3.0 ALTERNATIVES

We have evaluated a number of alternatives to the Golden Pass LNG Terminal and Pipeline Project to determine whether any would be reasonable and environmentally preferable to the proposed action. Alternatives described in the following sections include the no-action or postponed-action alternatives, LNG terminal site and system alternatives, and pipeline system and route alternatives.

Golden Pass states that its Project would help meet growing demand for natural gas by providing an LNG import terminal and service through the multiple existing interstate and intrastate pipelines to supply the regional (Texas and Louisiana) and national natural gas market. Golden Pass also states that a potentially viable terminal site and associated pipeline system must have, at a minimum, the following specific attributes:

- Be technically and economically feasible and practicable;
- Provide an LNG site that is situated near existing or proposed Texas and Louisiana intrastate and interstate pipeline systems with downstream takeaway capacity greater than 2.0 Bcfd, and capable of providing natural gas to the ExxonMobil Beaumont Refinery complex;
- Provide access to a deepwater (≥40 feet) channel for a berthing facility capable of accommodating LNG ships with capacities of up to 250,000 m^3;
- Allow for the terminal and vaporization facilities of at least 1.0 Bcfd of natural gas to be placed in-service by 2008 and at least 2.0 Bcfd of natural gas to be placed in-service by 2009; and
- Provide Golden Pass with sufficient control and proprietary rights of operation over its site and interconnecting pipelines to ensure facility operation and pipeline availability for a 25-year Project life.

The Project, as proposed, has these attributes. Therefore, our evaluation of potentially reasonable and environmentally preferable alternatives is based on whether these alternatives meet the objectives identified by Golden Pass.

3.1 NO ACTION OR POSTPONED ACTION

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

If the Commission denies the proposal (the no-action alternative), the short- and long-term environmental impacts identified in section 4 of this EIS would not occur. If the Commission postpones action on the application, the environmental impacts identified in section 4 of this EIS would be delayed, or if the applicant decided not to pursue the Project, would not occur.

If the Commission selects the no-action alternative, the objectives of the proposed Project would not be met, and Golden Pass would not be able to provide the proposed import, storage, vaporization, and transportation services to its shippers. If action is postponed, the objective of providing natural gas service to the intrastate and interstate market by 2008 and to the ExxonMobil Beaumont Refinery complex would probably not be achievable.

Because the demand for energy in the U.S. is predicted to increase and domestic natural gas supplies are declining, natural gas customers may have fewer and potentially more expensive options for obtaining natural gas supplies in the near future. It is possible that existing natural gas infrastructure supplying natural gas to the market area could be developed in other ways unforeseen at this point, including the further development of natural gas sources in North America and construction of associated pipeline projects. Alternatively, potential customers of natural gas could select other available energy alternatives to compensate for the reduced availability of natural gas. However, increased use of alternative fossil fuels, such as oil or coal, generally would result in higher emission rates of 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. Another option – the development of renewable sources of energy, such as wind and solar – would result in lower emission rates for NO_x and SO_2 than would be the case with alternative fuels. However, while development of renewable energy sources as well as energy conservation can play a critical role in the future of the U.S. energy sector, growth projections continue to indicate that the demand for energy, and specifically natural gas, will far exceed energy provided through renewable sources or savings resulting from energy conservation. Ultimately, it is purely speculative to predict the resulting actions that would be taken by the end users if the natural gas supplied by the Project were not available or the associated direct and indirect environmental impacts of these actions.

3.2 LNG TERMINAL FACILITY ALTERNATIVES

According to the DOE, the Gulf of Mexico has provided most of the natural gas consumed in the U.S. and accounted for 19 Bcfd to these markets in 2001. As reserves decline in the Gulf of Mexico, this pipeline capacity would become available to transport LNG delivered to LNG terminals in the Gulf of Mexico. Therefore, for this alternatives analysis, we did not consider existing LNG facilities, or proposed or planned LNG projects on the East or West Coasts of the U.S., or projects outside of the U.S. in Mexico or Canada because these projects would serve different regional (or niche) markets and could not make use of existing infrastructure that has been developed to transport natural gas from the Gulf to U.S. markets. Further, there is adequate market demand in Texas and Louisiana and the U.S. markets served by the existing Gulf infrastructure to support the proposed Project and other planned LNG projects in the Gulf of Mexico area as well. So, we had no compelling reason to evaluate alternative sites in other geographic areas.

The proposed Project location in the Gulf Coast region would take advantage of available existing pipeline infrastructure with access to the vast interstate and intrastate markets in the U.S. Historically, this infrastructure has provided up to 19 Bcfd to Louisiana and U.S. markets, including Chicago, New York, and Boston (DOE, 2001a). Golden Pass states that the primary purpose of its Project is to provide an additional source of firm, long-term, and competitively priced natural gas to the Texas and Louisiana intrastate and interstate natural gas markets. To that end, the Project is designed to supply these markets with a base load of approximately 2 Bcfd of natural gas. The natural gas would be used in part by industrial customers in Texas; including the ExxonMobil Beaumont refinery complex, and the remainder would be made available to national customers in the southeastern, mid-Atlantic, central and northeast markets through interconnections with interstate pipelines. This additional source of natural gas would help meet the growing imbalance between supply and demand (which is projected to be approximately 14 Tcf by the year 2025).

Within the Gulf Coast region, there are two operating LNG facilities: the onshore Lake Charles, Louisiana facility and the offshore Energy Bridge Gulf of Mexico (Energy Bridge GOM) which began operation in March 2005. Six LNG terminals have been approved but are not yet in operation: the Cameron, Freeport, Cheniere Corpus Christi, and Sabine Pass onshore LNG projects, and the Port Pelican and Gulf Landing offshore LNG projects. Construction is underway at the Freeport and Sabine Pass

onshore terminals. In addition, there are another seven proposed onshore and offshore LNG projects in the Gulf of Mexico (Golden Pass, Port Arthur, Vista del Sol, Ingleside, Compass Port, Pearl Crossing, and Main Pass Energy Hub LNG Projects) that have been under agency review over the past year.

In addition to the above LNG projects, there is one announced project in Galveston, Texas; and five projects that are in the preliminary stages of environmental review by the Coast Guard (Beacon Port Clean Energy Project) or the FERC. These projects are briefly described below.

- Bay Crossing Project – In September 2004, the Port of Galveston announced that it had approved a 3-year option on a 35-year lease agreement with British Petroleum Energy to develop an LNG terminal on about 185 acres of land and water at Pelican Island, Texas, about 5 miles from the center of Galveston. The LNG facility would have a sendout capacity of 1.2 Bcfd.

- Gulf Energy Project – In December 2005, Gulf LNG Energy LLC filed a request to use our NEPA pre-filing environmental review process for development of the LNG Clean Energy Project (Docket No. PF05-5-000).[1] As proposed, the project would consist of one LNG ship berth, two LNG storage tanks and 5 miles of 36-inch-diameter sendout pipeline. The terminal would be located on a 40-acre site within a 200-acre site on Bayou Casotte in Pascagoula, Mississippi, that is owned by the Jackson Port Authority. The LNG terminal would have a sendout capacity of 1.0 Bcfd.

- Beacon Port Clean Energy Project – In January 2005, ConocoPhillips submitted an application to the Coast Guard to construct and operate an offshore LNG unloading, storage, and vaporization terminal, located 56 miles off the coast of Louisiana in the Gulf of Mexico. The project would consist of two concrete gravity-based LNG storage tanks, regasification equipment, docking platforms and other unloading and loading equipment. A second platform, adjacent to the LNG tanks, would house the crew. The natural gas would be transported to the mainland via 46 miles of new pipeline and a new riser platform that would connect to existing pipelines approximately 29 miles south-southeast of Johnsons Bayou, Cameron Parish, Louisiana. The project would have a sendout capacity of up to 1.5 Bcfd.

- Casotte Landing LNG Project – In March 2005, Bayou Casotte Energy LLC (a subsidiary of Chevron U.S.A., Inc.) filed a request to use our NEPA pre-filing environmental review process for development of the Casotte Landing LNG Project (Docket No. PF05-9-000). The project would consist of a single LNG ship berth capable of receiving 166 LNG shipments per year and three LNG storage tanks. The LNG terminal would be located on a 95-acre site within a former industrial site adjacent to the existing Chevron Pascagoula, Mississippi Refinery and about 1 mile from the proposed LNG Clean Energy project. The LNG terminal is expected to have a sendout capacity of 1.3 Bcfd.

- Creole Trail LNG Project – In March 2005, Cheniere Energy, Inc. filed a request to use our NEPA pre-filing environmental review process for development of the Creole Trail Project (Docket No. PF05-8-000). The project would consist of two marine berths, four LNG storage tanks, and two parallel and adjacent 42-inch-diameter sendout pipelines extending about 118 miles. The project would also include a western 42-inch-diameter lateral pipeline approximately 47 miles long, and a 36-inch-diameter lateral approximately 6 miles long. The LNG terminal would be located on approximately 773 acres of land on the Calcasieu Ship Channel in Cameron

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

Parish, Louisiana and would be able to accommodate 400 ships per year. The terminal would have a sendout capacity of 3.3 Bcfd.

- Calhoun LNG Project – In March 2005, Gulf Coast LNG Partners LP filed an application to construct and operate the Calhoun LNG Project (Docket No. CP05-91-000). As proposed, the project would consist of two LNG storage tanks and one LNG ship berth in Port Lavaca, Calhoun County, Texas, approximately 100 miles southwest of Houston. The terminal would include facilities to separate natural gas liquids from the LNG thus allowing the terminal to accommodate higher Btu LNG from worldwide sources. The terminal would be capable of delivering 1 Bcfd of natural gas to the existing pipeline system, where there is approximately 2 Bcfd of takeaway capacity within 13 miles of the terminal. The applications were filed with FERC in March 2005.

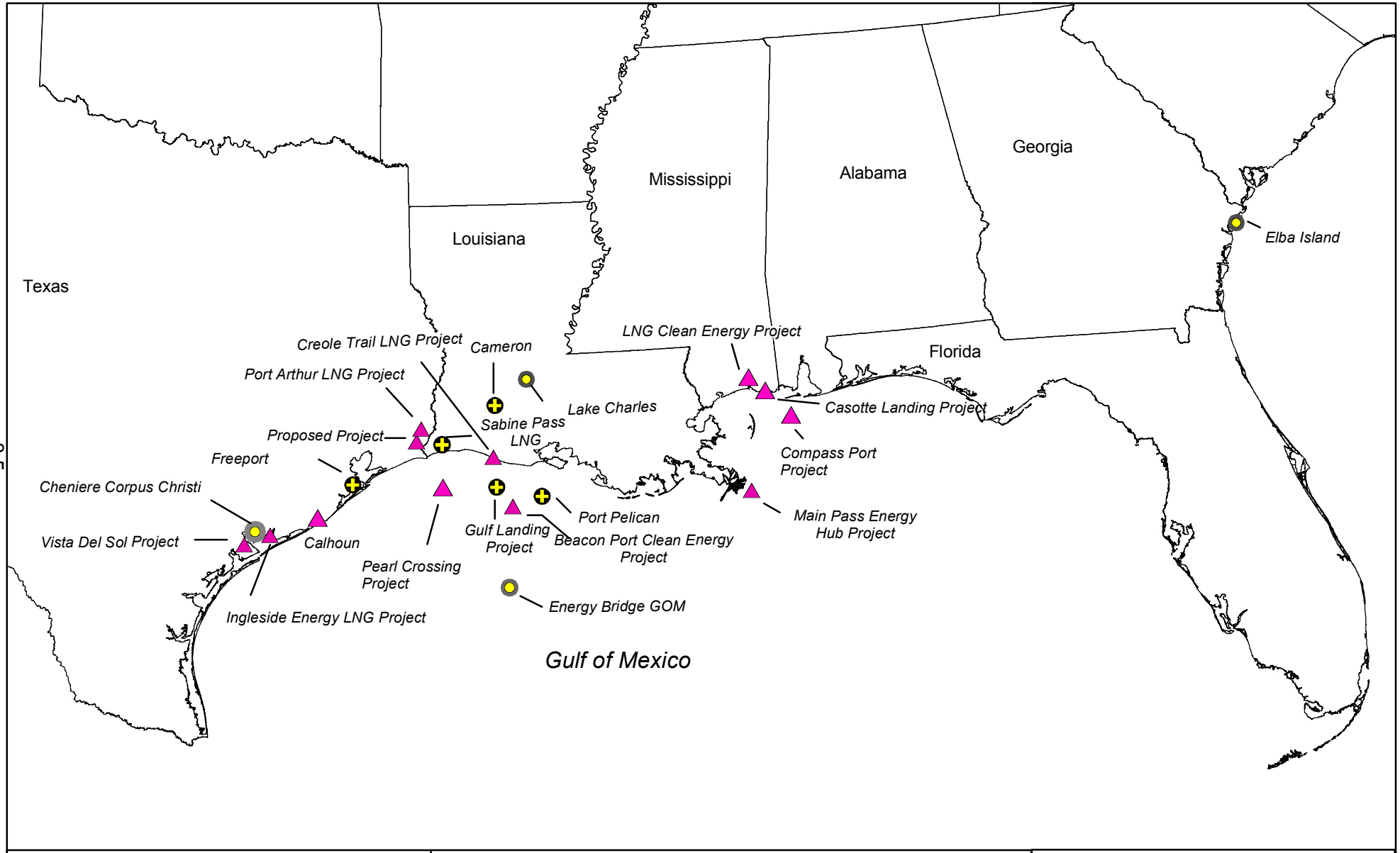
Figure 3.2-1 shows the general location of these existing, approved, and proposed facilities in Texas, Louisiana, Mississippi, and the Gulf of Mexico. Because there is limited information available on the announced project in Galveston and the five projects recently filed with the Coast Guard and the FERC, we have not included them in our analysis. Table 3.2-1 provides a summary of the major environmental characteristics of the remaining 15 LNG projects in the Gulf of Mexico region that are discussed further in the following sections.

3.2.1 Use of Other Existing, Approved, or Planned Onshore LNG Terminals

Since one of the purposes of the proposed Project is to provide facilities that would allow LNG from worldwide sources to be imported, stored, and delivered into the existing U.S. pipeline infrastructure, we considered expansion of the four existing terminals in the U.S. as well as those LNG projects that are proposed along the Texas/Louisiana coastline of the Gulf of Mexico. Although expansion of these existing facilities or planned facilities could make it unnecessary to construct all or part of the Golden Pass LNG Terminal and Pipeline Project, significant modification of these existing facilities may be required that would also result in environmental impacts.

The Golden Pass LNG Terminal and Pipeline Project would provide facilities that would provide for the import of LNG from ships with capacities up to 250,000 m^3, a storage capacity of 775,000 m^3, and vaporization facilities to deliver an average of approximately 2 Bcfd of natural gas (with a peak capacity of 2.7 Bcfd) into the existing intrastate and interstate pipeline systems. The LNG terminal would be capable of unloading up to 200 ships per year.

Table 3.2.1-1 summarizes the current and planned sendout capacities of the one existing and four approved LNG import terminals that can or would provide unloading, storage, and delivery services in the U.S. For any of these existing or approved facilities to meet the proposed Project objectives, the facility would need to have sufficient, uncommitted storage and sendout capacities to meet the requirements of Golden Pass' proposal and capable of delivering natural gas to the ExxonMobil Beaumont Refinery complex.



Operating LNG Terminal
Approved LNG Terminal
Proposed LNG Terminal Under Review

0 75 150 300 Miles

Figure 3.2-1
Existing and Planned
LNG Facilities in the Gulf
Coast and South Eastern U.S.

N

Golden Pass LNG Terminal
and Pipeline Project

Jefferson, Orange & Newton Counties, TX
and Calcasieu Parish, LA

TABLE 3.2-1

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

	Property Size (acres)	Site Size (acres)	Existing Land Use a/	Adjacent Land Use a/	Wetlands Temporarily Affected within LNG Terminal Site (acres)	Wetlands Permanently Affected within LNG Terminal Site (acres)	Dredging Required (million yd^3)	Associated Non jurisdictional Facilities	Residences within 0.5 mile of Property Line (number)	Onshore Sendout Pipeline (miles)	Offshore Sendout Pipeline (miles)
ONSHORE LNG TERMINAL PROJECTS											
Sabine Pass, TX/LA:											
Sabine Pass c/	568	236.6	DMPA	DMPA, O	8.8	47.7	4.5	None	0	16	NA
Proposed Golden Pass	477	205	DMPA, O	O	1.4	108.8	6.3	10 miles - power	17	122.4 b/	NA
Port Arthur	2,900	198	DMPA	DMPA, O	NA	82.5	6.7	23 miles – power 3.7 miles – highway, pipeline/utility relocation	0	73	NA
Calcasieu Lake, LA:											
Lake Charles d/	395	125	I	I, A, R	None	None	0.07	None	3	22.8	NA
Cameron c/	118.6	100.8	I	I, F, O	67.7	55	2.1	None	0	35.4	NA
Quintana Island, TX:											
Freeport c/	188	120	O, C/I, P	O, C/I, R, P	22.5	46.9	2.2	2-4 miles - power	9	9.6	NA
Corpus Christi, TX:											
Vista del Sol	357	288	A, I	I	24.7	24.7	5.8	0.08-mile- power	0	25	NA
Ingleside Energy	1196	82	I	I	0	4.5	3.7	None	0	26	NA
Cheniere Corpus Christi c/	772	366	I	I	12.4	10.7	4.4	1.6-mile- power 1.6-mile- water 0.7 mile – pipeline relocation	0	23	NA
OFFSHORE LNG TERMINAL PROJECTS											
Energy Bridge GOM	NA	0	W	W	NA	NA	NA	NA	0	0	5.3
Port Pelican c/	NA	2 e/	W	W	NA	NA	NA	NA	0	0	42.6
Gulf Landing c/	NA	12.6 e/	W	W	NA	NA	NA	NA	0	0	75.6
Compass Port	NA	31 e/	W	W	NA	NA	NA	NA	0	5	27
Pearl Crossing Port	NA	4 e/	W	W	NA	NA	NA	NA	0	65 b/	106 b/
Main Pass Energy Hub	NA	0	W	W	NA	NA	NA	NA	0	5.1	192

a/ DMPA = Former Dredge Material Placement Area; O = Open; C = Commercial; I = Industrial; F = Forest; A = Agriculture, R = Residential; W = Water, P= Park
b/ Total includes mainline, loop, and lateral.
c/ Approved but not yet constructed.
d/ Expansion of existing LNG terminal.
e/ Does not include land impacts associated with construction of the GBSs.

NA Not Applicable

TABLE 3.2.1-1

Existing and Approved Onshore LNG Facilities

Operator/LNG Import Terminal	County/Parish, State	Maximum Capacity (Bcfd)	Percent Committed
Trunkline LNG Company LLC – Lake Charles	Calcasieu, LA	1.3 a/	100
Cameron LNG LLC – Cameron b/	Cameron, LA	1.5	Unknown
Sabine Pass LNG, LP – Sabine Pass b/	Cameron, LA	2.6	65
Freeport LNG Development LP – Freeport b/	Brazoria, TX	1.5	100
Corpus Christi LNG LP – Cheniere Corpus Christi b/	San Patricio, TX	2.6	Unknown

a/ Maximum capacity includes planned expansion.
b/ Recently approved LNG terminals

3.2.1.1 Lake Charles LNG Terminal

The Lake Charles LNG import terminal is the largest operating LNG import facility in the U.S. It is located approximately 43 miles northeast of the Project on the northeast side of Calcasieu Lake in Calcasieu Parish, Louisiana, and is owned by Southern Union and operated by Trunkline LNG Company LLC. The Commission approved expansions of the Lake Charles Terminal on December 18, 2002 and March 18, 2003. These expansions were amended again and that amendment was approved by the Commission on October 27, 2003. The expansion, as amended, includes adding a second berth, a new 880,000-barrel LNG storage tank (in addition to the three existing 600,000 barrel storage tanks) and additional pumps, vaporizers, and appurtenant facilities. The terminal is capable of unloading about 175 LNG ships per year. In February 2004, applications were filed to further amend the expansion project to increase sendout capacity. This would involve adding additional vaporizers and pumps, facilities to increase the capabilities to unload LNG vessels from the second dock, and a loop of the existing pipeline to increase the takeaway capacity from the terminal.

After the expansion work is completed, the Lake Charles LNG terminal would not have adequate space within its 125-acre fenced site to accommodate the storage tanks and sendout facilities associated with the delivery volumes for the proposed Project. Because the terminal is 100 percent committed, further expansion outside the existing fence line would be needed. Expansion potential at this site is limited by existing or planned industrial facilities so the Lake Charles LNG terminal cannot be considered a practical alternative.

3.2.1.2 Cameron LNG Terminal

Cameron LNG LLC plans to construct and operate the Cameron LNG import terminal on the west side of the Calcasieu River ship channel, southwest of the Lake Charles LNG terminal near Hackberry, Cameron Parish, Louisiana. It will consist of a ship unloading slip with two berths, three 160,000 m^3 LNG storage tanks, pumps, vaporizers, appurtenant facilities, and a 35.4-mile-long, 36-inch-diameter natural gas sendout pipeline. The marine terminal will be capable of unloading 210 LNG ships per year. The proposed facilities will transport up to 1,500,000 dekatherms per day (approximately 1.5 Bcfd) of imported natural gas to interstate pipeline markets. In November 2004, Cameron LNG LLC filed a modification to its application to expand the ship berths to accommodate larger LNG ships.

The Cameron LNG terminal site has been designed to provide for the spatial requirements of the terminal facilities while minimizing the required filling of site wetlands. Consequently, there is not sufficient buildable area for the additional tanks and facilities that would be needed to increase the proposed throughput of the terminal to meet the additional capacity of the proposed Project without similar or

greater impact on wetlands. The design of the 36-inch-diameter natural gas pipeline also was optimized to handle the output (1.5 Bcfd) of the terminal and does not have sufficient excess capacity to support the additional volumes (2 Bcfd) associated with the proposed Project or to provide natural gas to the ExxonMobil Beaumont Refinery. We anticipate that at least 35 miles of looping and 44 miles of new pipeline to the Beaumont Refinery would be required to allow the Cameron LNG terminal to accommodate the proposed Golden Pass volumes. Since these activities would result in similar and likely additional environmental impacts; we have eliminated this alternative from further consideration.

3.2.1.3 Sabine Pass LNG Project

In December 2004, the Commission approved the Sabine Pass LNG Project as proposed by Sabine Pass LNG, L.P. This project will consist of two ship berths, three LNG storage tanks, and one 16-mile-long, 42-inch-diameter sendout pipeline. The facility will have a nominal output of 2.6 Bcfd and a marine terminal that will be capable of unloading up to 300 LNG ships per year. The LNG terminal will be located on approximately 236.6 acres of a 568-acre site on the eastern shore of the Sabine Pass Channel in Cameron Parish, Louisiana east of the town of Sabine Pass, Texas, and approximately 3 miles east-southeast of the Golden Pass LNG terminal.

While this terminal potentially could be expanded to accommodate five additional LNG tanks and the associated vaporization facilities, the 16-mile-long sendout pipeline would be inadequate to transport the 2 Bcfd proposed by Golden Pass and the takeaway capacity of the existing pipeline system at this location (estimated at an aggregate of 3.9 Bcfd) may be unable to accommodate the additional proposed natural gas volumes. It therefore is likely that the proposed Golden Pass pipeline system would be required as well as an approximate 3-mile-long pipeline (and loop) across the SNWW to connect the Sabine Pass LNG terminal with the proposed Golden Pass pipeline system. Further, because the only areas available for expansion at the Sabine Pass site would be DMPA wetlands, the additional LNG facilities required for the expansion would result in the permanent loss of additional wetlands at the Sabine Pass site. This permanent wetland loss may be equal to or greater than the 108.8 acres of wetlands that would be permanently lost for development of the proposed Golden Pass LNG terminal site. For these reasons, we eliminated this alternative from further consideration.

3.2.1.4 Freeport LNG Terminal

In May 2004, the Commission approved the Freeport LNG Project as proposed by Freeport LNG Development LP. The terminal will consist of a single LNG ship berth capable of unloading up to 200 ships per year, two LNG storage tanks, and 9.6 miles of 36-inch-diameter sendout pipeline with a nominal output of 1.5 Bcfd. The LNG terminal will occupy about 120 acres of land within an approximate 188-acre site on Quintana Island near the City of Freeport, Brazoria County, Texas and will disturb about 69.4 acres of coastal marsh. The project is 100 percent committed and would have to be expanded to meet Project objectives. Freeport LNG Development LP is currently planning to expand the facility by adding a second berth and another LNG tank. This would increase the capacity of the terminal by 2.5 Bcfd. However, this proposed additional capacity is already partially committed to shippers and it is unlikely that the site could accommodate an additional two ship berths and three to five LNG tanks needed to import and transport 2 Bcfd of natural gas proposed by Golden Pass. This site is also approximately 100 miles west of the proposed project and serves a different regional market in Texas. For these reasons, we eliminated this alternative from further consideration.

3.2.1.5 Cheniere Corpus Christi Project

In April 2005, the Commission approved the Cheniere Corpus Christi Project (Docket Nos. CP04-37, CP04-44, CP04-45, and CP04-46), as proposed by Corpus Christi LNG LP (an affiliate of Cheniere

Energy, Inc.). The terminal would consist of two LNG ship berths capable of unloading up to 300 ships per year, three LNG storage tanks, and 23 miles of 48-inch-diameter sendout pipeline with a nominal output of 2.6 Bcfd. The LNG terminal would occupy about 366 acres of a total of approximately 722 acres of land and water at a site located east of Portland in Corpus Christi, San Patricio County, Texas. While this project could either accommodate or be expanded to meet Project objectives, the site is well over 100 miles west of the proposed Project and serves a different regional market in Texas. For this reason, we eliminated this alternative from further consideration.

3.2.1.6 Proposed Onshore LNG Terminals Under Review

In addition to the existing or approved projects, there are three other proposed onshore LNG terminal projects along the shorelines of Texas and Louisiana in the Gulf of Mexico. These are summarized in table 3.2.1-2 and described briefly below. All of these projects would be capable of importing, storing, and vaporizing LNG for sendout to the existing natural gas pipeline system.

TABLE 3.2.1-2

Proposed Onshore LNG Facilities Under Review in Texas and Louisiana

Operator	Project	County/ State	Capacity (Bcfd)
Sempra Energy LNG	Port Arthur LNG Project	Jefferson, TX	1.5 to 3.0
Vista del Sol LNG Terminal LP	Vista del Sol LNG Project	San Patricio, TX	1.0
Ingleside Energy Center LLC	Ingleside Energy LNG Project	San Patricio, TX	1.0

Port Arthur LNG Project

The Port Arthur LNG Project (Docket Nos. PF04-11, CP05-84, CP05-85, and CP05-86)), 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 an additional three LNG tanks with a nominal output of 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 198 acres within a 2,900-acre site on the Port Arthur Channel, in Port Arthur, Jefferson County, Texas. This project used our NEPA pre-filing environmental review process. The applications were filed with FERC in February 2005, with publication of the draft EIS expected in several months.

Vista del Sol LNG Project

The Vista del Sol LNG Project (Docket Nos. PF04-3, CP04-395-000, CP04-405-000, CP04-406-000, and CP04-407-000) as proposed by Vista del Sol LNG Terminal LP (an affiliate of ExxonMobil Corporation), would consist of two LNG ship berths, three LNG storage tanks, and about 27 miles of 36-inch-diameter sendout pipeline. The three LNG storage tanks would have a nominal output of 1 Bcfd. The marine terminal would be capable of receiving up to 100 LNG ships per year, or the equivalent of about one LNG tanker visiting the terminal every 4 days. The LNG terminal would be located on approximately 288 acres within a 311-acre site between the communities of Ingleside and Gregory, San Patricio County, Texas and adjacent to the Sherwin Alumina plant to the north and south, and the Oxy Generator/Oxy Chemical and DuPont plants to the east. The terminal would be designed to accommodate further expansion that would include an additional berth and two more LNG tanks. The expanded facility would be capable of unloading up to 200 LNG ships with a nominal sendout capacity of 2 Bcfd and peak capacity of 2.7 Bcfd. This project used our pre-filing environmental review process. The applications were filed with the

FERC in August 2004, and the draft and final EISs were issued in December 2004 and April 2005, respectively.

Ingleside Energy Center LNG Project

The Ingleside Energy Center LNG Project (Docket Nos. PF04-9, CP05-13, CP05-11, CP05-12, and CP05-14), as proposed by Ingleside Energy Center LLC (an affiliate of Occidental Energy Ventures Corp.), would consist of one ship berth, two LNG storage tanks, a natural gas liquids extraction facility, and about 26 miles of 26-inch-diameter pipeline with interconnections to nine existing interstate and intrastate pipelines. Vaporization heat would be provided by waste heat from the adjacent chemical manufacturing process. The project would have an output of 1 Bcfd and would be located on an 82-acre site adjacent to Occidental's chemical manufacturing facility west of Ingleside in Corpus Christi, San Patricio County, Texas. This project used our pre-filing environmental review process. The applications were filed with FERC in October 2004, and the draft EIS was published in February 2005.

3.2.1.7 Conclusions

Golden Pass is proposing to construct and operate an LNG facility that would have the ability to unload, store, and deliver an average of 2 Bcfd (and up to 2.7 Bcfd) of imported LNG to the ExxonMobil Beaumont Refinery Complex and the interstate and intrastate pipeline network that exists in the Texas/Louisiana Gulf Coast region. None of the existing, approved, or proposed onshore LNG terminal facilities could handle the additional volumes proposed by Golden Pass without significant expansion of the proposed facilities and associated environmental impact. This would include:

- adding one or possibly two ship berths to accept an additional 2.0 to 2.7 Bcfd of LNG;
- increasing the number of inbound and outbound ships by 200 ships per year;
- adding three to five LNG tanks; and
- increasing the takeaway capacity by construction of additional new pipeline.

The Cameron and Freeport projects are too distant to serve the Golden Pass markets. The same is true of the Corpus Christi (San Patricio County) sites. Further, all five of these sites may not be able to accommodate both a third or fourth berth and an additional three to five LNG tanks.

The Sabine Pass and Port Arthur project sites are large enough to accommodate the additional LNG tanks and could accommodate the additional berths (if needed) and the LNG ships. However, permanent impacts on wetlands as a result of expansion at the Sabine Pass and Port Arthur LNG sites would be similar to development of the LNG facility at the Golden Pass site because both the Sabine Pass and Port Arthur sites have wetlands in the areas available for expansion. Neither Sabine Pass nor Port Arthur are designed to serve Golden Pass' primary market area, ExxonMobil's Beaumont Refinery and areas in Texas northeast of Beaumont. To serve these markets, the Sabine Pass project would have to be constructed in its entirety, as well as about 3 miles of pipeline (including a crossing of the SNWW) to connect the Sabine Pass site to the Golden Pass pipeline system, and all of the Golden Pass pipeline system.

The Port Arthur project is designed to provide potential interconnections with the same interstate customers as Golden Pass (*e.g.*, NGPL, Florida Gas, Tennessee Gas, TETCO, and Transco). However, the Port Arthur pipelines could not provide interconnections to the ExxonMobil Beaumont Refinery complex or other intrastate pipelines (*e.g.*, KM Texas, KM Tejas, AEP Texoma, and Channel). To meet the objectives of the Golden Pass Project, at least 60.6 miles of the Golden Pass pipeline system (up to the Channel interconnect) and the Beaumont Lateral (1.8 miles) would need to be constructed. This would eliminate construction of the remaining 17.2 miles of Mainline and could eliminate construction of some or the entire Loop (42.8 miles). However, the volume of natural gas available from both the Port Arthur

and Golden Pass projects would be between 2.5 and 5 Bcfd and would require multiple interconnects to accommodate the sendout volumes. So it is reasonable to assume that all of the Golden Pass pipeline system would be required with the exception of the first 1.5 miles from the Golden Pass LNG site to the NGPL/Centana interconnect (the Port Arthur project includes a 3-mile-long lateral from the Port Arthur site to the NGPL pipeline).

Table 3.2.1-3 summarizes the potential to expand the approved or proposed onshore LNG projects to serve the markets identified by Golden Pass.

TABLE 3.2.1-3

Summary of the Expansion Potential of Approved or Proposed Onshore LNG Facilities

LNG Facility	County/Parish, State	Expandable to 3 to 5 LNG Tanks	Ability to Handle 200 LNG ships/year	Ability to Serve Proposed Market	Pipeline System (miles)
Proposed Golden Pass	Jefferson, TX	Yes	Yes	Yes	122.4 a/
Sabine Pass	Cameron, LA	Yes	Yes	Yes	125.4 b/
Port Arthur	Jefferson, TX	Yes	Yes	Yes	120.9 b/
Cameron	Cameron, LA	No	Yes	No	c/
Freeport	Brazoria, TX	Possibly	Possibly	No	c/
Vista del Sol	San Patricio, TX	Possibly	Possibly	No	c/
Ingleside Energy	San Patricio, TX	No	Possibly	No	c/
Cheniere Corpus Christi	San Patricio, TX	Possibly	Possibly	No	c/

a/ Includes the entire Golden Pass pipeline system (Mainline, Loop, and Beaumont Lateral).
b/ Includes pipeline to connect the LNG facility with the Golden Pass pipeline system and/or pipeline no longer needed.
c/ Project serves a different regional market and is over 100 miles from the proposed Golden Pass LNG terminal. Therefore, it is difficult to estimate the number of miles of pipeline that would be required to transport natural gas to the proposed interconnections, including the ExxonMobil refinery complex.

Based on the above, we do not believe that any of these sites offer a significant environmental advantage over construction of the Project as proposed, and have eliminated all of them from further consideration.

3.2.2 Use of Other Approved or Planned Offshore LNG Facilities

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

Although an offshore LNG import facility has not yet been completed, the technology for doing so is being developed and guidance documents for building offshore LNG storage and vaporization terminals have recently been produced. Currently, offshore LNG terminals have been proposed and are under review in the U.S., Australia, West Africa, Taiwan, and Italy. Because of the demand for natural gas and the potential advantages of offshore unloading and vaporization facilities, we have identified nine

approved or proposed offshore LNG import terminals in the U.S. (FERC, 2005). The four main offshore technologies under development include:

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

Our review of potential offshore LNG terminal facility locations included offshore LNG facilities approved or currently proposed and under review by the Coast Guard in the Gulf of Mexico. These projects are listed in table 3.2.2-1 and shown on figure 3.2-1, and are discussed in the following sections. No FSRUs are currently planned for the Gulf of Mexico. We did not consider other proposed offshore projects in other regions of the U.S. because these planned projects would not meet the objective of providing natural gas to the existing Texas and Louisiana intrastate and interstate market.

TABLE 3.2.2-1

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

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

a/ Approved.
b/ NEPA review in process.

3.2.2.1 LNG Regasification Vessels

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

Energy Bridge GOM/Gulf Gateway Energy Bridge GOM

The application for the Energy Bridge/Gulf Gateway Energy Bridge GOM project was submitted to the Coast Guard in December 2002 (Docket No. 14294). The Coast Guard's Final EIS for the project was published in December 2003, and the final license was issued in April 2004. Excelerate Energy LLC acquired rights to the project in December 2003 and began manufacturing various components of the

facility, including three regasification vessels. Construction of the facilities is complete and the first LNG delivery was received in March 2005.

The deepwater port is located approximately 116 miles off the coast of Louisiana in the Gulf of Mexico and utilizes new specially-designed LNG tankers (El Paso Energy Bridge Vessels or EPEBVs) with onboard regasification equipment to directly input natural gas into the pipeline grid. The 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 EPEBV 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 EPEBV 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. It is anticipated that each EPEBV will have a transport capacity of about 138,000 m^3 of LNG. Under optimal operating conditions, each EPEBV will have the capability to regasify and unload a maximum of 0.69 Bcfd of natural gas for an average natural gas delivery rate of about 0.5 Bcfd.

Our review of the Energy Bridge GOM Project indicates that it would not be able to accommodate the additional 2 Bcfd required to meet the throughput volumes proposed by Golden Pass without the addition of five or more STL buoy ports. Further, because there is no storage component to this system, a significant number of EPEBVs would be required to provide continuous service to the STL buoy ports to avoid any disruption in service. The EPEBVs are unique and the first of their kind. None of the existing LNG worldwide fleet can provide onboard vaporization capability so increased use of this technology would require new ships. Three EPEBVs are under construction for this project alone. To provide comparable delivery rates to replace the Golden Pass Project, five or more new EPEBVs would need to be constructed.

3.2.2.2 GBS

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

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

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

Port Pelican Project

Port Pelican, LLC (an affiliate of the ChevronTexaco Corporation) received approval in November 2003 and a license in January 2004 from the U.S. Maritime Administration (Docket No. 14134) for its Port Pelican Project, an LNG unloading, storage, and vaporization terminal that would be located about 37 miles offshore from Vermillion Parish, Louisiana and about 90 miles southeast of the Project. The vaporized natural gas will be transported into the interstate natural gas pipeline system at Henry Hub by constructing a new 42.6-mile-long, 42-inch-diameter pipeline to the existing Tiger Shoal "A" platform, then using the existing pipeline infrastructure to Henry Hub. The Port Pelican Project will have the capability of vaporizing and transporting up to 2 Bcfd of natural gas to U.S. markets.

The Port Pelican Project will use two GBSs for the offshore terminal that will be anchored to the sea bottom in 83 feet of water. Each GBS will consist of a large concrete structure that will be specially designed and fabricated to provide a safe and secure foundation for the LNG tanks, and a supportive deck for vaporization equipment and crew quarters. Berthing facilities (mooring and breasting dolphins and unloading platforms) will be able to accommodate two LNG ships, one on either side of the terminal. In June 2004, the Coast Guard announced its intent to prepare an Environmental Assessment to address the environmental impacts associated with the fabrication of the GBSs and consideration of two alternative onshore sites for fabrication: a preferred site in Port Aransas (174 acres) or an alternate site on Pelican Island in Galveston (67 acres). Because of the scope of the project, an EIS is now under preparation.

As approved, the Port Pelican Project will require two GBSs to provide unloading, storage, and vaporization facilities for 2 Bcfd. An additional two to three GBSs would be required to accommodate the additional 2.0 to 2.7 Bcfd proposed by Golden Pass, that could affect an additional 150 to 300 acres of shoreline for construction. In addition, while the existing infrastructure (as enhanced by the new 42.6-mile-long Port Pelican pipeline) can accommodate the output from the Port Pelican terminal, it would not be able to accommodate an additional 2.0 to 2.7 Bcfd at that location. New pipeline requirements could include construction of 45 to 50 miles of on- and offshore pipeline. 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 and about 45 miles from the Golden Pass Project site. The vaporized natural gas would be transported from the proposed facility into the existing interstate natural gas pipeline system through five segments of 16- to 36-inch-diameter offshore pipeline totaling about 75.6 miles. The Gulf Landing Project would have the capability of storing up to 180,000 m^3 of natural gas, and vaporizing and transporting up to 1.2 Bcfd of natural gas to U.S. markets.

The Gulf Landing Project would use two GBSs, each approximately 1,100 feet by 248 feet, for the offshore terminal that would be anchored to the sea bottom in about 55 feet of water. Each GBS would consist of a large concrete structure designed and fabricated to provide a secure foundation for the LNG tanks, and a supportive deck for accommodating all of the regasification equipment, utilities, and other related facilities (living quarters, metering, workshops, helicopter access, etc.). Berthing facilities

(mooring and breasting dolphins and unloading platforms) would be able to accommodate up to 135 LNG ships per year, ranging in size from 125,000 m^3 to 165,000 m^3. The GBSs would be initially built onshore, towed to the site, and installed on the seabed. The Coast Guard issued a draft EIS for the project in June 2004 and the final EIS in December 2004. A final Record of Decision for approval was issued in February 2005, and the terms of the license are now under review.

For this project to accommodate the volumes proposed by Golden Pass, an additional two to three GBSs would be required, affecting between 150 and 300 acres of shoreline for the graving docks. In addition, 75 or more miles of pipelines may be required both onshore and offshore to provide takeaway capacity for the added volumes. As with the Port Pelican Project, the environmental impact associated with construction of the GBSs on land, combined with construction of additional new offshore and onshore pipelines, likely would be equal to or greater than the impacts associated with construction of the proposed Project.

Compass Port Project

In March 2004, Compass Port LLC (a wholly owned subsidiary of ConocoPhillips Company) filed an application (Docket No. 17659) with the Coast Guard for a Deepwater Port License for its Compass Port Project in the Gulf of Mexico. The project would consist of two GBSs, with docking facilities for one LNG ship, two LNG storage tanks and regasification facilities, located in 70 feet of water, approximately 11 miles south of Dauphin Island and about 15 miles off the coast of Alabama. The project would also involve construction of approximately 27 miles of offshore and 5 miles of onshore[2] 36-inch-diameter sendout pipeline to connect the deepwater port with existing natural gas pipelines near Coden, Alabama. The application was determined to be complete in May 2004. The draft EIS was issued in February 2005, and meetings to take comments on the EIS were conducted in early March 2005.

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

To accommodate the volumes proposed by Golden Pass, this project would require an additional two to three GBSs for the three LNG storage tanks and potentially two large diameter pipelines (each 27 miles long) to move the natural gas to shore and interconnect with the existing natural gas pipeline system. Additional environmental impacts associated with an expanded Compass Port facility would include up to 140 acres of land for construction of the GBSs, an offshore facility footprint that would be nearly three times that proposed (or about 90 acres), and a subsea construction disturbance of approximately 1,300 acres for two 27-mile-long pipelines based on a 200-foot-wide construction right-of-way. Thus, the environmental impact associated with expansion of the Compass Port Project would be similar, if not greater, than the impacts associated with construction of the proposed Project.

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,

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

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 0.5 mile north to Johnsons Bayou, and then one 42-inch-diameter pipeline would continue north for about 64 miles to an interconnection with Transco near Starks, Calcasieu Parish, Louisiana.[3] Other interconnections include five interconnects at Johnsons Bayou (Tennessee Gas, NGPL, Transco and two others) and four along the pipeline route (Florida Gas, Tennessee Gas, TETCO, and one other). The application was determined to be complete in July 2004 and the draft EIS was issued in April 2005.

A number of commenters who live on Pleasure Island support development of the Pearl Crossing project as an alternative to the proposed project because it would eliminate their safety concerns associated with unloading of the LNG ships in close proximity to their homes. Golden Pass states that the Pearl Crossing LNG project is a complementary facility designed to establish diversity in the supply of LNG to another regulation market and beyond. In any case, to accommodate the volumes proposed by Golden Pass, the capacity of the Pearl Crossing LNG project would need to be approximately doubled, resulting in a minimum of one to two more GBSs in the Gulf of Mexico, and an additional 53 miles of offshore pipeline and 65.1 miles of onshore pipeline. To allow natural gas deliveries to the interconnections identified in both projects, the proposed Golden Pass pipeline system would need to be developed. This would require an additional 4 to 5 miles of onshore pipeline connecting the Pearl Crossing pipeline to the Golden Pass pipeline system. Environmental impacts associated with expansion of the Pearl Crossing LNG project to transport the natural gas volumes for the proposed project would be similar to, if not greater than, those associated with construction of the proposed Project or of both projects independently.

However, we note that both the Golden Pass and Pearl Crossing projects have interconnects at NGPL, Tennessee Gas, Florida Gas, TETCO, and Transco. Except for the interconnects at TETCO and Transco where the sendout pipelines from both the Golden Pass and Pearl Crossing LNG projects are collocated along the Transco pipeline right-of-way, these interconnections are at different locations. Therefore, it may be possible to shorten the length of the proposed pipeline system for either or both projects if the other common interconnects (*e.g.*, NGPL, Tennessee Gas, Florida Gas) could accept deliveries from both pipeline systems at the same location. However, these multiple interconnections as proposed for each project allow for diversity of supply to the interstate and intrastate markets.

3.2.2.3 Reuse of Existing Platforms

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

Main Pass Energy Hub Project

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

[3] 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.

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, and more than 300 miles from the proposed Golden Pass site on the Port Arthur Channel. The Main Pass Energy Hub Project would make use of existing platforms and other infrastructure in the Gulf of Mexico, including a nearby salt dome for underground storage of up to 28 Bcfd of natural gas and would have the capability of a peak deliverable volume of 3.1 Bcfd of natural gas to U.S. markets. The existing offshore platform facility was constructed in 1992 and would be reconfigured to consist of an LNG berth, LNG surface storage of up to 145,000 m^3, vaporization and compression facilities, living quarters, and associated facilities. Approximately 192 miles of offshore pipeline and 5.1 miles of onshore[4] pipeline would be constructed to connect the terminal to the existing pipeline infrastructure. The application was determined to be complete in June 2004, and the draft EIS is under preparation.

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 Golden Pass natural gas volumes (480,000 m^3), but it may be unable to accommodate the proposed number of LNG ships (up to 300 ships per year) without additional berths, and possibly additional platform construction, or the proposed sendout (2.6 Bcfd) without construction of additional, or larger, takeaway pipelines.

3.2.2.4 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 an onshore LNG terminal such as that proposed by Golden Pass. In addition, permanent staffing and personnel requirements for the proposed LNG terminal would be about one-fourth that needed for an offshore facility.

An LNG import terminal that is located in an offshore setting would be exposed to the effects of meteorological and oceanographic forces such as high winds, waves, and currents. A key technical issue for the successful operation of an LNG terminal in this environment includes designing the LNG transfer system (*i.e.*, unloading arms) to compensate for the relative motion between the terminal and LNG ship during unloading operations. Although storage and unloading technologies similar to those that would be used with an offshore LNG terminal have been applied for many years at onshore LNG terminals and at offshore petroleum product facilities (LNG Express, 2002), the technologies needed to transfer a cryogenic liquid under the harsher conditions in an offshore setting have not been demonstrated. This may be particularly problematic for offloading to a FSRU where the stresses on a transfer system could be even greater than what would be experienced at a stationary GBS or an existing platform. For a GBS, an

[4] 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.

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. Golden Pass proposes to use closed system vaporization (SCVs), which avoids the need for continuous large volume water withdrawal and discharge, and any potential impacts on aquatic 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. An offshore alternative to the proposed Project would need to be located a minimum of 40 miles offshore to allow for safe berthing of the LNG ships. 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 expansion of the Pearl Crossing LNG project (the closest planned offshore LNG facility) is unlikely to be able to accommodate transportation of the 2 Bcfd proposed by Golden Pass and that the new Golden Pass pipeline system would still need to be constructed to allow distribution of the vaporized LNG to multiple interconnects with existing intrastate and interstate pipelines. Because the existing offshore pipeline network is currently at its design capacity, the existing system would have to be expanded to transport the 2 Bcfd for Golden Pass. In addition, the Gulf Landing, Port Pelican, Main Pass Energy, and Compass Port LNG projects are designed to serve the Louisiana (Port Pelican, Main Pass Energy) and Alabama (Compass Port) markets, not the Texas markets. Therefore, expansion of these projects would not meet one of the objectives of the proposed project – namely, to provide natural gas to the Texas intrastate and interstate markets, including the ExxonMobil Beaumont refinery complex.

One of the tradeoffs for the regasification vessel technology is that it requires a dedicated LNG fleet with vaporization equipment on all of the vessels. This fleet does not exist, although three EPEBVs are on order for the Energy Bridge GOM Project. Additionally, it would take up to 6 days to unload a ship at a maximum design rate of about 0.5 Bcfd, and no fixed LNG storage would be provided. Further, since the STL buoy must be located in waters between 130 to 490 feet deep, this could significantly increase the length of offshore pipeline and associated environmental impacts. Finally, to maintain continuous sendout, two buoys likely would be required to transition between successive ships. With a one STL buoy system, the first ship would have decreased sendout as the cargo tanks are emptied, the ship disconnects, the buoy is lowered, and the ship releases its moorings and departs. The incoming ship then would reverse this procedure before being able to reestablish full natural gas sendout. A two STL buoy system would avoid this disruption.

One of the more significant tradeoffs for the GBS technology is the potential for environmental impacts associated with fabrication of the GBS within a graving dock. The final EIS for the Port Pelican Project

indicated that each of the project's two GBS units would be 210 feet wide by 500 feet long. The Gulf Landing Project GBS units are about twice as large. Fabrication of the GBSs would require between 50 and 100 acres of land and adequate infrastructure to move materials and workers to the site. The graving dock also must be located along the shoreline so that, when construction is complete, the GBS can be floated (in water about 45 feet deep) and towed to its final destination. While the level of impact would depend on whether the graving dock is located in an undisturbed or disturbed area, dredging would probably be required because many of the western Gulf Coast channels are 42 feet deep or less. It is also likely that wetlands could be dredged or filled because the Texas/Louisiana shoreline in the Project area is mostly wetland. There are no existing graving dock facilities in the U.S. of the size needed for a GBS. Fabrication of the GBS outside of the western Gulf Coast area and floating it into the offshore Louisiana/Texas area would increase costs and could potentially interfere with shipping.

3.2.2.5 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 Golden Pass LNG Terminal and Pipeline Project and would likely result in a similar level of (although different) environmental impacts (see table 3.2.2-2).

TABLE 3.2.2-2

Summary of the Expansion Potential of Approved or Proposed Offshore LNG Facilities

LNG Project	General Location	Expandable to 2 Bcfd of Storage	Ability to Handle 200 more LNG ships/year	Ability to Serve Proposed Market	Pipeline System (miles)
Proposed Golden Pass	Jefferson, TX	Yes	Yes	Yes	122.5 a/
Energy Bridge GOM	Offshore LA	No	New ships needed	Possibly	Over 128 b/
Port Pelican	Offshore LA	Yes – 2 more GBS	Yes	Possibly	Over 165 b/
Gulf Landing	Offshore LA	Yes – 2 more GBS	Yes	Possibly	Over 198 b/
Compass Port	Offshore AL	Yes – 2 more GBS	Yes	No	c/
Pearl Crossing Port	Offshore LA	Yes – 2 more GBS	Yes	Yes	Over 172 b/
Main Pass Energy Hub	Offshore LA	Yes	Yes	No	c/

a/ Includes the entire Golden Pass pipeline system (Mainline, Loop, and Beaumont Lateral).
b/ Assumes that each facility would need to construct its proposed offshore and onshore pipelines as well as the Golden Pass pipeline system. Not included is the length of pipeline needed to connect the Golden Pass pipeline system with the other LNG facility pipeline system.
c/ Project serves a different regional market and is over 300 miles from the proposed Golden Pass LNG terminal. Therefore, it is difficult to estimate the number of miles of pipeline that would be required to transport natural gas to the proposed interconnections, including the ExxonMobil Beaumont refinery complex.

The proposed Project would provide berthing for LNG ships of up to 250,000 m^3, storage for approximately 775,000 m^3 of natural gas, a sendout capacity of 2 Bcfd, and a pipeline system to connect to the existing natural gas infrastructure. In comparison:

- Use of the new specially-designed regasification vessels (or EPEBVs) with transport capacities of 138,000 m^3 would provide less delivery capacity, lack LNG storage, and may be less reliable due to transitioning between incoming and outgoing EPEBVs.

- While 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).

- Because one of the objectives of the Golden Pass Project is to provide natural gas to the Texas market, including the ExxonMobil Beaumont refinery complex, expansion of any one of the planned offshore LNG terminals would require construction of onshore pipeline of equal or greater length to that of the proposed project.

Based on the above, we found that none of the offshore alternatives could provide 2 Bcfd of natural gas to the Golden Pass interconnects without equal or greater offshore and onshore environmental impacts.

3.3 ONSHORE LNG TERMINAL SITE ALTERNATIVES

The examination of alternative sites for an LNG terminal typically involves a review process that considers environmental, engineering, economic, safety, and regulatory factors. The first step in the selection of an LNG terminal site is the identification of the most suitable regional area (and associated port locations) that would meet the objectives of the Project, based on natural gas demand, existing pipeline infrastructure, and other market factors, including specific customer needs and delivery points. Port locations that pass the initial screening criteria are then evaluated against additional criteria that focus on specific attributes of the ports, such as access to pipeline infrastructure, shipping traffic, and dredging requirements. The final step involves an assessment of suitable sites within the remaining port location to identify the preferred site. The following sections describe the site alternative analyses completed by Golden Pass. Our conclusions are in section 3.3.4.

3.3.1 Regional Alternatives

In conducting its site selection study for the proposed Project, Golden Pass identified the Gulf of Mexico as providing the most favorable location to achieve the purpose of the proposed Project. This region provided:

- proximity to the ExxonMobil Beaumont Refining Complex;

- availability of adequate pipeline takeaway capacity that would enable imported volumes of natural gas to reach multiple markets in the U.S.;

- availability of multiple interconnection points to existing intrastate and interstate pipeline systems; and

- familiarity of the communities and regulators in this region with the oil and gas industry that leads to acceptance of the industry.

The Gulf of Mexico has a well developed natural gas pipeline infrastructure with a takeaway capacity in excess of 27 Bcfd. It is also the closest deep water area to the existing ExxonMobil Beaumont refinery complex, which is an important objective and delivery point for the Project. The initial screening

included 20 port locations in three general regions in the Gulf of Mexico (see figure 3.3.1-1 and table 3.3.1-1).

TABLE 3.3.1-1

Potential LNG Terminal Locations in the Gulf of Mexico Region

Region	Proximity to Desired Market a/	Existence of Adequate Takeaway Capacity	Deep Water Port b/
Gulf of Mexico – Texas			
Brownsville, TX	No	No	Yes
Port Isabel, TX	No	No	No
Port of Mansfield, TX	No	No	No
Corpus Christi, TX	No	Yes	Yes
Aransas, TX	No	No	Yes
Port Lavaca, TX	No	No	Yes
Freeport, TX	No	Yes	Yes
Galveston, TX	Yes	Yes	Yes
Texas City, TX	Yes	Yes	Yes
Houston, TX	Yes	Yes	Yes
Beaumont, TX	Yes	Yes	No
Orange, TX	Yes	Yes	No
Port Arthur, TX	Yes	Yes	Yes
Sabine Pass, TX	Yes	Yes	Yes
Gulf of Mexico - Louisiana			
Port Cameron, LA	Yes	Yes	Yes
Gulf of Mexico – Mississippi, Alabama, and Florida			
Pearl River, MS	No	Yes	Yes
Gulfport, MS	No	No	No
Pascagoula, MS	No	No	Yes
Mobile Bay, AL	No	Yes	Yes
Pensacola, FL	No	No	No

a/ Port location is located within 100 miles of desired market area (Beaumont, TX).
b/ Existing channel depth greater than 40 feet.

Within the three regions, potential port locations were eliminated from further consideration if they did not possess all of the minimum requirements needed to satisfy the stated purpose and need of the Project. These minimum requirements were proximity to the desired market (within 100 miles of the Beaumont-Port Arthur area), adequate nearby takeaway capacity (over 2 Bcfd) of the existing pipeline system, and deep water (a channel with a depth of 40 feet). Using these criteria, 15 of the 20 potential port locations were eliminated. The remaining six port locations (Galveston, Texas City, Houston, Port Arthur, Sabine Pass, and Cameron) were evaluated further.

0 37.5 75 150 Miles

Figure 3.3.1-1
Potential LNG Terminal Locations
in the Gulf of Mexico

Golden Pass LNG Terminal and Pipeline Project

Jefferson, Orange & Newton Counties, TX
and Calcasieu Parish, LA

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3.3.2 Port Alternatives

The next step in the process was to evaluate the remaining five port locations to identify the preferred port for development of the LNG facility. The ports of Galveston, Texas City, Houston, Port Arthur, and Sabine Pass met the initial Project criteria. These ports also provided market or customer access points that correspond to industrial demand which centers on port activities. Golden Pass used the following criteria to evaluate port alternatives:

- Sites with easy access to multiple existing intrastate and interstate pipelines were preferred to accommodate the 2 Bcfd from the proposed LNG terminal, facilitate routing, and minimize the length of the sendout pipeline;

- Ship channels with a low shipping volumes were preferred to minimize potential delays to existing ship traffic; and

- Deeper and wider channels were preferred to better accommodate the large LNG ships and reduce new dredging requirements.

Golden Pass reviewed each port location to determine the viability of these locations for development of the proposed Project. Table 3.3.2-1 summarizes the results of this screening. Additional port-specific information on the six remaining port areas is presented below.

TABLE 3.3.2-1

Results of Screening of Potential LNG Terminal Locations in the Gulf of Mexico Region

Port Location	Ease of Access to Interstate Pipelines	Approximate Ship Volume (ship calls/year)	Approximate Channel Depth/Width (feet)
Galveston Bay			
Galveston, TX	No	>6,800 a/	42 / 800
Texas City, TX	No	>6,800 a/	40 / 400
Houston, TX	Yes	>6,800 a/	40 / 400-600
SNWW			
Port Arthur, TX	Yes	>1,600	40 / 400
Sabine Pass, TX	Yes	>1,600	40 / 500
Calcasieu Ship Channel			
Port Cameron, LA	No	> 1,100	40 / 400

a/ Includes ship traffic for Galveston, Texas City, and Houston.

Galveston, TX – This port does not have easy access to interstate pipelines. Easy access is only to small diameter intrastate natural gas pipelines that serve specific local markets. Access to the larger interstate natural gas pipeline systems to provide adequate takeaway capacity would require construction of new pipeline(s) that would need to be placed offshore in Galveston Bay to avoid the Greater Houston area. In addition, because this port is at the approach to Galveston Bay, it has the highest volume of ship traffic as the approach serves the Galveston, Texas City, and Houston ports. For these reasons, Golden Pass eliminated the Port of Galveston from further consideration.

Texas City, TX – Like Galveston, this port has easy access only to small diameter pipelines and would require construction of new offshore pipeline(s) to access the larger interstate market. It is also located upstream of Galveston where ships over 550 feet (such as LNG ships) are restricted to one-way travel,

resulting in delays to existing ship traffic. For these reasons, Golden Pass eliminated the Port of Texas City from further consideration.

Houston, TX – The Port of Houston is a 25-mile-long complex of public and private facilities located about 30 miles from the Gulf of Mexico. The port is ranked first in the U.S. in foreign waterborne commerce and is the sixth busiest port in the world. It also has the highest surrounding population density of the five port locations evaluated. As with Texas City, the main shipping channel is too narrow to allow large ships to pass side-by-side, requiring additional scheduling and potential delays to shipping traffic from the one-way travel restriction. For these reasons, Golden Pass eliminated the Port of Houston from further consideration.

Port Arthur, TX – This channel has far less ship traffic than Galveston Bay, but is narrow in the upper reaches, which increases marine traffic congestion. In addition, population density increases toward the city center areas of Port Arthur and large tracts of undeveloped waterfront property are limited. For these reasons, Golden Pass eliminated areas at the northern end of the Port Arthur ship channel from further consideration for this Project.

Sabine Pass, TX – This channel has relatively low ship traffic and has a wider channel compared to the other port areas considered. This port area is the closest to the ExxonMobil Beaumont Refinery and has reasonable access to connections to both interstate and intrastate pipeline systems. For these reasons, Golden Pass determined that the Sabine Pass port area in Texas best met the requirements of proposed Project.

Port Cameron, LA – Port Cameron, an area off the Calcasieu River upstream of a potential turning basin near Cameron, has sufficient acreage but is located in a narrow part of the channel. This would require widening and deepening the channel, and careful consideration to the design of the LNG ship berths to avoid impact to ship traffic. In addition, properties in the area were already commercially acquired and developed, and not available. Further, the site does not have easy access to the Louisiana pipeline system and a much longer pipeline would have to be constructed to serve southeast Texas markets. For these reasons, Golden Pass eliminated the Port Cameron area from further consideration for the Project.

3.3.3 Site Selection

Within the Sabine Pass port area on the SNWW, there are three potential areas other than the proposed site that could be developed for an LNG terminal facility:

- Sites on the east side of the Sabine Pass Channel in Cameron Parish, Louisiana. A site on an old DMPA has been leased by Sabine Pass LNG, L.P. and is not available for development by Golden Pass. Potential sites south of this site that would be large enough for an LNG facility are in predominantly undisturbed wetlands. For these reasons, potential sites in Louisiana on the Sabine Pass Channel were eliminated from further consideration.

- Sites north of the proposed Golden Pass site in Jefferson County, Texas on the Port Arthur Channel. Most of the land north of the proposed site is owned by Sempra Energy LNG and is not available for development by Golden Pass. Sempra Energy LNG is in fact, developing its own LNG project. For these reasons, this site was eliminated from further consideration.

- Sites south of the proposed Golden Pass site in Jefferson County, Texas on the Sabine Pass Channel. All potential sites south of the proposed site would be within Texas Point National Wildlife Refuge and can not be developed for an industrial facility. For this reason, these sites were eliminated from further consideration.

The proposed site is zoned for industry, is available for development, is large enough to accommodate an LNG facility, and has access to the Port Arthur Channel. The site is mostly upland pasture located within an inactive DMPA.

3.3.4 Conclusions

Because development of an onshore LNG import terminal requires a shoreline site with ocean access, development of new sites having the appropriate characteristics (in particular deepwater access for shipping) would have a greater environmental impact than use of existing port areas with established shipping infrastructure. Therefore, we agree that the evaluation of site alternatives would need to be focused on sites within existing port areas and within previously disturbed locations. We also conclude that ports outside of a 100-mile radius are not practical because they are too far from the Beaumont area to provide natural gas to the ExxonMobil refinery complex without development of a much longer pipeline system than that currently proposed. This includes ports in the Galveston and Houston area that also have large existing volumes of ship traffic, and the Port Cameron area where there would be difficulties associated with development of a site on the Calcasieu Channel, primarily because of the lack of available industrial/commercial sites and nearby pipeline systems.

Along the SNWW, two sites are currently planned for development of LNG facilities and are controlled by others. Sites, other than the one proposed by Golden Pass, are either in the Texas Point National Wildlife Refuge, which is not available for development, or within predominantly undisturbed wetland areas. The proposed Project would be mostly located on land that has been historically used for dredge material placement, and best fulfills the technical and economic criteria required to meet the Project objectives. Therefore, we conclude that there are no practical alternative sites which meet the Project purpose and that offer a clear environmental advantage to the proposed Golden Pass LNG terminal site. We also note that, if the U.S. is going to use LNG to meet rising energy demand and replace declining domestic production of natural gas, multiple LNG import terminals will be required.

3.4 ALTERNATIVE LNG FACILITY CONFIGURATIONS

We reviewed the site plan for the LNG tanks and marine basin to determine if there were alternative configurations that would minimize impacts on wetlands. As proposed, Golden Pass has placed its facilities to maximize use of the upland portion of its property that was previously used as a DMPA. Therefore, we identified no alternative facility configurations that would result in any significant reduction in wetland impacts.

However, 16 percent of the wetlands permanently affected at the LNG terminal site would be associated with construction and operation of the secondary access road (17.2 acres of the total 108.8 acres). The secondary road as proposed would be about 7,500 feet long (1.4 miles). Golden Pass states that the location of the easement for the proposed secondary access road was developed in negotiations with multiple affected property owners who are already burdened with other easements on their land. Golden Pass does not own the land outside its property so the route for the secondary access road must be acceptable to these landowners. Although an alternate, shorter route could be identified for this access road that would shorten its overall length, the alternate likely would affect a proportional amount of wetlands because the entire area between the Golden Pass property and SH 87 is predominantly wetlands. Since Golden Pass is not granted the right of eminent domain with authorization of the LNG terminal, the route for the access road must be acceptable to the affected landowners. Therefore, we conclude that there is no other practical alternative for the secondary access road.

3.5 DREDGE MATERIAL PLACEMENT ALTERNATIVES

Golden Pass identified and evaluated 34 alternative sites for disposal of dredge materials from the marine basin and berth area. Sites evaluated included existing onshore DMPAs along the SNWW and offshore DMPAs in the Gulf of Mexico. The initial range of sites included active DMPAs currently utilized by the COE and the Jefferson County WND, as well as beneficial use areas within J.D. Murphree WMA and off the Texas Point NWR. The evaluation primarily considered the availability and capacity of each alternative site.

3.5.1 DMPA Availability

The majority of the existing disposal sites along the SNWW are upland confined disposal sites. Upland confined disposal sites have levees on all sides with a weir structure that allows the decant water to flow back into a main waterway. The dredged material is pumped into the disposal site at different locations to allow the material to be placed as evenly as possible and begin to dewater. The weir structure is used to contain the decant water until the suspended solids are at or below the level of the surrounding water body. Once the suspended sediments have settled out, the decant water is released to flow back into the adjacent waterbody. Fully confined areas have a finite capacity for containing dredged material based on the size of the site and the height of the levees.

The remaining disposal sites are unconfined sites. Unconfined disposal sites are in open water or emergent sites on land with no containment structures to confine the dredged material. The dredged material is pumped to the site through a pipeline or dumped from a scow or hopper dredge and allowed to flow across the area. Emergent unconfined sites are typically upland areas created for beneficial use. Only six of the disposal areas that were identified within the SNWW system are unconfined sites, with five of these sites being offshore in the Gulf of Mexico.

In its comments on the draft EIS (April 26, 2005), Golden Pass submitted an updated Dredged Material Management Plan that expanded the evaluation of potential PAs to include additional beneficial use sites within the J.D. Murphree WMA as well as the additional soil and sediment sampling conducted in March 2005. As part of its evaluation of the 34 potential disposal sites, Golden Pass consulted with the COE, Jefferson County WND, and the TXPWD to determine the availability of these existing sites for dredged materials. Based on these contacts, 24 sites were removed from further consideration: including four offshore unconfined sites because these four sites are allocated for maintenance dredging the SNWW and the potential for offshore disposal of fine materials to degrade area beaches. Also eliminated were 20 confined sites because they are allocated for use by local projects only. We reviewed the documentation provided by Golden Pass and concur with the elimination of these sites. The remaining ten PAs are shown on figure 3.5.1-1 and listed in table 3.5.1-1. All ten sites are close enough to the LNG terminal site to allow dredge material to be removed by hydraulic dredging. The next phase of Golden Pass' evaluation focused on the capacity of the PA to accommodate dredge materials from the Project.

The Texas Point ocean disposal site is an unconfined placement area just on the northwest side of the jetty near Texas Point. The site is part of the Texas Point National Wildlife Refuge (NWR) managed by the FWS. In the past, approximately 1 million yd^3 of maintenance dredging material from the Sabine Jetty Channel has been placed at the site for beneficial use. This site is located about 8.1 miles from the LNG terminal property and is close enough for hydraulic dredging and placement of material. Golden Pass dropped this PA from further evaluation because it is unknown at this time how much material is needed for beneficial use and what types of material are needed. It is also one of the more distant PAs and would require additional pipeline and pumps to move the dredge material to the site. We concur with the elimination of this PA.

Non-Internet Public

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE
GOLDEN PASS LNG TERMINAL AND PIPELINE PROJECT
Docket Nos. CP04-386-000 and
CP04-400-000

Figure 3.5.1-1
Alternative Available Dredge Material Placement Areas

TABLE 3.5.1-1

Potentially Available DMPA Sites

Disposal Site	Existing Site Condition	Type of Disposal Site	Distance to LNG Site (miles)	Evaluation/Comments
Texas Point (ocean disposal)	Wildlife Refuge	Unconfined	8.5	Operational constraints and limitations unknown at this time.
J.D. Murphree WMA (beneficial use areas)				
Pintail Flats	WMA	Unconfined	4-5	The TXPWD can use 12 to 16 inches of fluid mud fill over select areas for beneficial use to reclaim degraded (open water) marshes.
Mud Lake	WMA	Partially confined	4	
Johnson Lake North	WMA	Partially confined	3 – 5	
Keith Lake North	WMA	Partially confined	2 – 3	
Keith Lake Island Delta	WMA	Partially confined	2	
Temporary stockpiles for pipeline fill	WMA	Partially confined	2.5 – 3.5	
PA-8	Active DMPA	Confined	2 - 7	Levees and discharge structure would need to be rebuilt. Discharge locations determined by COE.
PA-9	Inactive DMPA	Confined	5	Levees and discharge structure would need to be rebuilt. Site dormant for 20+ years.
PA-11 (Pleasure Island)	Active DMPA	Confined	9 - 12	Levees and discharge structure would need to be rebuilt.

The J.D. Murphree WMA beneficial use areas include:

- Pintail Flats Areas A through E, and Far West End Flats – These sites are wetland enhancement and restoration projects to protect the marsh from saltwater intrusion and replace eroded or subsided soils. Areas A through E are open water areas, with Area A being the largest. The Far West End Flats are not open water and are about three times the size of Area A.
- Mud Lake, Johnson Lake North, and Keith Lake North Shoreline – The goal for these areas is to restore eroded shorelines of the larger lakes in the WMA.
- Keith Lake Island Delta – The goal for this area is to install a set of islands near the entrance to Keith Lake to mitigate saltwater intrusion from Keith Lake Cut, which connects Keith Lake to the Port Arthur Channel. The islands would be placed in a tightly spaced island network emulating a delta which would impede flow into and out of the Keith Lake Cut.
- Stockpiles – The temporary stockpiles for pipeline fill are semi-confined placement areas along the northern shoreline of Johnson and Keith Lakes. Dredged material placed in these areas wold be used as needed for additional cover to restore original grade for the pipelines from the LNG terminal.

Initial results from chemical testing of soil and groundwater samples indicated concentrations of several metals that exceeded the most conservative ecological benchmarks and soil to groundwater protective concentration limits..[5] However, in March 2005, Golden Pass conducted additional soil and sediment sampling at the LNG site, and marine basin, and in the Pintail Flats Area A. The results of this additional sampling found that the dredge materials would be suitable for beneficial reuse in the J.D. Murphree WMA.

PA-8, PA-9, and PA-11 are available to accept the clayey sand and silty sand material present within the marine terminal and berth area and were carried forward for further evaluation. PA-8 and PA-11 are currently active DMPAs and have storage for additional material. PA-9 is an inactive site that has not been used in over 20 years, but is available to receive material. The levees and discharge structures at each of these areas would need to be reconstructed/improved prior to use.

3.5.2 DMPA Capacity

The capacity of the remaining disposal sites was determined through consultation with the Jefferson County WND, TXPWD, and COE. The maximum capacities for PA-8, PA-9, and PA-11 were estimated by Jefferson County WND using a maximum levee height of +30 feet MLT (+29 feet MLLW) and compared that to the quantity of material that would be expected to be dredged. The capacities for the beneficial use site in the J.D. Murphree WMA were estimated from information provided by the TXPWD. Table 3.5.2-1 provides additional information on the capacity of the available DMPAs

TABLE 3.5.2-1

Capacity of Available DMPAs

Disposal Site	Owner	PA Size (acres)	Estimated Capacity (million yd^3)	Approximate Distance to Site (miles)
J.D. Murphree WMA (beneficial use areas):				
Pintail Flats	TXPWD			
Area A		245	1.2	4
Areas B through E		101	0.5	4
Far West End		740	2.0	5
Mud Lake	TXPWD	45	0.15	4
Johnson Lake North	TXPWD	100	0.41	3 - 5
Keith Lake North		85	0.35	2 - 3
Keith Lake Island Delta	TXPWD	23	0.2	2
Temporary stockpiles for pipeline fill	TXPWD	60	0.34	2.5 - 3.5
PA-8	COE/City of Port Arthur	~3,000	152 a/	2 - 7
PA-9	Jefferson County WND	~900	4.3 a/	5
PA-11 (Pleasure Island)	COE/ Jefferson County WND	~1,400	92 a/	9 - 12

a/ Capacity based on raising the levee to 30 feet MLT.

Golden Pass estimates that the total amount of material to be dredged during construction of the marine basin and berth areas would be about 6.3 million yd^3. Golden Pass also agreed to mitigate for permanent

[5] TXCEQ Texas Risk Reduction Program's Tier 1 residential Protective Concentration Levels for soil and Ecological Benchmarks for soil as provided in the TXCEQ's *Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas* (December 2001, RG-263 (revised)) as the more conservative of the terrestrial plant and earthworm benchmark values.

wetland impacts resulting from construction and operation of the Project through restoration of eroded coastal marsh within the J.D. Murphree WMA. Therefore, Golden Pass evaluated potential PAs based on their ability to accommodate all of the dredge material and/or meet wetland mitigation goals. As a result, Golden Pass determined that all of the sites within the J.D. Murphree WMA, with the exception of Pintail Flats Area A, were too small to meet mitigation goals. Pintail Flats Area A can accommodate 1.2 million yd^3 of dredge material and would meet wetland mitigation requirements.

Two of the upland confined sites (PA-8 and PA-11) are large enough to contain all of the dredge material. The maximum capacity at PA-9 is only 4.3 million yd^3 and could not accommodate all of the dredged material, even with the allocation of 1.2 million yd^3 to Pintail Flats Area A for wetland mitigation. Since the dredging and delivery method would be identical for all disposal sites, the only cost differential would be based on the amount of pipeline necessary to perform the pumping operation. The fewest miles of pipeline would also minimize both cost and the potential for environmental impact. PA-11 is the furthest from the LNG site (9 to 12 miles) and was eliminated for that reason. Although PA-8 and PA-9 were considered viable options, PA-8 was preferred for initial dredge material placement because of its larger size.

3.5.3 Maintenance Dredging

Maintenance dredging of the marine terminal and berth area is estimated to be approximately 410,000 yd^3 per year, and would be performed every 2 years (820,000 yd^3) or as needed. Although the general requirements for the DMPA for maintenance dredging would be similar to that for initial dredging, the PA would need to be capable of containing all of the maintenance dredge material over the 25-year operational period (nearly twice the original dredge material volume) and would also need to be as close as possible to the LNG terminal because of the smaller quantities of dredge materials (about 14 percent of the original dredge material volume) and smaller equipment that would be used. A smaller dredge would have less capacity to pump longer distances.

Of the two available upland confined disposal sites (PA-8 and PA-9), PA-8 could individually contain all the operational dredge materials. PA-8 is the largest disposal site at approximately 3,000-acres and has enough capacity to contain all of the maintenance dredge material over the expected 25-year operational period. It is also the closest site. So, PA-8 was the preferred PA for maintenance dredge materials as well.

3.5.4 Preferred DMPA Option

PA-8, located about 2 to 7 miles north of the LNG terminal site, is an active DMPA. PA-8 is the largest of the disposal sites at approximately 3,000 acres and has enough capacity to contain all of the new work dredged material from construction of the LNG marine basin and the material removed during maintenance dredging over the life of the Project. Pintail Flats Area A has enough capacity to meet wetland mitigation requirements for beneficial use within the J.D. Murphree WMA. Therefore, Golden Pass selected Pintail Flats Area A and PA-8 as the preferred DMPA options. However, Golden Pass states that both the COE and the Jefferson County WND have indicated that use of two DMPAs may be preferred over the use of one DMPA.

Our review of the alternative DMPAs considered by Golden Pass indicates that the use of Pintail Flats Area A, PA-8, or PA-9 would be acceptable. However, the final determination regarding which DMPAs would ultimately be utilized by Golden Pass would be made by the COE as part of its analysis of Golden Pass' permit applications.

3.6 VAPORIZATION TECHNOLOGY ALTERNATIVES

The vaporization system warms the LNG from its stored temperature of approximately -260° F to a temperature at which it can be sent out as natural gas in the send-out pipelines. Golden Pass considered four alternative vaporization technologies for the LNG terminal: submerged combustion vaporizer (SCV), seawater warmed vaporization; shell and tube vaporization (STV) with gas fired heaters; and air warmed vaporization. These technologies are described below.

3.6.1 Submerged Combustion Vaporizer (SCV)

With an SCV, LNG passes through a heat exchanger submerged in a water bath, which is directly heated by flue gas generated from the combustion of natural gas. The water bath is typically maintained at temperatures between 60 and 105º F. SCVs have high thermal efficiency (up to 98 percent on a high heating value basis). SCVs typically consume about 1.5 percent of the send-out natural gas from the terminal and use electricity to run air blowers.

Combustion water is generated in the course of the SCV process. Disposal of the excess combustion water requires treatment with alkaline chemicals to neutralize the acidity caused by absorbed carbon dioxide. Because the SCVs are heated by the combustion of natural gas, they produce air emissions, particularly NO_X. Ultra-low NO_x burner tips can be used with SCV technology to reduce the NO_x emissions. SCVs are in use at LNG terminal facilities at Elba Island, Georgia; and Lake Charles, Louisiana; and are approved for use at the Cameron LNG project near Hackberry, Louisiana. These sites are all located within air quality attainment areas. In nonattainment areas, use of SCVs with their higher NO_x emissions require additional regulatory review and approval. Because the proposed LNG terminal would be located within the Beaumont-Port Arthur area that is currently a nonattainment area for ozone, SCV emissions would not meet Best Available Control Technology (BACT) standards. Therefore, Golden Pass eliminated SCV technology from consideration for the proposed LNG terminal. We concur that SCV technology would not be the best technology for use at the Golden Pass LNG terminal because of the site's location within a nonattainment area and because the proposed technology (STV) would offer reduced air emissions.

3.6.2 Seawater Vaporization

Seawater may be used as the source of heat for vaporization. Seawater is typically chlorinated to protect the surface of the tube panel and the piping from biological growth. The volume of seawater required for this technology is a function of the allowable decrease in seawater temperature. If seawater temperature is above approximately 63 ^{o}F, seawater can typically serve as the sole vaporization technology for an LNG terminal. When temperatures drop to between 50 and 63 ^{o}F, supplemental heat is typically required.

Seawater vaporizers are widely used at international LNG terminal facilities in Japan and Korea, and have been proposed for the offshore Gulf Landing and Pearl Crossing deepwater LNG projects in the Gulf of Mexico. Use of seawater vaporizers has been approved for the Port Pelican deepwater LNG project. However, in estuaries and certain river environments, NOAA Fisheries opposes the use of seawater vaporizers and advised Golden Pass that it would require collection of extensive seasonal species baseline information and completion of demonstration projects for intake structures prior to approval of seawater vaporization for the proposed Project. Given these requirements and agency concerns over the use of seawater vaporization for the proposed Project, Golden Pass eliminated this technology from consideration. We concur that seawater vaporization could have a much greater impact on the aquatic environment and do not recommend its use.

3.6.3 Shell and Tube Vaporizer (STV) with Gas Fired Heaters

STV vaporization technology involves a heat exchanger in which tubes containing LNG pass through a counter-current of heat exchange media such as a water/glycol mixture. STVs have a slightly higher fuel gas consumption than SCVs resulting from the lower thermal efficiency of the fired heaters (85 to 90 percent on a low heating value basis). This results in a typical consumption of approximately 1.6 percent of the send-out natural gas from the LNG terminal. Because STVs are powered by the combustion of natural gas, they produce air emissions, particularly NO_X. However, this technology uses conventional gas-fired heaters, which can be constructed with effective emission control devices suitable for use in a non-attainment area. Similar to SCV technology, STVs can employ low NO_x burner tips to reduce emissions. Further reductions are possible through the use of SCR technology. Because this design uses a closed loop system, no water would be generated from the vaporization as would occur with use of SCVs. STVs are in use at LNG terminal facilities at Everett, Massachusetts; Cove Point, Maryland; and Guayanilla Bay, Puerto Rico.

Because STVs are a reliable, widely used, proven technology and can be installed with emissions control devices suitable for non-attainment areas, Golden Pass proposes to use both low NO_x burners and SCR emission reduction technology at the proposed LNG terminal site. This would result in an approximate two-fold reduction in emissions compared to SCV technology utilizing low NO_x burners alone (84 tons per year [tpy] compared to 42 tpy NO_x). We concur that use of STVs (with SCR) would minimize air emissions in this nonattainment area.

3.6.4 Ambient Air Heated Vaporizers

Ambient air heated vaporizers operate either in a natural draft mode or in a forced draft mode to vaporize LNG. However, SCVs or STVs would be required during winter months as a supplemental heat source. The Freeport project would use STVs where the circulating water/glycol solution would be heated by an air/water heat exchange tower (air tower) during warm weather and a fired heater or boiler at other times. Petronet LNG in India commissioned an LNG facility with ambient air heated vaporizers. However, Golden Pass eliminated this technology from further consideration because there is little operating experience to measure the success of the technology and because of the need to construct 100 percent standby heat capacity. We conclude that since ambient air heated vaporizers would not significantly reduce air emissions, this technology offers no advantage over STVs with SCR.

3.7 ELECTRIC POWER ALTERNATIVES

The LNG facility would require 35 megawatts of electric power. There are two alternatives to meet this power requirement: 1) purchase power from the public utility, which would construct either an overhead or underground powerline from the public utility to the LNG terminal site; or install an onsite electric generation facility at the LNG terminal site. Golden Pass considered onsite generation and determined that an onsite electric generation facility would increase site air emissions and would require additional capital costs.

According to Golden Pass, preliminary capital cost estimates indicate that it would cost about $35 million for Entergy (the public utility) to upgrade and/or construct a new powerline and a new substation to provide electricity to the LNG facility. By comparison, construction of a dedicated onsite electrical generation plant would be about $79 million. This estimate is based on installation of four 11-megawatt gas turbine generator packages, including a spare to provide redundancy during repair and routine maintenance of each generator set, and SCR air emissions control equipment to achieve BACT since the LNG terminal site would be within the Beaumont-Port Arthur non-attainment area. In addition, a major new source review would be required to satisfy air permit requirements, which could potentially result in

delays to the Project. For these reasons, Golden Pass eliminated onsite power generation from further consideration.

Because the proposed LNG terminal would be located within a nonattainment area, we conclude that purchasing power from Entergy would have less impact on air emissions without a substantial increase in other environmental impacts.

3.8 PIPELINE ALTERNATIVES

3.8.1 Pipeline System Alternatives

Our analysis of pipeline system alternatives included examination of the use of existing and proposed pipeline systems to meet the objectives of the proposed Golden Pass LNG Terminal and Pipeline Project. We also considered if shortening the overall length of the proposed pipeline system would still meet the Project objectives. The objectives as stated by Golden Pass include the transportation of vaporized LNG (2 Bcfd) into the Texas and Louisiana intrastate and interstate natural gas pipeline systems and delivery of natural gas to industrial customers in the Beaumont-Port Arthur area (including the ExxonMobil Beaumont refinery complex).

3.8.1.1 Use of Existing Pipeline Systems

Currently, there is no existing pipeline system that could be used to move the vaporized LNG from the proposed Golden Pass LNG terminal to the existing interstate and intrastate natural gas pipeline systems or to the 10 potential interconnects, and the ExxonMobil Beaumont Refinery identified by Golden Pass. There are two existing natural gas transportation systems near the Golden Pass terminal site: an interstate pipeline operated by NGPL and an intrastate pipeline operated by Centana. These systems have a total capacity of about 1 Bcfd and could not transport the additional 2 Bcfd proposed by Golden Pass to the intrastate and interstate markets, including the ExxonMobil Beaumont refinery complex without construction of a new pipeline system similar to that proposed. Since construction of similar facilities would result in similar environmental impacts, we conducted no further analysis of existing pipeline system alternatives.

3.8.1.2 Use of Proposed Pipeline Systems

There are three other LNG projects with proposed sendout pipelines in the same vicinity as the Golden Pass LNG Terminal and Pipeline Project: the Sabine Pass, Port Arthur, and Pearl Crossing Port projects. The sendout pipeline for the Sabine Pass project extends east for 16 miles from the Sabine Pass LNG terminal to Johnsons Bayou in Cameron Parish, Louisiana and is not a practical alternative for Golden Pass because it could not serve the same market segment.

The sendout pipelines for the Port Arthur project include an approximate 70-mile-long pipeline that generally extends northeast from the LNG terminal through Sabine Lake to Transco Compressor Station 45 in Beauregard Parish, Louisiana and a 3-mile-long pipeline extending south from the LNG terminal to an interconnection with NGPL at about the same location as Golden Pass' NGPL/Centana Interconnect. Potential interconnects include NGPL, Florida Gas, Tennessee Gas, TETCO, and Transco. The sendout pipeline for the Pearl Crossing Port project includes approximately 65 miles of onshore pipeline from the landfall south of Johnsons Bayou. The route for the pipeline generally extends north to Johnsons Bayou, west to Sabine Lake, and then northeast through Sabine Lake, north to the Golden Pass Tennessee Gas Interconnect, and then north along the Transco pipeline to the Golden Pass Transco Interconnect. Potential interconnects that are the same as Golden Pass include Tennessee Gas, NGPL, and Transco at the Johnsons Bayou interconnect, and Florida Gas, Tennessee Gas, and Transco.

Both the Port Arthur and Pearl Crossing Port pipelines are designed to transport the volumes from the respective LNG terminals. To transport the Golden Pass volumes (2.0 Bcfd), either one or both of the proposed pipeline systems would require modification, either by use of larger diameter pipelines, looping, or compression. Use of either system alternative would eliminate three of Golden Pass' planned interstate and intrastate interconnections (AEP Texoma, Beaumont-Port Arthur, and Channel). Further, it may not be possible for the existing pipelines along the route of either the Port Arthur or Pearl Crossing Port projects to accept the volumes from all three projects at these interconnects. Reducing the number of interconnections would limit the diversity of supply to the interstate and intrastate natural gas markets. For these reasons, we did no further analysis of a system alternative that would make use of these proposed sendout pipelines.

3.8.1.3 Use of a Shorter Proposed Pipeline System

The COE commented that most of the permanent wetland impacts to forested areas (90 percent or 57.7 acres) would occur north of Beaumont and the AEP Texoma Interconnect at MP 42.8. As shown in table 1.1-1, there is approximately 3.0 Bcfd of potential customer takeaway capacity between the LNG terminal and the AEP Texoma Interconnect with the remaining 3.4 Bcfd of potential customer takeaway capacity between the AEP Texoma and Transco Interconnects (MPs 42.8 to 77.8). Since Golden Pass proposes an average 2.0 Bcfd of sendout capacity from its LNG terminal, there may be sufficient takeaway capacity between the LNG terminal and the AEP Texoma Interconnect so that construction of the remaining 35 miles of mainline would not be required, thus avoiding impacts to these forested areas.

It is speculative to estimate actual available takeaway capacity on any of the 10 potential interstate and intrastate interconnects. Actual daily available transportation capacity would vary depending on demand and/or supply, and existing customer base, and may increase by 2007, when the proposed pipeline system would be constructed, due to general declining Gulf production trends. If the pipeline ended at MP 42.8, it would not interconnect with these interstate pipeline systems: Florida Gas (MP 44), Tennessee Gas (MP 72.8), TETCO (MP 75.8) and Transco (MP 77.8). As proposed, the pipeline system would diversify the transportation and market opportunities for shippers. This would allow shippers to choose any or all of these delivery points depending on their needs and transportation contracts with both Golden Pass and the interconnecting pipeline. Much of the diversity would be lost if the shorter pipeline were constructed and this would not meet the proposed purpose of the project. Because the Project would provide a new and reliable source of competitively priced natural gas to the region and the U.S., diversity in takeaway capacity is also an important consideration. Therefore, we do not believe that the pipeline system should be reduced in length.

3.8.2 Pipeline Design Alternatives

Our analysis included evaluation of Golden Pass' proposed 42.8-mile-long Loop to determine if the Loop could be eliminated by increasing the pipe diameter of the Mainline from 36 inches to 42 inches. Golden Pass stated that its design was based on optimizing the capacity and flexibility of the pipeline system to ensure that all of the natural gas from the LNG terminal reaches the market. To meet these market requirements, Golden Pass designed the pipeline system to transport an annual average of 2 Bcfd (with a plus/minus 10 percent daily variation), including the ability to supply up to 2.5 Bcfd to the AEP Texoma and Florida Gas interconnects (MPs 42.8 and 44.0, respectively), and up to 1.2 Bcfd to the Tennessee Gas, TETCO, and Transco interconnects (MPs 72.8, 75.2, and 77.8, respectively). This assumes that capacity on the NGPL pipeline system may be unavailable because of natural gas supplies from the Sabine Pass or Port Arthur projects.

Assuming a minimum delivery of 1.2 Bcfd to Tennessee Gas and Transco, Golden Pass established a design criteria of a maximum of 1,260 pounds per square inch gauge (psig) (or 1,257 psig operating pressure) for the sendout operating pressure from the LNG terminal, and a delivery pressure of 1,000 psig at Florida Gas (upstream of the interconnect) and 950 psig at Tennessee Gas (upstream of the

interconnect). The pipeline system as proposed would meet the design criteria with a delivery pressure of between 1,071 and 1,126 psig at Florida Gas and between 950 to 975 psig at Tennessee Gas. Use of a single 42-inch-diameter pipeline would not meet the design criteria, without the addition of an 11,000 horsepower (hp) compressor station. A single pipeline and the compressor station would allow for a delivery pressure of between 1,085 and 1,107 psig at Florida Gas and 950 psig at Tennessee Gas. Golden Pass states that it eliminated the single pipeline/compressor station alternative because of air emissions impacts over the life of the Project.

The addition of an 11,000 hp compressor station would result in additional air emissions in a nonattainment area. While construction of the Loop would involve wetland impacts, these can be minimized by implementation of our Procedures and other mitigation that may be required by the COE, including compensation for any permanent wetland losses. The FERC Engineering Branch staff reviewed the data provided by Golden Pass, and concurs that a 42-inch-diameter pipeline alternative would not meet the design criteria without the addition of an 11,000 hp compressor station and that the selection of a looped 36-inch-diameter pipeline alternative is reasonable. Therefore, we conclude that use of a single pipeline and associated compressor station would result in greater long-term impacts and would not meet the objectives of the Project.

3.8.3 Pipeline Route Alternatives

In evaluating pipeline alternatives, we reviewed both alternative corridors and specific route variations. We examined alternatives that could reduce overall environmental impacts associated with the pipeline route and could avoid or reduce impact to environmentally sensitive resources, namely population centers and extensive wetland areas. Route alternatives generally follow a different corridor for a portion of the proposed route, and may ultimately terminate at different locations. 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 site-specific terrain conditions.

We considered one major route alternative that would place the Golden Pass pipeline(s) adjacent to the proposed pipeline route for the Port Arthur or Pearl Crossing Port sendout pipelines (also see section 3.8.1.2). This would involve routing the Golden Pass pipeline from the Golden Pass LNG terminal northeast through Sabine Lake (parallel to the routes for the sendout pipelines for the Port Arthur and Pearl Crossing Port projects), and then north along the same route as the sendout pipeline for the Pearl Crossing Port project. To transport the Golden Pass volumes, this would require construction of about 48 miles of pipeline along the Port Arthur/Pearl Crossing Port pipeline route, 38.2 miles of pipeline to the Beaumont-Port Arthur Interconnect, and 1.8 miles of the Beaumont Lateral. This would total about 88 miles of pipeline and may require some looping as well. Use of this alternative would increase the width of the rights-of-way along the Port Arthur/Pearl Crossing Port projects pipeline route and may result in multiple impacts if the projects are not constructed at the same time. Because it may not be possible to reduce the number of pipelines due to the volume of natural gas from the three projects, use of this alternative may only transfer environmental impacts from the proposed Golden Pass route to this alternative route. Use of this alternative also would eliminate two of Golden Pass' planned interstate and intrastate interconnections (AEP Texoma and Channel). It would also reduce the number of interconnections which in turn would limit the diversity of supply to the interstate and intrastate natural gas markets. For these reasons, we did no further analysis of a system alternative that would make use of other proposed sendout pipelines.

3.8.3.1 Corridor Alternatives

Golden Pass initially identified four potential pipeline corridors or major route alternatives (Alternatives A, B, C, and D) for its proposed pipeline system (see figure 3.8.3-1).

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Figure 3.8.3-1
Alternative Pipeline Route Corridors

These corridors were evaluated and compared to identify a preferred corridor that best met the Project's objectives of providing the maximum number of potential interconnects to the Texas interstate and intrastate pipeline system with the least environmental impact. Table 3.8.3-1 provides a summary of the significant environmental characteristics of these four corridor alternatives.

TABLE 3.8.3-1

Comparison of Corridor Alternatives A, B, C, and D a/

Criteria	Alternative A	Alternative B	Alternative C	Alternative D
Project Design Criteria (Pass/Fail):				
Right-of-way space available	No	Yes	Yes	Yes
Multiple pipeline interconnect access	Yes	Yes	Yes	Yes
Pipeline access to Beaumont area	Yes	Yes	Yes	Yes
Length (mi.)	64.2	74.5	86.0	54.5
Use of existing rights-of-way (percent)	63%	58%	54%	54%
Potential interconnects with existing pipelines (no.)	10	10	10	9
Interconnect with ExxonMobil Beaumont Refinery	Yes	Yes	No	No
Road crossings (no.)	90	77	88	45
Number of water crossings	44	42	44	25
Number of major waterbody crossings	9	9	10	3
Length of wetland crossings (mi.) b/	22.0	30.9	37.2	26.4
Estimated total land requirements (ac.)				
Construction (100-foot-wide right-of-way)	778.2	903.0	1,042.4	660.6
Operation (50-foot-wide right-of-way)	389.1	451.5	521.2	330.3

a/ Analysis based on review of available mapping.
b/ Wetland data based on National Wetlands Inventory (NWI) maps for Texas and does not include Calcasieu Parish where there is no available NWI mapping.

Corridor Alternative A

Alternative A would leave the LNG terminal site and continue northwest along SH 87 and West Port Arthur Road into the Beaumont area where it would turn in a northeasterly direction and follow existing rights-of-way to the Neches River. The alternative would then continue northeast into Orange County, primarily following existing rights-of-way, cross the southeast corner of Newton County, Texas, and enter Calcasieu Parish, Louisiana where it would cross the Sabine Island WMA. Alternative A would then follow an existing right-of-way north to the proposed Transco interconnect near Starks, Louisiana. An approximate 2-mile-long lateral would be constructed to provide service to the ExxonMobil refinery complex and customers in the Beaumont, Texas area.

This alternative would cross through a congested industrial/urban area along West Port Arthur Road. Within this area, the existing pipeline corridor is close to capacity and residential construction has encroached on the right-of-way. In addition, TXPWD has expressed concern over impact to the wetlands along the alternative. Because of the potential for continued development pressure, and constructability and maintenance concerns associated with the extensive pipeline infrastructure in the area and TXPWD's concerns, we do not consider the segment of Alternative A from the LNG terminal to the Beaumont area to be a practical alternative corridor and have eliminated it from further consideration. The northern segment of this corridor, from the area south of the Neches River crossing to the Transco interconnect, is discussed below as part of Alternative B.

Corridor Alternative B

Alternative B would extend west from the LNG terminal and follow two existing pipelines through the J.D. Murphree WMA, cross the northeast corner of the McFaddin National Wildlife Refuge and the Intracoastal Waterway before turning north to follow LaBelle Road. The alternative would pass near a residential area north of Taylor Bayou and then follow existing rights-of-way toward the northeast to the Neches River. Alternative B would then continue to the northeast along the route of Alternative A to terminate at the proposed Transco interconnect near Starks, Louisiana. An approximate 2-mile-long lateral would be constructed to provide service to ExxonMobil and customers in the Beaumont, Texas area.

Alternative B would make use of existing rights-of-way, could provide interconnects with the Texas and Louisiana intrastate and interstate pipeline systems, and would allow for a reasonably short lateral pipeline to the Beaumont area. Alternative B would also avoid the residential areas developing west of Port Arthur (Port Acres area) in the vicinity of Farm to Market Road 365. Alternative B met the Project objectives and minimized impacts to wetlands and residential areas. Therefore, this alternative became the basis for the proposed route as evaluated in this EIS.

Corridor Alternative C

Alternative C would follow the same alignment as Alternative B from the LNG terminal site to Taylor Bayou. At this point, Alternative C would continue north to Interstate (I)-10, where it would turn northwest and north around the developed Beaumont area. At SH 105, the alternative would turn east across the Neches River, continue east across Orange County to terminate at the Transco pipeline in Newton County, Texas. The lateral to the Beaumont area would require construction of about 12 miles of pipeline.

Alternative C satisfied the criteria of connecting to Texas intrastate and interstate transmission systems. However, the alternative would cross a populated area near Beaumont and would require 12 miles of lateral pipeline to the ExxonMobil refinery complex (10 miles more than for Alternatives A and B). This alternative also would cross through more areas of residential and commercial development, especially adjacent to major highways, such as I-10, U.S. Highway 90, and SH 105. As shown in table 3.7.3-1, Alternative C would require the most pipeline and would impact the most wetlands in comparison to the other alternatives. Therefore, Alternative C was eliminated from further consideration.

Corridor Alternative D

Alternative D would follow the same alignment as Alternatives B and C from the LNG terminal site to LaBelle Road, where it would continue northwest along an existing right-of-way to cross SH 73 and I-10, northeast of Winnie, Texas. In Liberty County, Texas, the alternative would turn north, cross U.S. Highway 90 and terminate at a Transco compressor station west of Sour Lake, Texas. This alternative is the westernmost alternative considered and would require a lateral to serve the Beaumont area.

Alternative D was identified in an attempt to reduce impacts to population centers and wetland areas. This alternative would provide interconnects with the Texas intrastate and interstate pipeline systems. However, in order to provide natural gas service to the Beaumont area a lateral about 28 miles long would be required. This would bring the total miles for this alternative from 54.5 miles to 82.5, the second longest of these alternative corridors. Because of its longer length, combined with fewer potential interconnects (9 instead of 10), this alternative was eliminated from further consideration.

3.8.3.2 Route Variations Incorporated by Golden Pass

During the NEPA Pre-Filing environmental review process, Golden Pass continued to consult with resource agencies to optimize a pipeline route within the preferred route corridor (Alternative B) that would minimize environmental impacts. Prior to filing its August 2004 application with the FERC, Golden Pass identified a number of route realignments (or route variations) along the Alternative B corridor that were incorporated into the preferred route as analyzed in this EIS. Described below are those route variations that accounted for the most change between the Alternative B corridor and the currently proposed route.

J.D. Murphree WMA – Jefferson County, Texas
(Approximate MPs 0.0 to 22.7)
Golden Pass originally proposed to construct the Mainline and Loop along an existing pipeline right-of-way through the J.D. Murphree WMA. The TXPWD staff reviewed this alignment, which would diagonally cross a large wetland complex within the WMA, and commented that this pipeline route would likely require extensive mitigation that, if unsuccessful, could result in the long-term impact to these salt-stressed wetlands south of the Gulf Intracoastal Waterway. The TXPWD also stated that construction of other pipelines in this wetland complex has resulted in the creation of open water corridors along these pipeline rights-of-way.

Based on the TXPWD comments, Golden Pass modified the route between MPs 0.0 to 22.7 to incorporate the following three recommendations from TXPWD:

- Minimize encroachment onto wetlands by routing the pipeline through the open waters of Keith, Johnson, and Shell Lakes;
- Align pipeline route to maximize use of existing drainage ditch and levee systems north of the Gulf Intracoastal Waterway to reduce wetland impacts; and
- Bury pipelines at a sufficient depth so that the TXPWD could continue maintenance and periodic replacement of flow control structures within the drainage ditch and levee system.

Golden Pass has determined that that the proposed route could be constructed and that sufficient space would be available within the existing drainage ditch and levee systems to install the two 36-inch-diameter pipelines. Although the route variation would add 3.1 miles to the pipeline route, it would avoid direct impacts on at least 10.1 miles of wetlands by construction within the lakes and levee system. Impacts on other resources (*e.g.*, residences or stream crossings) would be about the same. We have no objection to this route variation since it maximizes the use of existing open water, drainage ditches, and canals and reduces impacts on emergent wetlands. However, this route variation would involve creation of a channel for equipment access from the Intracoastal Waterway to Shell, Johnson, and Keith Lakes. Golden Pass is developing a site-specific mitigation plan for impacts to the J.D. Murphree WMA in consultation with the COE, FWS, NOAA Fisheries, and TXPWD (see section 4.4.3).

La Belle Road – Jefferson County, Texas
(Approximate MPs 22.7 to 29.5)

This route variation was identified to avoid impact on an existing residential subdivision where Alternative B followed an existing pipeline right-of-way through the subdivision. During our January 2004 site visit, we reviewed this route variation which would relocate the pipeline to the west of the subdivision. Although the route variation would add about 0.6 mile of pipeline to the route, it would avoid impact on this residential area.

Neches River – Jefferson/Orange Counties, Texas
(Approximate MP 35.0 to 42.0)

Golden Pass identified this route variation which would begin at a tank farm near West Port Arthur Road in Beaumont, Texas and extend across the Neches River. The Alternative B alignment would have followed existing pipeline/utility rights-of-way south of a large tank farm (MP 37.0) between West Port Arthur Road and U.S. Highways 69/96/287 on the west side of the Neches River. Immediately south of the tank farm is a Texas Department of Corrections facility. The route variation would relocate the Mainline and Loop north of the tank farm and out of the congested pipeline corridor. This improved constructability for the proposed pipelines and avoided any encroachment on the Texas Department of Corrections property. In addition, Golden Pass confirmed the presence of two known archaeological sites near the west side of the Neches River crossing (MP 38.5). This route variation would also avoid these sites. We have no objection to this route variation.

SH 87/Forest Heights Subdivision Adjustment – Orange County, Texas
(Approximate MPs 55.4 to 63.5)
This route variation was identified during our field review in January 2004, to avoid the Forest Heights subdivision near SH 87 (approximate MP 62.3) that has encroached upon the existing TETCO right-of-way that Golden Pass had proposed to follow. The route variation would leave the TETCO right-of-way at about MP 55.4 and then follow another pipeline right-of-way north to a point south of the Kansas City Southern railroad right-of-way near MP 57.8. The route variation would then turn east, adjacent to the railroad right-of-way and continue along the railroad right-of-way to a pipeline right-of-way at MP 60.8. The route variation would follow that pipeline right-of-way until the intersection with the original TETCO right-of-way, east of the Forest Heights Subdivision. Although this route variation would add about 1.4 miles to the length of the pipeline, it would avoid impacts to the Forest Heights Subdivision and eliminate 15 road crossings. We agree that incorporation of this variation is appropriate.

The proposed variations to the preferred corridor (Alternative B) would increase the overall length of the pipeline system and would increase impacts on waterbodies and wetlands. However, impacts on waterbodies and wetlands would be short-term and primarily limited to the construction period and shortly thereafter. Golden Pass proposes to use eleven HDDs to minimize impact on waterbodies and wetlands, and would implement our Procedures during construction and operation of the pipeline system. The proposed variations would increase the length where the proposed pipeline would be adjacent to existing rights-of-way, thus reducing the creation of new right-of-way. The proposed modifications would also significantly reduce the number of residences within 50 feet of the construction work areas. For these reasons, we have no objection to these route variations as proposed by Golden Pass. Our analysis in this EIS is based on the proposed route as modified by these variations.

3.8.3.3 Route Variations Considered but Eliminated

In addition to the route variations incorporated into the proposed route, the following areas were evaluated for potential route variations that were considered, but eliminated, for the reasons described below.

Lake Access Variation – Jefferson County, Texas
(Approximate MP 8.6)

Golden Pass proposes to use a flotation channel from the Intracoastal Waterway to Shell Lake near MP 8.6 to allow construction equipment and barges access to Shell, Johnson, and Keith Lakes for the purpose of installing the Mainline and Loop within the lakes. This would require dredging a 950-foot-long channel between the Intracoastal Waterway and Shell Lake.

There are two other potential options to allow equipment access to the lakes. The first would make use of Keith Lake Cut which connects Keith Lake with the Port Arthur Channel, about 6,500 feet north of the point where the pipeline(s) enter Keith Lake at approximate MP 2.0. Once the equipment enters Keith Lake it would have access to Shell and Johnson Lakes. Keith Lake Cut, however, is crossed by a low, permanent, concrete bridge on SH 87 and has insufficient clearance for anything larger than small recreational boats. The barges, tugs, and other major equipment needed for construction of the pipelines would not be able to pass under this bridge. Also, as the bridge is the only road access to the community of Sabine Pass, three public recreational areas, and other homes and businesses on SH 87, temporary dismantling or removal of the bridge is not feasible or practical. A second option would be to transport the construction equipment on SH 87 and launch it into Keith Lake from a temporary staging area on the west side of SH 87 near MP 1.4 where the pipeline(s) enter Keith Lake. However, the equipment (barges, etc.) are too large to be transported by truck to the launch site and it would not be feasible to dismantle this large equipment for transport and reassembly at the staging area. We conclude that neither of these options is practical for the purpose of providing equipment access to the lakes. We have recommended that Golden Pass provide a site-specific plan for how it plans to maintain the flotation channel during construction in the lakes and restore the channel after construction (see section 4.3.3.2).

Big Hill Bayou Variation – Jefferson County, Texas
(Approximate MP 11.9)

We asked Golden Pass to evaluate a route variation that would realign the right-of-way for a perpendicular crossing of Big Hill Bayou and the channels south of the bayou. Golden Pass stated that a perpendicular crossing of Big Hill Bayou would require at least two additional turns or points of intersection, each requiring additional extra workspaces in wetlands. In addition, the proposed route through the channels south of Big Hill Bayou follows the recommendations of the TXPWD to minimize impact on wetlands in the J.D. Murphree WMA (see section 3.7.3.2).

Since Golden Pass proposes to install the pipelines across Big Hill Bayou using an open cut, we also asked Golden Pass to evaluate use of an HDD for this crossing. Golden Pass states that the proposed crossing method would result in the least environmental impact because there are no upland locations near the crossing to serve as a platform for the HDD equipment. If an HDD were attempted it would require that a barge-mounted drilling rig and associated equipment be brought in. Since there are no access channels available to move a barge into the area, the barge would have to be brought in through the borrow ditch between levees that serve as containment for wetland areas (or wetland compartments). The TXPWD uses these levees to manage water levels to enhance wetlands within the compartments. Barge access would require removal of the levees to widen the existing borrow ditch. This would temporarily prevent management of the wetland water levels in several of the compartments as well as directly impacting additional wetlands by excavation. Following construction, the affected wetlands would need to be restored and the levee system would need to be rebuilt. Golden Pass states that its proposed open cut crossing of the Big Hill Bayou would result in the least environmental impact.

Based on the above, we conclude that neither the route variation nor the alternate construction method (*e.g.*, HDD) would significantly reduce impacts on wetlands or Big Hill Bayou.

Sabine Island WMA – Newton County, Texas / Calcasieu Parish, Louisiana
(Approximate MPs 64.3 to 72.0)

The Mainline would cross the Sabine River and the Sabine River floodway, a wide forested wetland associated with the river that is regularly flooded by releases from the upstream Toledo Bend dam. The Sabine Island WMA is located between MP 66.5 (Sabine River) at the Texas/Louisiana state line and MP 67.3 (Old River) in this floodway. Because of the sensitivity of the Sabine Island WMA and the LADWF's concern to avoid any impact on the WMA, Golden Pass proposes to use an HDD to cross

under the WMA. However, this is a relatively long HDD at 6,020 feet and is near the limit for successful completion. Therefore, Golden Pass identified three possible route variations for crossing the Sabine River floodway and the Sabine Island WMA. These three variations are described below and shown on figure 3.8.3-2.

Variation 1 would turn north from the proposed route at MP 64.3 and follow an existing powerline for about 3.2 miles, and then east around the northern limits of the Sabine Island WMA. The variation would then leave the powerline right-of-way, and turn east along new right-of-way for about 4.6 miles to a second existing powerline right-of-way. Then, it would turn southeast along this powerline right-of-way for about 0.8 mile to rejoin the proposed route at MP 71.9 at Number 7 Road. Variation 1 would cross the Sabine River along the powerline right-of-way and the Old River along new right-of-way, and would be about 1 mile longer than the proposed route.

Variation 2 would turn north from the proposed route at MP 64.3 and follow the same powerline north as Variation 1 for about 1.3 miles to the intersection with a second powerline. The variation would turn east for about 6.8 miles along this powerline across the Sabine River, Sabine Island WMA, and the Old River to rejoin the proposed route near MP 71.9. The crossing of the Sabine Island WMA would be about the same length; Variation 2 would be about 0.5 mile longer than the proposed route.

Variation 3 would turn south from the proposed route at MP 65.2 at Indian Lake Road and would follow Indian Lake Road for about 0.5 mile before turning east to cross Indian Creek, the Sabine River, the Sabine Island WMA, and Old River on new right-of-way. This segment would be about 2 miles in length. Variation 2 would then turn northeast for about 0.3 mile and rejoin the proposed route at approximate MP 67.5. The crossing of the Sabine Island WMA would be about the same length; Variation 3 would be about 0.5 mile longer than the proposed route.

Golden Pass states that an HDD under the Sabine Island WMA would not be possible for Variations 2 and 3 without clearing large areas for access to the drill entry and exit sites, and to stage and fabricate the pipeline for the pullback. While Variation 1 would avoid crossing the Sabine Island WMA, this variation would be longer and would require clearing of about 4.6 miles of new right-of-way. The proposed route would be adjacent to existing rights-of-way for its entire length. Golden Pass proposes to use two HDDs to cross under the Sabine River floodway and the Sabine Island WMA. One HDD drill entry site would be set up in Newton County, Texas within the Sabine River floodway. The pad would be raised to prevent inundation from the Sabine River, and ground access would be from the Texas side of the river. From this entry site, one HDD would extend west under Indian Bayou to Indian Lake Road and one HDD would extend east under the Sabine River, Sabine Island WMA, and the Old River.

We reviewed the proposed route and work areas in the field in November 2004, with the COE and LADWF. Golden Pass has also provided a detailed plan for the crossing of the Sabine Island WMA, as well as a contingency plan for inadvertent loss of drilling muds (see appendix E). Because of the sensitivity of the Sabine Island WMA, we have also recommended that Golden Pass complete the HDD of the Sabine Island WMA before construction of the pipeline between MPs 61.2 (Old SH 87) and 72.0 (No. Seven Road) (see section 4.8.3.2). For these reasons and because Variations 1, 2, and 3 would be longer and could potentially result in greater environmental impacts on wetlands than the proposed route (if the HDDs can be successfully completed), we eliminated Variations 1, 2, and 3 from further consideration at this time. However, if an HDD of the Sabine Island WMA cannot be completed as proposed, Golden Pass would be required to evaluate these variations or others for the crossing of the WMA.

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Figure 3.8.3-2
Sabine Island WMA Route Variations