline to connect the deepwater port with existing natural gas pipelines near Coden, Alabama.

The generalized dimensions of the entire terminal facility (including the GBSs; regasification, unloading, and living quarters platforms; mooring, berthing, and support structures; and flare tower) would be 1,350 feet by 1,000 feet (31 acres) and anchored in water depth of 70 feet. However, facility structures would occupy only about 6.2 acres.

Construction of the two GBSs would require 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 (see section 4.13). Construction of the project is expected to take about four years. In February 2005, the Coast Guard produced a draft EIS for the Compass Port Deepwater LNG project.

To accommodate the volumes proposed by Ingleside San Patricio, 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

[8] 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.

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.

Pearl Crossing Port Project

In May 2004, Pearl Crossing LNG LLC (an affiliate of ExxonMobil) filed an application (Docket No. 18474) with the Coast Guard for a Deepwater Port License for its Pearl Crossing Port Project that would be located in the Gulf of Mexico, approximately 41 miles southeast of Johnsons Bayou, Cameron Parish, Louisiana. The GBS would be about 590 feet long and 295 feet wide, occupying an area of approximately 12 acres. The terminal would be designed with two LNG storage tanks, two ship berths, and vaporization equipment to provide for an average sendout rate of 1.4 bcfd and a peak sendout rate of approximately 2.8 bcfd. Two parallel 42-inch-diameter offshore pipelines would extend about 53 miles from the offshore terminal to the high water mark south of Johnsons Bayou. From there, the two onshore pipelines would extend about 1.1 miles north to Johnsons Bayou to a metering and distribution station for delivery to several interstate and intrastate pipelines near the station. An additional 64 miles of 42-inch-diameter pipeline would continue north to interconnections with up to ten interstate and intrastate existing pipelines. The pipeline would end near Starks, Calcasieu Parish, Louisiana. [9]

As with the above GBSs, Pearl Crossing's GBS would be initially built onshore, towed to the site, and installed on the seabed. The onshore graving dock/fabrication site under consideration for this project would be at KOS site near Ingleside, Texas (see section 4.13).

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

3.2.2.3 Reuse of Existing Platforms

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

Main Pass Energy Hub Project

In February 2004, Freeport-McMoRan Energy LLC (a division of McMoRan Exploration Company) (Freeport-McMoRan) filed an application (Docket No. 17696) with the Coast Guard

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

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[10] 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 Ingleside San Patricio natural gas volumes (320,000 m^3), but it may be unable to accommodate the proposed number of LNG ships (up to 140 ships per year) without additional berths, and possibly additional platform construction, or the proposed sendout (1.0 bcfd) without construction of additional, or larger, takeaway 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 Ingleside Energy Center 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 Ingleside Energy Center LNG Project may be avoided (*e.g.*, permanent fill of coastal wetlands, ship traffic in La Quinta Channel). For an offshore site alternative, we considered the technologies using a FSRU or a GBS. The regasification vessel (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 Ingleside San Patricio, an offshore LNG

[10] 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.

terminal would require a 26-inch-diameter sendout pipeline that ultimately interconnects with the intrastate and interstate pipeline system north of Sinton, Texas. Ideally, the cost and environmental impacts associated with construction of a sendout pipeline between an offshore terminal and the intrastate and interstate pipeline system would be avoided or reduced by connecting to and using existing offshore pipelines that have excess capacity available to carry gas from offshore waters to or near interconnect sites onshore in Texas.

While it may be possible to construct an offshore LNG storage and vaporization facility as an alternative to the Ingleside Energy Center 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 Ingleside Energy Center 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 Ingleside Energy Center 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 Ingleside Energy Center LNG Terminal. In addition, permanent staffing and personnel requirements for the proposed Ingleside Energy Center 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 Ingleside San Patricio 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 Ingleside Energy Center LNG Project and would likely result in a similar level of (although different) environmental impacts. The proposed Project would provide berthing for LNG ships of up to 250,000 m^3, storage for approximately 320,000 m^3 of natural gas, a sendout capacity of 1.0 bcfd, and a 26.4-mile-long 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 a LNG import terminal involved a comprehensive process that considered environmental, engineering, economic, safety, and regulatory factors. The first step was to identify the most suitable region within the U.S. for a LNG terminal based on the stated purpose of the proposed Project. The second step was the identification of specific ports within the selected region that could accommodate LNG ship traffic. The third step was the evaluation of suitable sites meeting Project objectives.

3.3.1 U.S. Regional Review

To identify the most suitable region within the U.S. for a LNG terminal that would serve its market objectives, Ingleside San Patricio considered regions where it could introduce a competitive supply of natural gas to its affiliates, and other large energy-consuming industries in the Corpus Christi area, and deliver natural gas into the existing interstate and intrastate natural gas pipelines north of Sinton, 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 Ingleside San Patricio proposes to import; regions other than Corpus Christi would not fully meet Ingleside San Patricio's project objectives, as described below.

3.3.2 Port Review

Ingleside San Patricio considered the following screening criteria when selecting the location for its LNG terminal site: (1) availability of isolated tracts of brownfield sites and zoning that would support industrial development, (2) proximity to deep water channels, (3) proximity to natural gas transmission systems and end users, and (4) availability of a convenient heat source and shared infrastructure.

Avoiding populated areas would minimize land use conflicts and maximize Project safety. Ingleside San Patricio selected its LNG terminal site because of its industrialized nature and isolation from non-industrialized zones.

Ships that are currently used to transport LNG have capacities that range from 75,000 to 138,000 m^3, and future ships may be sized to transport up to 165,000 m^3. A typical LNG carrier

is in the range of 950 feet long by 145 feet wide, and requires an air draft (space between the water and an overhead stationary object that the ship would be required to pass under such as a bridge) larger than 180 feet. The larger LNG ships have typical loaded draft of 38 feet. To ensure that the LNG ships do not run aground an additional 2 feet of draft is required under the keel. This means importing LNG requires sea-going access and berthing facilities within waterbodies containing depths of a minimum of 40 feet.

Access to the Texas interstate and intrastate natural gas markets is a critical consideration for the development and long-term viability of the Ingleside Energy Center 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, including Corpus Christi, and one in Louisiana had sufficient channel depth (more than 40 feet deep) and access (more than 80 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, 2004). A critical component of the Ingleside Energy Center LNG Project is its integration with the Occidental Chemical manufacturing complex in order for the two facilities to offset the other's respective heating and cooling needs. Because port locations other than Corpus Christi would not allow Ingleside San Patricio to fully meet its project objectives, or to integrate with Occidental Chemical (and ICLP), we eliminated them from further consideration.

3.3.3 Alternative Site Review

Based on the above analysis, the port at Corpus Christi met Ingleside San Patricio's criteria of having land that was zoned for industrial use, along a deepwater channel with access for LNG ships, nearby existing interstate and intrastate pipelines with adequate take-away capacity, and access to other end users in the Corpus Christi area. Since a critical component of siting the LNG terminal facility included that it be in proximity to the Occidental Chemical manufacturing complex, Ingleside San Patricio evaluated three alternative locations for its terminal site along the northeast shoreline of Corpus Christi Bay in the vicinity of this complex. These sites include properties owned by DuPont, Sherwin Alumina, and Welder. The criteria used by Ingleside San Patricio in its site selection process is outlined in table 3.3.3-1.

The DuPont and Sherwin Alumina properties were rejected from further consideration because they are not available for use by Ingleside San Patricio. The Sherwin Alumina site has been obtained by Cheniere for its Corpus Christi LNG terminal project and the DuPont site has been obtained by Vista del Sol for its LNG terminal project. In addition, the Sherwin Alumina site is about 3.0 miles northwest of the proposed site and would not allow for an uncomplicated and cost efficient integration with the Occidental Chemical manufacturing complex. We have conducted separate environmental reviews of the Vista del Sol and Cheniere Corpus Christi projects. The Welder property was rejected because it is a heavily vegetated greenfield site that would result in greater impacts on biological resources such as vegetation and habitat. In addition, the site is not owned by Occidental Chemical and would not allow for a cost efficient integration with its manufacturing complex. In addition to these alternative sites, a comment we received from Johnny D. French (see appendix H) suggested the KOS site as an alternative. Ingleside San Patricio stated in its response to the draft EIS that placing the proposed Ingleside

Energy Center facilities on KOS property would preclude KOS from using approximately 100 acres of its 400 acre site. This would potentially affect KOS's ability to receive, build, and launch offshore platforms or other facilities unrelated to the GBS.

Ingleside San Patricio selected the site adjacent to the Occidental Chemical manufacturing complex on the northeast shoreline of Corpus Christi Bay, west of Ingleside, Texas as its preferred Project location. This site offered the following advantages:

- property owned by Occidental Chemical and adjacent to its manufacturing complex;
- available isolated brownfield site within an existing industrial area large enough for the proposed facilities and exclusion zones;
- proximity to a deep water channel;
- proximity to natural gas transmission systems and nearby potential industrial customers; and
- availability of a convenient heat source and shared existing infrastructure with Occidental Chemical.

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	
On property owned by Occidental Chemical and located adjacent to its manufacturing complex	To integrate with the Occidental Chemical manufacturing complex, and ICLP, to offset respective heating and cooling needs, share infrastructure, and provide a competitive supply of natural gas.
Brownfield 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.
Channel Access	Areas requiring minimal dredging to develop and maintain an unloading berth and a shipping channel of sufficient depth for the LNG ships were considered more favorable than those areas requiring more significant dredging.
Distance to Interstate and Intrastate Pipeline Systems and end users	Sites that were near existing pipeline systems and end users in the Corpus Christi area would be more favorable.
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.

3.4 LNG TERMINAL LAYOUT AND VAPORIZATION ALTERNATIVES

3.4.1 LNG Terminal Layout Alternatives

In evaluating LNG terminal site configurations, it is important to first recognize any environmental disadvantages associated with the proposed LNG terminal facilities as sited and configured. Ingleside San Patricio's LNG terminal design was developed to ensure that the facility layout would be within the property owned by Occidental Chemical, operationally compatible with the existing adjacent manufacturing facilities, fully accessible during operation and maintenance, and compatible with the existing ship traffic along the La Quinta Channel.

Ingleside San Patricio evaluated two LNG docking layouts that optimized dock design, minimized environmental impacts, and allowed for the safe operation of LNG ship maneuvering and docking. The first design layout positioned the LNG dock north of Occidental Chemical's existing loading dock along the La Quinta Channel. This LNG dock layout was rejected from further consideration because it would be parallel and closer to the ship channel and the LNG unloading lines would be longer in length and routed through the existing manufacturing complex.

The second design layout involves the relocation of Occidental Chemical's existing loading dock from its current location, west of the proposed LNG ship dock/berth area, to an area about 2,000 feet to the northwest. The existing loading dock, and associated facilities, would be removed and rebuilt in the same configuration and orientation to the La Quinta Channel as the existing dock. Once the existing loading dock is relocated, Ingleside San Patricio would construct the LNG ship dock within property owned by Occidental Chemical, east of the former loading dock location and perpendicular to the La Quinta Channel. This layout would allow for uninterrupted use of the La Quinta Channel by other ships while the LNG ship is unloading. The LNG ship maneuvering area would be located in front (west) of the LNG docking area and centered on the La Quinta Channel. This dock layout has been incorporated into Ingleside San Patricio's proposed LNG terminal layout.

3.4.2 LNG Vaporization Alternatives

Ingleside San Patricio evaluated three alternative LNG vaporization technologies: open rack vaporizers (ORVs), SCVs, and STVs.

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 for a maximum sendout of 1.0 bcfd would be the required use of large volumes of seawater. Ingleside San Patricio 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.

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. Ingleside San Patricio rejected this vaporization technology from further consideration because it has a readily available source of heated wastewater from the Occidental Chemical manufacturing complex and would not need to generate a source of heat.

STVs are compact vaporizers with a high heat transfer coefficient. Heated wastewater would be used from Occidental Chemical's and/or ICLP's cooling water system as a source of vaporization heat. 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 be returned to the Occidental Chemical and/or ICLP facility for reuse. The primary advantages of the STV technology are its conservation or avoidance of the release of regulated air emissions (about 300 tons per year [tpy]) and conservation of water (about two million gallons per day). There are no disadvantages with this vaporization technology if heated wastewater from the manufacturing complex is used and each facility offsets the other's respective heating and cooling needs. This vaporization technology and process is a key component of the Ingleside Energy Center LNG Project.

3.5 ALTERNATIVE DREDGED MATERIAL DISPOSAL AREAS

Construction of the Ingleside Energy Center LNG Project would require dredging of approximately 3,084,700 cubic yards of material (1,365,300 and 1,719,400 cubic yards of material for the maneuvering area and LNG ship berth, respectively). An additional 550,300 cubic yards of material would be removed for the relocation of Occidental Chemical's existing loading dock (see section 2.10.1 of this EIS). As discussed in sections 2.2.1.1 and 2.4.1.2, Ingleside San Patricio's preferred primary disposal area would be on land owned by Alcoa, located about 3 miles northwest of the terminal site. Ingleside San Patricio has identified the PCCA's DMPA No. 13 as an alternative disposal area, about 800 feet west of the terminal site.

The Alcoa site consists of two bauxite storage beds and other designated placement areas. The bauxite storage beds have a capacity for 1.2 mcy of material, while the remainder of the site is capable of accommodating over 15 mcy of material. The placement of dredge material within the bauxite beds would complement a Texas Risk Reduction Program that was developed to complete closure of the Alcoa site. Representatives from Alcoa indicated that their facility has sufficient capacity to receive dredged material from the Ingleside Energy Center LNG Project as well as the proposed Cheniere Corpus Christi and Vista del Sol LNG terminal projects. See section 2.4.1.2 for further information on the Alcoa site as Ingleside San Patricio's proposed DMPA.

The PCCA's DMPA No. 13 is an active placement area in close proximity to the proposed LNG terminal site. It has sufficient capacity for the proposed Project; however, the use of DMPA No. 13 as placement areas for the proposed Project would reduce their overall capacity to accept dredged material from the maintenance of the Corpus Christi and La Quinta Channels. The PCCA confirmed that DMPA No. 13 has been used by other non-federal projects and is not solely dedicated for federal maintenance projects. The PCCA has also indicated there is potential to increase capacity at DMPA No. 13 by raising the containment levees if the need arises.

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 north of Sinton, Texas and introduce a competitive supply of natural gas to Ingleside San Patricio affiliates and other large energy-consuming industries in the Corpus Christi area. 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 Ingleside San Patricio. The environmental impacts of an expanded interstate or intrastate pipeline would also be similar to the San Patricio 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 population centers, special use areas, waterbodies, wetlands, existing or planned residences, 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 cultural resource sites, residences, or significant terrain conditions. Route variations were also considered to resolve landowner concerns.

As an alternative to the proposed San Patricio Pipeline route, we considered the collocation of this pipeline with the natural gas pipelines proposed as part of the Cheniere Corpus Christi and Vista del Sol LNG projects. These proposed pipelines would interconnect with interstate and intrastate pipelines similar to those proposed by Ingleside San Patricio. Each of the pipeline routes would cross San Patricio County in a northwesterly direction; however, collocation of these pipelines was not considered a practicable alternative because:

- each pipeline route would generally cross the same topography, land use, and habitat and not offer a clear environmental advantage over another;

- a majority of each pipeline route would be collocated with existing pipeline or utility corridors; and
- because construction of each pipeline could occur during the same timeframe, we believe that potential cumulative impacts to any single landowner (*e.g.*, construction related noise, dust, or traffic) would be avoided by the construction of each pipeline along their respective rights-of-way.

For these reasons, we do not recommend the collocation of the San Patricio Pipeline with the pipelines proposed as part of the Cheniere Corpus Christi and Vista del Sol LNG projects.

3.6.2.1 Route Alternatives

We evaluated three pipeline route alternatives proposed by Ingleside San Patricio to determine if impacts associated with the proposed route could be avoided or reduced by following a different alignment (see appendix C, figure C-10). 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 Sinton to provide delivery capacity and the flexibility required by Ingleside San Patricio.

Route Alternative A

Route Alternative A would begin at the northern fence line of the proposed Ingleside Energy Center LNG Terminal and proceed in a northwest-west direction for its entire length. It would be parallel to and south of State Route 361 for about 4 miles as it approaches the southwestern limits of the City of Gregory. At this point, Route Alternative A would turn south for about 1 mile and then northwest crossing under U.S. Route 181 and paralleling State Route 361. It would continue along this route for about 9.7 miles until it approaches the southwest limits of the Town of Taft. At this point, Route Alternative A would turn in a westerly direction for about 13.4 miles to its terminus location about 6 miles southwest of Sinton. Table 3.6.2.1-1 compares significant environmental factors of the proposed route with Route Alternative A.

TABLE 3.6.2.1-1

Environmental Comparison of Ingleside San Patricio's Preferred Pipeline Route with Route Alternative A

Environmental Factor	Proposed Route	Route Alternative A
Total Length (miles)	26.4	28.1
Length Adjacent to Existing Rights-of-Way (miles)	22.9	28.1
Construction Disturbance (acreage) a/	320.0	340.1
Waterbodies Crossed (number)	10	11
NWI Wetlands Crossed (acreage) b/	0.4	0.5
Railroad Crossings (number)	2	3
Road Crossings (number)	26	27
Residences within 0.25 mile of Construction Work Area (number)	26	80

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

Route Alternative A would be 1.7 miles longer than the corresponding segment of the proposed route and it would be adjacent to existing rights-of-way for its entire length. The primary disadvantage of the alternative is that it would affect 20.1 acres more land, one more waterbody, 0.1 acre more wetlands, and cross one more roadway. In addition, 54 more residences would be located within 0.25 mile of the construction work area. We believe that the Route Alternative A does not offer an environmental advantage over the corresponding segment of the proposed route, and therefore we do not recommend use of the alternative.

Route Alternative B

Route Alternative B would begin at the northern fence line of the proposed Ingleside Energy Center LNG Terminal and proceed north for about 1.5 miles under U.S. Route 181 and an existing railroad right-of-way. It would continue in a northerly direction paralleling an existing pipeline right-of-way for about 4 miles before turning in a northwesterly direction for about 20.2 miles to its terminus location about 6 miles northeast of Sinton. Route Alternative B would be collocated with existing pipeline corridors for about 20.1 miles. Table 3.6.2.1-2 compares significant environmental factors of the proposed route with Route Alternative B.

Route Alternative B would be 0.7 mile shorter than the corresponding segment of the proposed route. It would be adjacent to 2.8 miles less of existing rights-of-way, affect 8.5 acres less land, and 14 less residences would be located within 0.25 mile of the construction work area. The primary disadvantage of the alternative is that it would cross five more waterbodies and affect three acres more wetlands. We believe that the Route Alternative B does not offer an environmental advantage over the corresponding segment of the proposed route, and therefore we do not recommend use of the alternative.

TABLE 3.6.2.1-2

Environmental Comparison of Ingleside San Patricio's Preferred Pipeline Route with Route Alternative B

Environmental Factor	Proposed Route	Route Alternative B
Total Length (miles)	26.4	25.7
Length Adjacent to Existing Rights-of-Way (miles)	22.9	20.1
Construction Disturbance (acreage) a/	320.0	311.5
Waterbodies Crossed (number)	10	15
NWI Wetlands Crossed (acreage) b/	0.4	3.4
Railroad Crossings (number)	2	0
Road Crossings (number)	26	21
Residences within 0.25 mile of Construction Work Area (number)	26	12

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

Route Alternative C

Route Alternative C would begin at the proposed Ingleside Energy Center LNG Terminal and proceed in a westerly direction through the adjacent DuPont facility. It would parallel existing and abandoned 12-inch-diameter pipelines and cross tailing ponds associated with the Sherwin

Alumina facility. It would continue in a northwesterly direction for its entire length crossing under U.S. Route 181 near the southwestern limits of the City of Gregory and the southwest-western limits of the Town of Taft. It would parallel State Route 361 to its terminus about 2.5 miles northwest of Sinton. Route Alternative C would be parallel and adjacent to existing pipeline rights-of-way for its entire length. Table 3.6.2.1-3 compares significant environmental factors of the proposed route with Route Alternative C.

Route Alternative C would be 2.5 miles shorter than the corresponding segment of the proposed route, would be adjacent to 1 mile more of existing rights-of-way, and it would affect 30.3 acres less land. The primary disadvantage of the alternative is that it would cross seven more waterbodies, affect 5.5 acres more wetlands, and 64 more residences would be located within 0.25 mile of the construction work area. It would also cross the DuPont and Sherwin Alumina facilities. We believe that the Route Alternative C does not offer an environmental advantage over the corresponding segment of the proposed route, and therefore we do not recommend use of the alternative.

TABLE 3.6.2.1-3

Environmental Comparison of Ingleside San Patricio's Preferred Pipeline Route with Route Alternative C

Environmental Factor	Proposed Route	Route Alternative C
Total Length (miles)	26.4	23.9
Length Adjacent to Existing Rights-of-Way (miles)	22.9	23.9
Construction Disturbance (acreage) a/	320.0	289.7
Waterbodies Crossed (number)	10	17
NWI Wetlands Crossed (acreage) b/	0.4	5.9
Railroad Crossings (number)	2	2
Road Crossings (number)	26	24
Residences within 0.25 mile of Construction Work Area (number)	26	90

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

3.6.2.2 Route Variations

During the development of the pipeline route, Ingleside San Patricio evaluated four minor route variations to minimize potential impacts to specific localized resources such as agricultural resources and residences. 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 3.6.2.2-4.

Route Variation A

Route Variation A would deviate from the proposed route at about MP 12.1 and continue in a northerly direction for about 0.5 mile paralleling an existing products pipeline right-of-way through similar land uses to that crossed by the proposed route. It would tie into Tetco's existing pipeline system via a meter station that would be located about 0.1 mile northwest of the

currently proposed Tetco meter station site. 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 Ingleside San Patricio's Preferred Pipeline Route with Route Variation A

Environmental Factor	Proposed Route	Route Variation A
Total Length (miles)	0.6	0.5
Length Adjacent to Existing Rights-of-Way (miles)	0.5	0.5
Construction Disturbance (acreage) a/	7.2	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 A would be 0.1 mile shorter than the corresponding segment of the proposed route. It would be adjacent to 0.1 mile more of existing rights-of-way and affect 1.1 acres less land. The primary disadvantage of Route Variation A is that the meter station site would be located in the middle of an agricultural field that would make access to the site difficult during construction, operation, and maintenance. This would also result in the need for permanent access roads in these agricultural fields, resulting in greater environmental impact to the land and land use. The currently proposed Tetco meter station would be located north of and adjacent to County Road 102, at the edge of an agricultural field, and would not require an access road to the station site. We believe that Route Variation A does not offer an environmental advantage over the corresponding segment of the proposed route, and therefore we do not recommend use of the variation.

Route Variation B

Route Variation B would deviate from the proposed route at about MP 17.8 and continue in a northwesterly direction for about 0.2 mile where it would rejoin the proposed route near MP 18.1. Route Variation B would be south of and parallel to County Road 100/1178 for its entire length. It would cross through similar land uses to that crossed by the proposed route and be within 100 feet of a residence. Table 3.6.2.2-2 compares significant environmental factors of the proposed route with Route Variation B.

Route Variation B would be 0.1 mile shorter than the corresponding segment of the proposed route and affect 1.2 acres less land. The primary disadvantage of Route Variation B is that it would be within 100 feet of a residence. Ingleside San Patricio indicated that the driveway and landscaping of this residence would be within the construction work area of the pipeline and could be affected during construction. The corresponding segment of the proposed route would be located north of the County Road 100/1178, about 250 feet from the residence, and impacts to the driveway and landscaping would be avoided. We believe that Route Variation B does not

offer an environmental advantage over the corresponding segment of the proposed route, and therefore we do not recommend use of the variation.

TABLE 3.6.2.2-2

Environmental Comparison of Ingleside San Patricio's Preferred Pipeline Route with Route Variation B

Environmental Factor	Proposed Route	Route Variation B
Total Length (miles)	0.3	0.2
Length Adjacent to Existing Rights-of-Way (miles)	0.2	0.2
Construction Disturbance (acreage) a/	3.6	2.4
Waterbodies Crossed (number)	0	0
NWI Wetlands Crossed (acreage) b/	0	0
Road Crossings (number)	0	2
Residences within 100 feet of Construction Work Area (number)	0	1

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

Route Variation C

Route Variation C would deviate from the proposed route at about MP 19.2 and continue in a northwesterly direction for about 0.1 mile. At this point it would turn due north for about 0.5 mile and then due west for 0.6 mile where it would rejoin the proposed route near MP 20.3. Route Variation C would parallel existing utility and roadway rights-of-way for its entire length and would cross through similar land uses to that crossed by the proposed route. It would only allow for a tie into CrossTex's existing pipeline system at a meter station site that would be located about 0.6 mile northeast of the currently proposed GulfTerra Pipeline Company and CrossTex Pipeline Company (GulfTerra/CrossTex) meter station site. Table 3.6.2.2-3 compares significant environmental factors of the proposed route with Route Variation C.

TABLE 3.6.2.2-3

Environmental Comparison of Ingleside San Patricio's Preferred Pipeline Route with Route Variation C

Environmental Factor	Proposed Route	Route Variation C
Total Length (miles)	1.0	1.1
Length Adjacent to Existing Rights-of-Way (miles)	1.0	1.1
Construction Disturbance (acreage) a/	12.1	13.3
Waterbodies Crossed (number)	1	1
NWI Wetlands Crossed (acreage) b/	0	0.4
Road Crossings (number)	2	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 C would be 0.1 mile longer than the corresponding segment of the proposed route. It would affect 1.2 acres more land and 0.4 acre more wetland. The primary disadvantage of Route Variation C is that the meter station would only tie into CrossTex's existing pipeline system. This would require Ingleside San Patricio to construct a separate meter station that would tie into GulfTerra's existing system, which would impact about 0.2 acre for construction and about 0.1 acre for operation. The corresponding segment of the proposed route would allow for one meter station that would tie into both of these systems. The proposed GulfTerra/CrossTex meter station site would be located along the corresponding segment of the proposed route at MP 19.7. 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 the variation.

Route Variation D

Route Variation D would deviate from the proposed route at about MP 25.6 and continue in a northwesterly direction for about 0.6 mile to its terminus. Route Variation D would parallel GulfTerra's existing pipeline right-of-way and tie into the existing NGPL, Transco, and Tennessee pipeline systems about 0.1, 0.5, and 0.6 mile northeast of the currently proposed meter station sites, respectively. It would cross through similar land uses to that crossed by the proposed route. 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 Ingleside San Patricio's Preferred Pipeline Route with Route Variation D

Environmental Factor	Proposed Route	Route Variation D
Total Length (miles)	0.8	0.6
Length Adjacent to Existing Rights-of-Way (miles)	0.8	0.6
Construction Disturbance (acreage) a/	9.7	7.2
Waterbodies Crossed (number)	0	0
NWI Wetlands Crossed (acreage) b/	0	0
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.

Route Variation D would be 0.2 mile shorter than the corresponding segment of the proposed route. It would affect 2.5 acres less land and cross one more roadway. The primary disadvantage of Route Variation D is that the NGPL, Transco, and Tennessee meter station sites would be located in the middle of an agricultural field that would make access to these sites difficult during construction, operation, and maintenance. This would also result in the need for permanent access roads in these agricultural fields. The currently proposed NGPL, Transco, and Tennessee meter stations would be located south of and adjacent to a farm field road, thereby improving accessibility to these meter station sites and avoiding impacts on agricultural land and production. 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 use of the variation.

3.6.3 Aboveground Facility Site Alternatives

Ingleside San Patricio proposes to construct eight meter stations north of Sinton, Texas as part of the proposed Project. As described above, Ingleside San Patricio originally evaluated five meter station locations; however, these sites were relocated based on civil surveys and landowner consultations. Ingleside San Patricio now proposes new locations for its Tetco, GulfTerra/CrossTex, NGPL, Transco, and Tennessee meter stations that would move the meter stations from the middle of agricultural fields closer to existing roads. This would eliminate the need for permanent access roads to these meter stations across the fields.

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