Site Selection for the Expansion of the Strategic Petroleum Reserve Final Environmental Impact Statement

VOLUME 1

Summary and Chapters 1 - 8

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DOE/EIS-0385

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Final Environmental Impact Statement for Site Selection for the Expansion of the Strategic Petroleum Reserve Document No. DOE/EIS-0385

Responsible Federal Agency: U.S. Department of Energy (DOE), Office of Petroleum Reserves

Location: Potential new Strategic Petroleum Reserve (SPR) storage sites are Bruinsburg salt dome located in Claiborne County, Mississippi; Chacahoula salt dome in Lafourche Parish, Louisiana; Richton salt dome in Perry County, Mississippi; and Stratton Ridge salt dome in Brazoria County, Texas. Existing SPR storage sites that could be expanded are Bayou Choctaw in Iberville Parish, Louisiana; Big Hill in Jefferson County, Texas; and West Hackberry in Calcasieu and Cameron Parishes, Louisiana. Associated pipelines, marine terminals, and other facilities that might be developed are located in East Baton Rouge, East Feliciana, St. James, Terrebonne, West Baton Rouge, and West Feliciana Parishes, Louisiana; Adams, Amite, Forrest, George, Greene, Jackson, Jefferson, Lamar, Lincoln, Marion, Pike, Walthall, and Wilkinson Counties, Mississippi; and Galveston County, Texas.

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Abstract: The Energy Policy Act of 2005 (P.L. 109-58) requires DOE to expand the SPR to its full authorized 1 billion-barrel capacity. DOE's proposed action is to develop one new site and expand capacity at two or three existing sites. Storage capacity would be developed by solution mining of salt domes and disposing of the resulting salt brine by ocean discharge or underground injection. New pipelines, marine terminal facilities, and other infrastructure would also be required. DOE's preferred alternative is to build a new SPR storage site at Richton, Mississippi, and expand existing SPR sites at Bayou Choctaw and West Hackberry, Louisiana; and Big Hill, Texas.

DOE has determined that site selection and expansion constitute a major Federal action within the meaning of the National Environmental Policy Act of 1969, as amended (42 USC 4321-4347). The Environmental Protection Agency (EPA) published a Notice of Availability of the draft EIS in the *Federal Register* on May 26, 2006 (71 FR 30400), starting the 45-day public comment period that ended July 10, 2006. DOE held public hearings in Houma, Louisiana; Pascagoula, Port Gibson, and Richton, Mississippi; and Lake Jackson, Texas. DOE received 93 written comment letters and 21 people testified at public hearings on the draft EIS. This final EIS responds to comments on the draft EIS, including revising the Richton alternatives to provide a supplemental source of surface water and providing additional information on essential fish habitat and endangered species. Also, a new storage site at Clovelly, LA, considered in the draft EIS, has since been shown to not be feasible, and therefore DOE has not analyzed the Clovelly alternatives in the final EIS because they are unreasonable.

DOE will issue a Record of Decision no sooner than 30 days after publication of the EPA's Notice of Availability of this final EIS.

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Summary

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S.1 BACKGROUND

The Strategic Petroleum Reserve (SPR) is a national stockpile of petroleum (crude oil). Following the 1973-74 oil embargo, the SPR was established pursuant to the Energy Policy and Conservation Act of 1975 to protect the United States from interruption in petroleum supplies that would be detrimental to our energy security, national security, and economy. The SPR currently consists of four underground oil storage facilities along the Gulf Coast—two in Louisiana (Bayou Choctaw and West Hackberry) and two in Texas (Big Hill and Bryan Mound)—and an administrative facility in New Orleans, LA. At the storage facilities, crude oil is stored in caverns constructed by the solution mining of rock salt formations (salt domes). The four SPR facilities have a combined storage capacity of 727 million barrels (MMB) and an inventory of 688.5 MMB as of November 10, 2006.

If the United States is confronted with an economically threatening disruption in oil supplies, the President can use the SPR as an emergency response tool, transferring oil from the SPR into the commercial oil distribution systems. The SPR has been used twice under these conditions. First, at the beginning of Operation Desert Storm in 1991, the United States joined its allies in assuring the adequacy of global oil supplies when war broke out in the Persian Gulf. An emergency sale of SPR crude oil was announced the day the war began. The second instance was in September 2005 after Hurricane Katrina devastated oil production, distribution, and refining facilities in the Gulf region of Louisiana and Mississippi. In addition to national energy emergencies, crude oil has been withdrawn many times from the SPR sites for other reasons. Small quantities of oil are routinely pumped from the storage caverns to test the reserve's equipment. In addition, oil has been removed from the caverns under the authority of the 1975 statute to "exchange" SPR crude oil with oil from private companies by which the SPR ultimately receives more oil than it released.

The U.S. Department of Energy (DOE) conducted planning activities for the expansion of SPR's capacity to 1 billion barrels under congressional directives in 1988 and 1990. The expansion planning directive in 1988 resulted in an initial plan entitled *Report to Congress on Expansion of the Strategic Petroleum Reserve to One Billion Barrels*. The expansion planning directive in 1990 likewise resulted in a plan called *Report to Congress on Candidate Sites for Expansion of the Strategic Petroleum Reserve to One Billion Barrels* and the preparation of *Draft Environmental Impact Statement on the Expansion of the Strategic Petroleum Reserve, DOE/EIS–0165–D* in 1992, which assessed 5 candidate sites for the expansion of the SPR to 1 billion barrels: Big Hill, TX; Stratton Ridge, TX; Weeks Island, LA; Cote Blanche, LA; and Richton, MS. DOE/EIS–0165–D is available on the DOE Fossil Energy Web site at http://www.fossil.energy.gov/programs/reserves/spr/expansion-eis.html. Prior to completion of the final Environmental Impact Statement (EIS), DOE notified Congress that due to the existence of a large unfilled capacity in the SPR, DOE would be deferring any site selection decisions and expansion of the SPR until such time that the oil inventory of the SPR supported the need for further capacity development.

S.2 PURPOSE AND NEED

On August 8, 2005, the President signed the Energy Policy Act of 2005 (EPACT). Section 303 of EPACT states that:

> "Not later than 1 year after the date of enactment of this Act, the Secretary shall complete a proceeding to select, from sites that the Secretary has previously

Vertical lines in the left margin indicate where text in the draft EIS has been deleted, revised, or supplemented in this final EIS.

> studied, sites necessary to enable acquisition by the Secretary of the full authorized volume of the Strategic Petroleum Reserve."

EPACT Section 301(e) directs the Secretary to "… acquire petroleum in quantities sufficient to fill …" the SPR to 1 billion barrels, which is what was authorized by congressional directives. Thus, the purpose and need for agency action is to select and develop the sites to expand SPR capacity from 727 MMB to 1 billion barrels, that is, to add 273 MMB of capacity.

S.3 PROPOSED ACTION AND ALTERNATIVES

EPACT Section 303 states that in evaluating sites for SPR expansion, DOE:

> "[s]hall first consider and give preference to the five sites which the Secretary previously addressed in the Draft Environmental Impact Statement, DOE/EIS-0165-D. However, the Secretary, in his discretion may select other sites as proposed by a State where a site has been previously studied by the Secretary to meet the full authorized volume of the Strategic Petroleum Reserve [1 billion barrels]."

Consistent with these mandates, DOE's proposed action is to develop one new SPR site, to expand petroleum storage capacity at two or three existing SPR sites, and to fill the SPR to its full authorized volume of 1 billion barrels. Sections S.3.1 and S.3.2 of this Summary of the EIS describe the potential new SPR sites and the potential expansion of existing SPR sites, respectively. Section S.3.3 identifies the alternatives considered in the EIS, including the preferred alternative. Section S.3.4 presents background information on SPR construction and operations. Sections S.3.5 and S.3.6 discuss the potential new and expansion sites and their associated infrastructure.

S.3.1 Potential New Sites

As required by EPACT Section 303, DOE has limited its review of potential new sites for expansion of the SPR to: (1) sites that DOE addressed in the 1992 draft EIS and (2) sites proposed by a state in which DOE has previously studied a site. The following five sites met those conditions and were considered in the draft EIS:

- Richton, MS, and Stratton Ridge, TX, which were addressed in the 1992 draft EIS;
- Chacahoula and Clovelly, LA, which the Governor of Louisiana requested that the Secretary of Energy consider; and
- Bruinsburg, MS, which the Governor of Mississippi requested that the Secretary of Energy consider.

Subsequent to the publication of the draft EIS, DOE determined that use of the Clovelly site, located at the Louisiana Offshore Oil Port's (LOOP's) Clovelly facility, is not feasible because of geotechnical issues and thus is not a reasonable alternative. DOE therefore removed the site from detailed consideration in this EIS.

Recent seismic surveys of the Bruinsburg salt dome indicate that it may not be able to provide the needed storage capability; however, it is retained as a potential new site.

While the 1992 draft EIS addressed the potential new salt dome sites at Cote Blanche, LA, and Weeks Island, LA, DOE's preliminary review of these sites for this EIS concluded that they are no longer viable due to the sale of the DOE's Weeks Island crude oil pipeline and its subsequent conversion to natural gas transmission. The Cote Blanche site would have been connected by pipeline to the Weeks Island pipeline.

S.3.2 Potential Expansion Sites

In addition to potential new sites, this EIS considers expanding the following three existing SPR sites:

- Big Hill, TX, which was addressed in the 1992 draft EIS; and
- Bayou Choctaw and West Hackberry, LA, which the Governor of Louisiana requested that the Secretary of Energy consider.

The existing SPR site at Bryan Mound was not considered for expansion because the salt dome has no capacity available for additional storage caverns. Figure S.3.2-1 shows the location of the proposed new and expansion sites.

S.3.3 Alternatives

In developing the range of reasonable alternatives, DOE first considered expansions of three existing storage sites, which would capitalize on existing site infrastructure and operations and thereby minimize development time and construction and operations costs. DOE, however, cannot reach its goal of 273 additional MMB by expanding capacity only at existing sites. The amount of new capacity that is reasonable to develop at an existing site is limited by the physical size of the salt dome, the site's infrastructure for cavern development, and the availability of the commercial petroleum distribution infrastructure to support the increased rate of oil withdrawal from the site.

DOE has the capability to expand three of its existing sites as follows:

- Bayou Choctaw is the SPR's smallest storage site with only 6 caverns and a current storage capacity of 76 MMB. The salt dome is small and DOE currently shares the salt dome with a commercial storage operating company. Expansion is very limited due to the size of the salt dome. DOE has the capability of developing 2 additional caverns on its current property, which would expand the site's capacity by 20 MMB. Other than developing two new caverns, DOE would have to acquire existing commercial storage caverns on the salt dome to increase capacity at Bayou Choctaw. Therefore, DOE has considered the potential expansion of 20 MMB at the Bayou Choctaw site.

- The West Hackberry storage site has a current capacity of 227 MMB and could also be expanded by acquiring land and developing or acquiring additional caverns. However, the West Hackberry site no longer has the offshore brine disposal system necessary to support a cavern development operation. There are 3 existing commercial caverns on the salt dome that could be acquired to increase the site capacity by 15 MMB, to a total capacity of 242 MMB, without developing new caverns. Therefore, DOE has considered the maximum potential expansion of 15 MMB at the West Hackberry site.

- The Big Hill storage site has a current capacity of 170 MMB and could be easily expanded by acquiring land and developing several additional caverns. However, DOE does not desire to expand its sites beyond 250 MMB due to the very high drawdown rates necessary to withdraw the oil in a timely manner and the lack of existing commercial infrastructure to accommodate oil distribution at those rates. Therefore, DOE has considered the maximum expansion of 80 to 96

MMB at Big Hill. (The Big Hill expansion of 96 MMB is considered an alternative to the West Hackberry expansion of 15 MMB.)

To achieve the full 1 billion barrels, DOE will be required to construct a new site with a capacity of 160 MMB with a drawdown rate of 1.0 MMBD. A 160-MMB site provides the needed capability to store 2 crude oil segregations at the site and the 7-8 caverns of each crude type to achieve a site drawdown rate of 1.0 MMBD. Four potential new sites were designated for consideration in this EIS: Bruinsburg, MS; Chachoula, LA; Richton, MS; and Stratton Ridge, TX.

Potential development of each new site in combination with potential expansion of existing sites led to the alternatives analyzed in this EIS, as presented in Table S.3.3-1.

Table S.3.3-1: Alternatives

<table>
<tr><th>New Sites and Capacity</th><th>Expansion Sites and Added Capacity</th><th>Total New Capacity*</th></tr>
<tr><td>Bruinsburg, MS (160 MMB)</td><td rowspan="4">115 MMB
Bayou Choctaw (20 MMB)
Big Hill (80 MMB)
West Hackberry (15 MMB)
OR
116 MMB
Bayou Choctaw (20 MMB)
Big Hill (96 MMB)</td><td rowspan="4">275 MMB
or
276 MMB</td></tr>
<tr><td>Chacahoula, LA (160 MMB)</td></tr>
<tr><td>Richton, MS (160 MMB)</td></tr>
<tr><td>Stratton Ridge, TX (160 MMB)</td></tr>
<tr><td>No-action alternative</td><td>None</td><td>None</td></tr>
</table>

* DOE would not fill the SPR beyond 1 billion barrels if it developed more than 273 MMB of new capacity.

Under the no-action alternative, the SPR would not be expanded, and it would continue to operate with a 727-MMB capacity. No expansion or new sites would be developed.

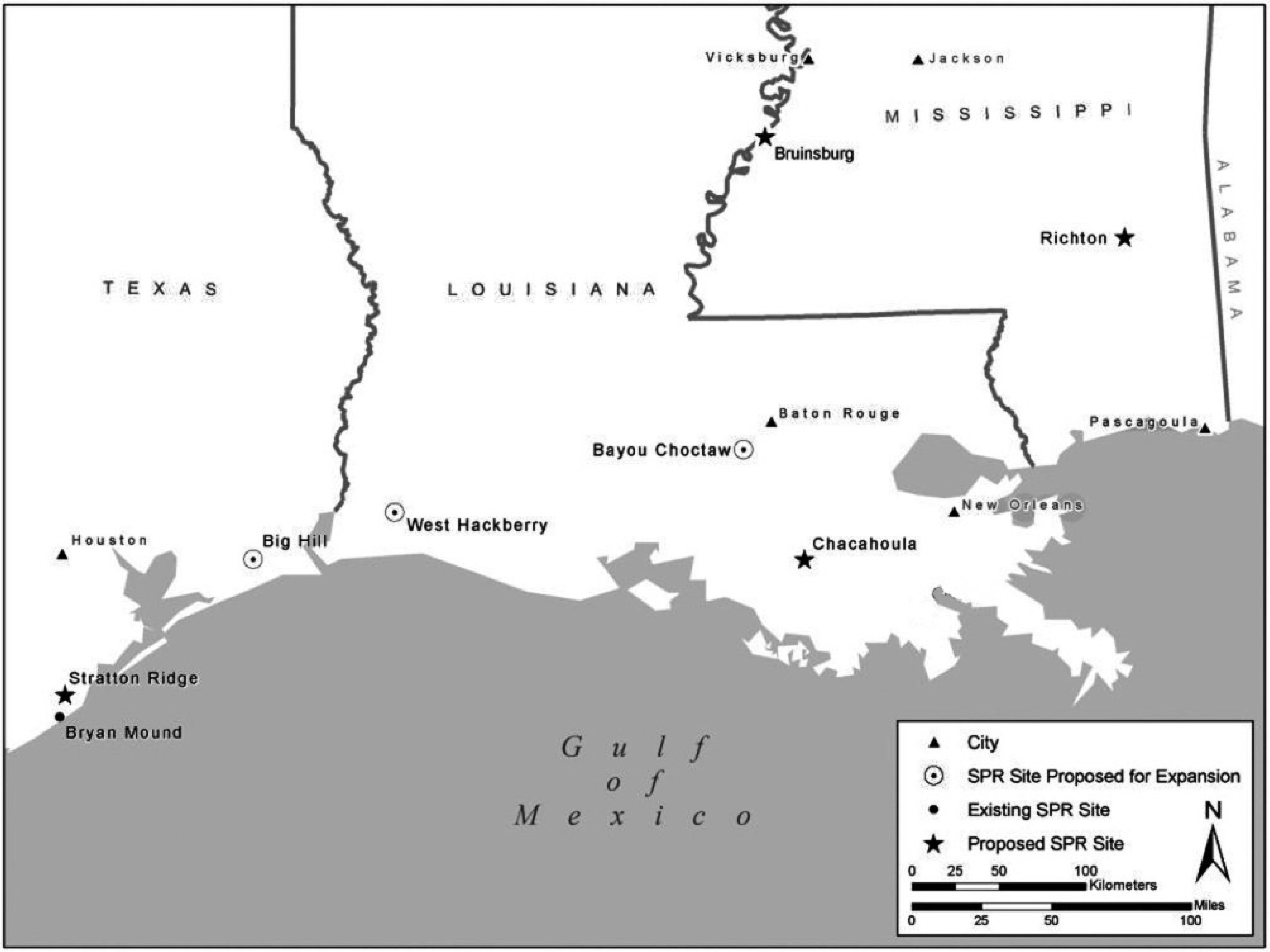
The Council on Environmental Quality (CEQ) regulations require an agency to identify its preferred alternative or alternatives, if one or more exists, in the draft EIS and identify such alternative in the final EIS. DOE identifies the Richton site alternative (with expansion of the Bayou Choctaw, Big Hill, and West Hackberry sites) as the **preferred alternative** based on crude oil distribution system capabilities, environmental considerations, project risks, and project costs. However, the three commercial caverns at the West Hackberry site were recently sold to Sempra Pipelines and Storage and ProLiance Transportation and Storage. As a result, DOE may not be able to acquire the West Hackberry site caverns at a reasonable cost. DOE will weigh the cost of expansion at the West Hackberry site as a factor in selecting sites.

DOE has analyzed the potential impact of its proposed action for each potential new and expansion site location separately. This will permit the public and DOE decisionmakers to understand the impacts unique to each site and each combination of sites. In its Record of Decision (ROD), DOE will determine which combination of sites best meets its goal of adding 273 MMB of capacity.

S.3.4 Background on Construction and Operations of SPR Storage Sites

Developing a new SPR storage site generally would include preparing the site; constructing the raw water intake (RWI) and brine disposal systems, including pipelines; creating caverns; installing oil pipelines to connect to existing petroleum distribution networks; and constructing support structures. Expanding an existing site would involve creating or acquiring additional storage caverns; using or modifying the existing RWI, brine disposal, and oil distribution systems; and augmenting support systems.

Figure S.3.2-1: Existing and Proposed New SPR Facility Locations



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Site preparation in dry upland areas would involve clearing, grading, stabilization, and compaction. Site preparation in wetlands would include dredging to allow for construction barges and filling to create areas for drill pads, roads, pipelines, buildings, and other structures. A 300-foot (91-meter) security buffer would be cleared around each new site area and new land acquired for expansion.

An RWI system would supply the large amounts of water needed for cavern creation and later oil drawdown. Individual storage caverns would be created in salt domes by solution mining, which would involve pumping raw water into the salt dome, dissolving the salt, pumping out the brine solution, and thereby forming a cavern. The brine solution would be pumped through a pipeline into the Gulf of Mexico or into underground injection wells for disposal.

Site preparation, development of support infrastructure, and construction of pipelines would take 4 to 5 years to complete. This would be followed by up to 5 years of cavern development; therefore, developing a new storage site may take up to 10 years to complete. The Richton alternatives could take longer if low flows in the Leaf River limit the amount of water available for solution mining for two reasons: (1) the volume of water available from the supplemental source, the Gulf of Mexico, may be smaller than the reduction in the volume from the Leaf River; and (2) a greater volume of saltwater than freshwater is needed in solution mining. See further discussion of the Leaf River and supplemental water sources for the Richton alternatives in section S.5.2.1.

When a cavern is completed, brine would be pumped out and displaced by crude oil. Crude oil would be stored until drawdown for redistribution through onsite and offsite pipelines and pumps connecting to an existing oil distribution network expanded as necessary to include new tank farms, terminals, marine docks, and other equipment.

Prior to brine disposal and crude oil distribution pipeline construction, DOE would clear and grade rights-of-way (ROWs) for pipelines. As needed, DOE would build temporary facilities such as roads and bridges for use during pipeline construction. The methods deployed for pipeline construction would depend on terrain, pipe size, and presence of groundwater and surface water. All pipelines would be buried, except where they would cross levees. Pipelines would require both temporary construction easements and permanent easements. Where feasible, new pipeline ROWs would follow existing ROWs.

In addition, a variety of structures would be needed at each site, including support buildings and enclosures. Power lines would be built along existing ROWs or along ROWs shared with pipelines or roads, where possible, to supply a new SPR storage site and the RWI, brine disposal, and oil distribution systems with the needed electric power.

S.3.5 Potential New Sites and Associated Infrastructure

This section describes the proposed action at each of the proposed new sites in alphabetical order. The following section S.3.6 describes the proposed action at each of the proposed expansion sites in alphabetical order. The descriptions to follow include a figure showing the location of the proposed new or expansion site and its proposed new infrastructure. Table S.3.5-1 presents the basic information on the key elements of the proposed action for each proposed new and expansion site.

Bruinsburg, MS

The Bruinsburg salt dome is located in Claiborne County, MS, 10 miles (16 kilometers) west of the town of Port Gibson and 40 miles (64 kilometers) southwest of the city of Vicksburg (not shown in figure S.3.5-1). Figure S.3.5-1 shows the location of the proposed Bruinsburg site and associated pipelines and other infrastructure. The proposed storage site encompasses a cypress swamp, cotton fields, forested

Table S.3.5-1: Key Elements of Proposed Action for Each Storage Site and Associated Infrastructure

Proposed Site	Increased Storage Capacity	Storage Site and Buffer	Water Source	Brine Disposal Facilities	Length of ROWs for New Pipelines, Roads, & Power Lines[a]	Other New Facilities	
						Facility Type	Size
Bruinsburg	160 MMB in 16 caverns[b]	365 acres	Mississippi River	60 new underground injection wells	230 miles	Terminals/tank farms at Peetsville, MS, and Anchorage, LA	141 acres
Chacahoula	160 MMB in 16 caverns	320 acres	ICW	New brine diffuser in Gulf of Mexico	184 miles	None[c]	N/A
Richton	160 MMB in 16 caverns	350 acres	Leaf River and Gulf of Mexico	New brine diffuser in Gulf of Mexico	229 miles	Terminals/tank farms at Liberty, MS, and Pascagoula, MS, and intermediate pump station near Columbia, MS	130 acres
Stratton Ridge	160 MMB in 16 caverns	371 acres	ICW	New brine diffuser in Gulf of Mexico	61 miles	Terminal/tank farm in Texas City, TX	39 acres
Bayou Choctaw	20 MMB in 2 caverns	0 acres[d]	Cavern Lake (existing RWI)	Existing and 6 new underground injection wells	2 miles	None[c]	N/A
Big Hill 80	80 MMB in 8 caverns	206 acres	ICW (existing RWI)	Existing brine diffuser in Gulf of Mexico	24 miles	None[c]	N/A
Big Hill 96	96 MMB in 8 caverns	206 acres	ICW (existing RWI)	Existing brine diffuser in Gulf of Mexico	24 miles	None[c]	N/A
West Hackberry	15 MMB in 3 caverns	81 acres[e]	ICW (existing RWI)	Existing underground injection wells	None	None[c]	N/A

1 acre = 0.405 hectares; 1 mile = 1.609 kilometers; N/A = not applicable; ICW = Intracoastal Waterway.

[a] Length of each ROW that would be used for two or more SPR purposes (e.g., pipelines, roads, and power lines) is counted once.

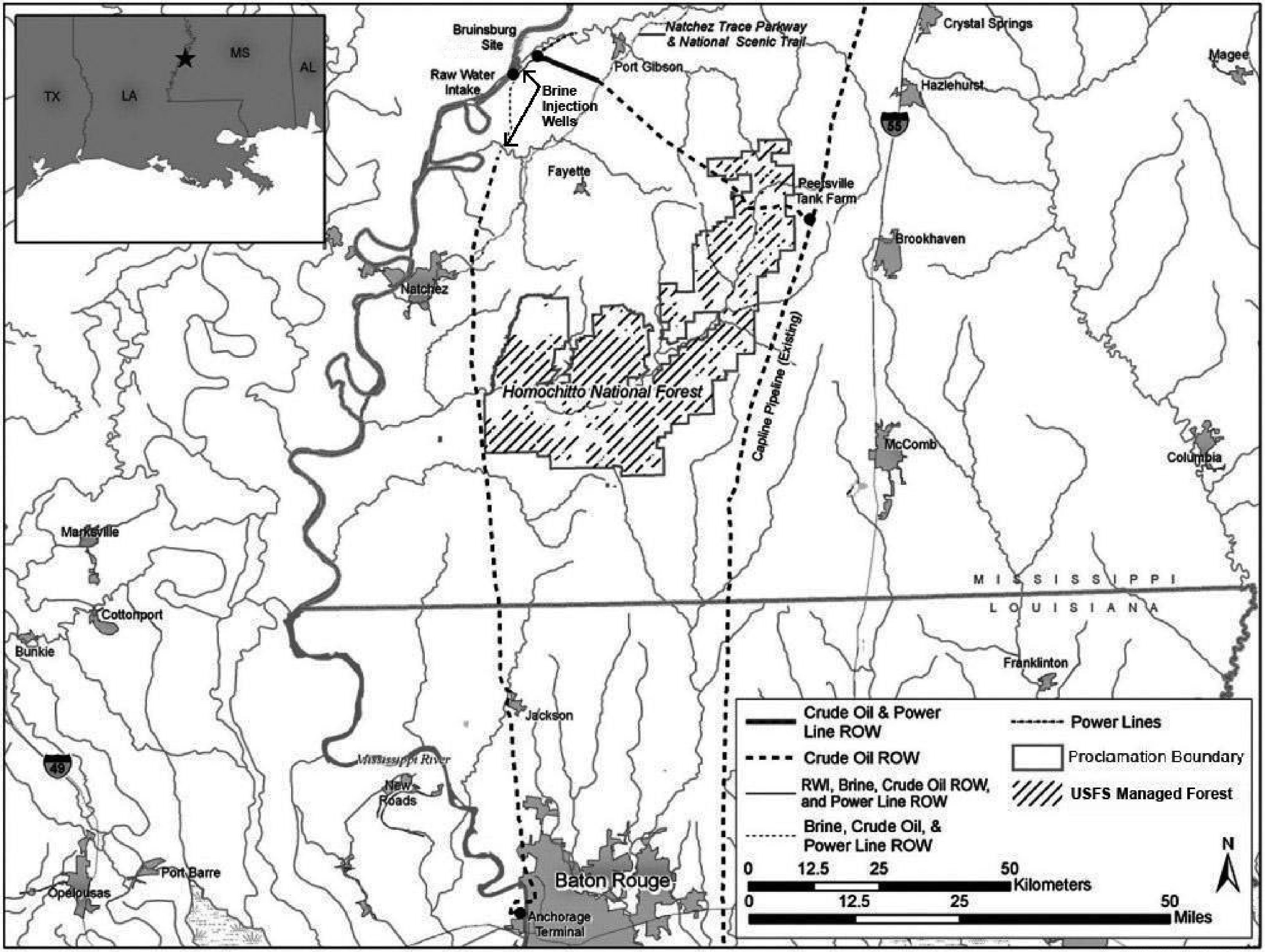
[b] Surveys indicate the salt dome can accommodate only 70 MMB above 5,000 feet (1,500 meters) and that development lower would be technically difficult and would involve operational risks.

[c] Terminal(s) for the proposed site already exist and the current distribution capacity is sufficient to handle the potential increase in oil storage and distribution.

[d] Two new caverns would be on existing SPR land.

[e] DOE also would purchase, but not entirely develop, an additional 147-acres adjacent to the existing site, which is part of a parcel needed for the 81-acre expanded site and buffer area.

Figure S.3.5-1: Proposed Location of Bruinsburg Storage Site and Infrastructure



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areas, and a bluff overlooking the Mississippi River. DOE recently conducted seismic surveys of the Bruinsburg salt dome to measure the size of the dome to confirm its capability to provide 160 MMB of oil storage capacity. Analysis of the surveys indicates that the salt dome is smaller than initially thought and would likely be incapable of accommodating the planned 16 caverns with 10-MMB capacity each in the salt strata above 5,000 feet (1,500 meters) below the surface, as would be required under current SPR operating criteria. Surveys of salt dome characteristics at depths below 5,000 feet (1,500 meters) indicate that there may be an ability to develop oil storage caverns below 5,000 feet (1,500 meters), but doing so would be more difficult technically and would involve uncertain operational risks. This EIS retains the Bruinsburg site as presented in the draft EIS.

The infrastructure associated with the Bruinsburg storage site would include new terminals with a tank farm at Peetsville, MS, and Anchorage, LA.

Chacahoula, LA

The Chacahoula salt dome site is located 40 miles (64 kilometers) north of the Gulf of Mexico in northwestern Lafourche Parish, southwest of Thibodaux, LA. Figure S.3.5-2 shows the location of the proposed Chacahoula site and associated (existing) infrastructure. The proposed storage site largely lies underwater in wetlands.

Richton, MS

The Richton salt dome is located in northeastern Perry County, MS, 18 miles (29 kilometers) east of Hattiesburg, MS. Figure S.3.5-3 shows the location of the proposed Richton site and associated infrastructure. The proposed storage site is comprised of an actively managed pine plantation with a small emergent wetland area. The infrastructure associated with the Richton storage site would include new terminals with a tank farm at Liberty, MS, and Pascagoula, MS. Also, RWI structures would be built in both the Leaf River and the Gulf of Mexico at Pascagoula.

Stratton Ridge, TX

The Stratton Ridge salt dome is located in Brazoria County, TX, 3 miles (4.8 kilometers) east of Lake Jackson-Angleton, TX. Figure S.3.5-4 shows the location of the proposed Stratton Ridge site and associated infrastructure. The proposed storage site is currently used for cattle ranching and has some forested wetlands. The infrastructure associated with the Stratton Ridge storage site would include a new terminal with a tank farm in Texas City, TX.

S.3.6 Potential Expansion Sites and Associated Infrastructure

Bayou Choctaw, LA

The Bayou Choctaw SPR storage site occupies a 356-acre (144-hectare) site in Iberville Parish, LA, about 12 miles (19 kilometers) southwest of Baton Rouge. The Mississippi River is located about 4 miles (6.4 kilometers) east of the salt dome, and the Intracoastal Waterway (ICW) is about 0.5 miles (0.8 kilometers) to the west. The general area is swampy with an elevation ranging from less than 5 feet (1.5 meters) to more than 10 feet (3 meters) above mean sea level. Figure S.3.6-1 shows the location of the Bayou Choctaw site and proposed new infrastructure.

Figure S.3.5-2: Proposed Location of Chacahoula Storage Site and Infrastructure

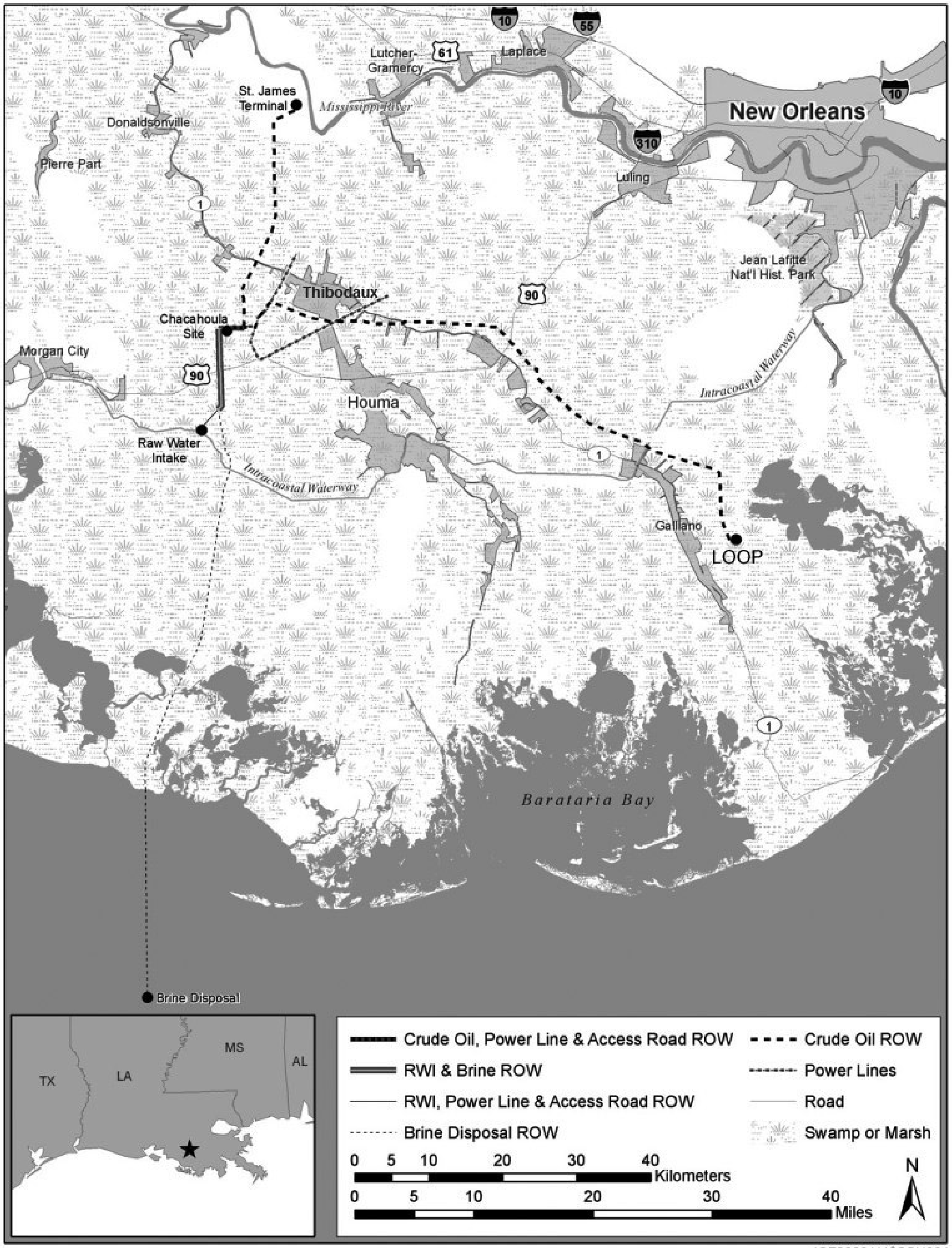

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Figure S.3.5-3: Proposed Location of Richton Storage Site and Infrastructure

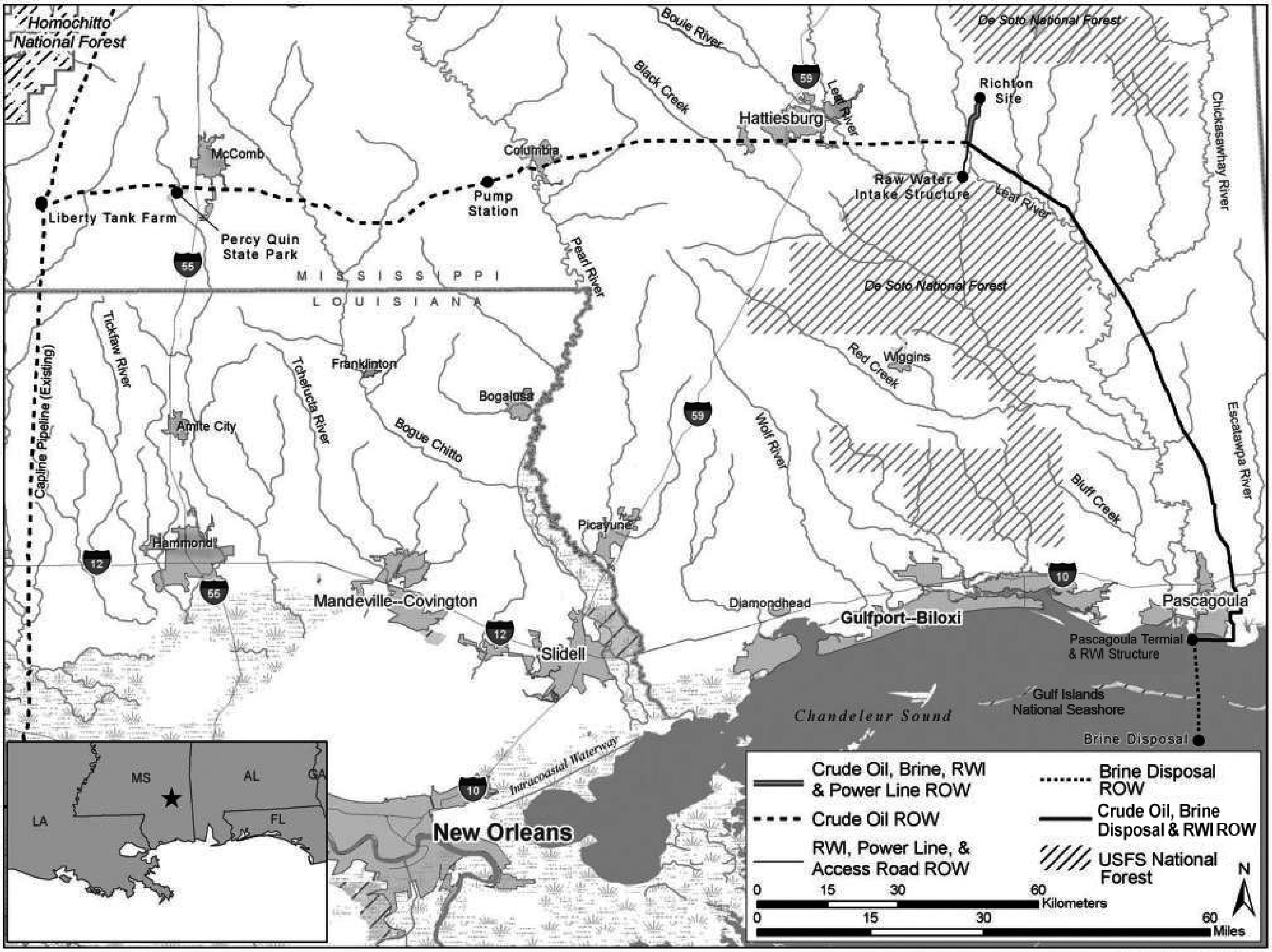

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Figure S.3.5-4: Proposed Location of Stratton Ridge Storage Site and Infrastructure

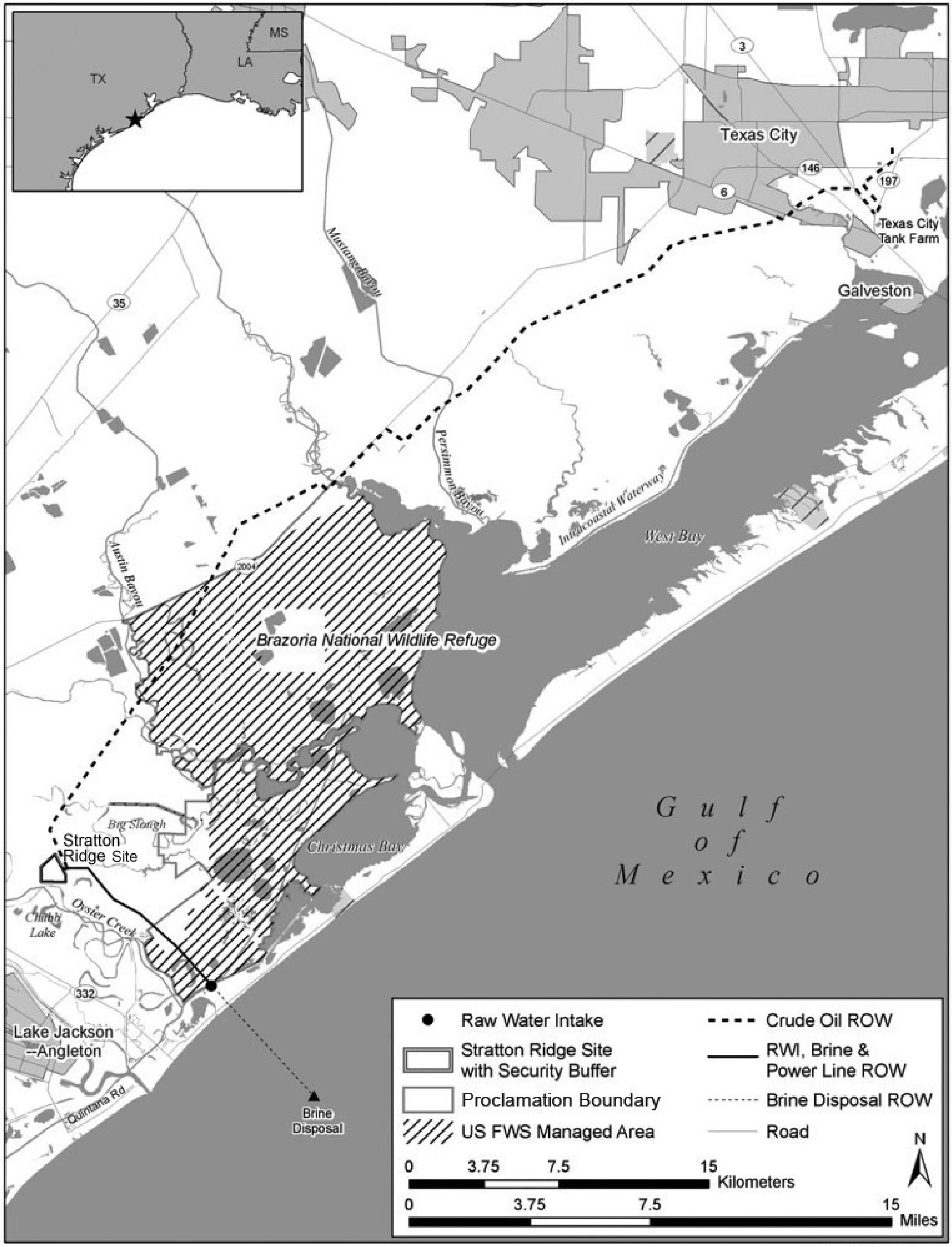

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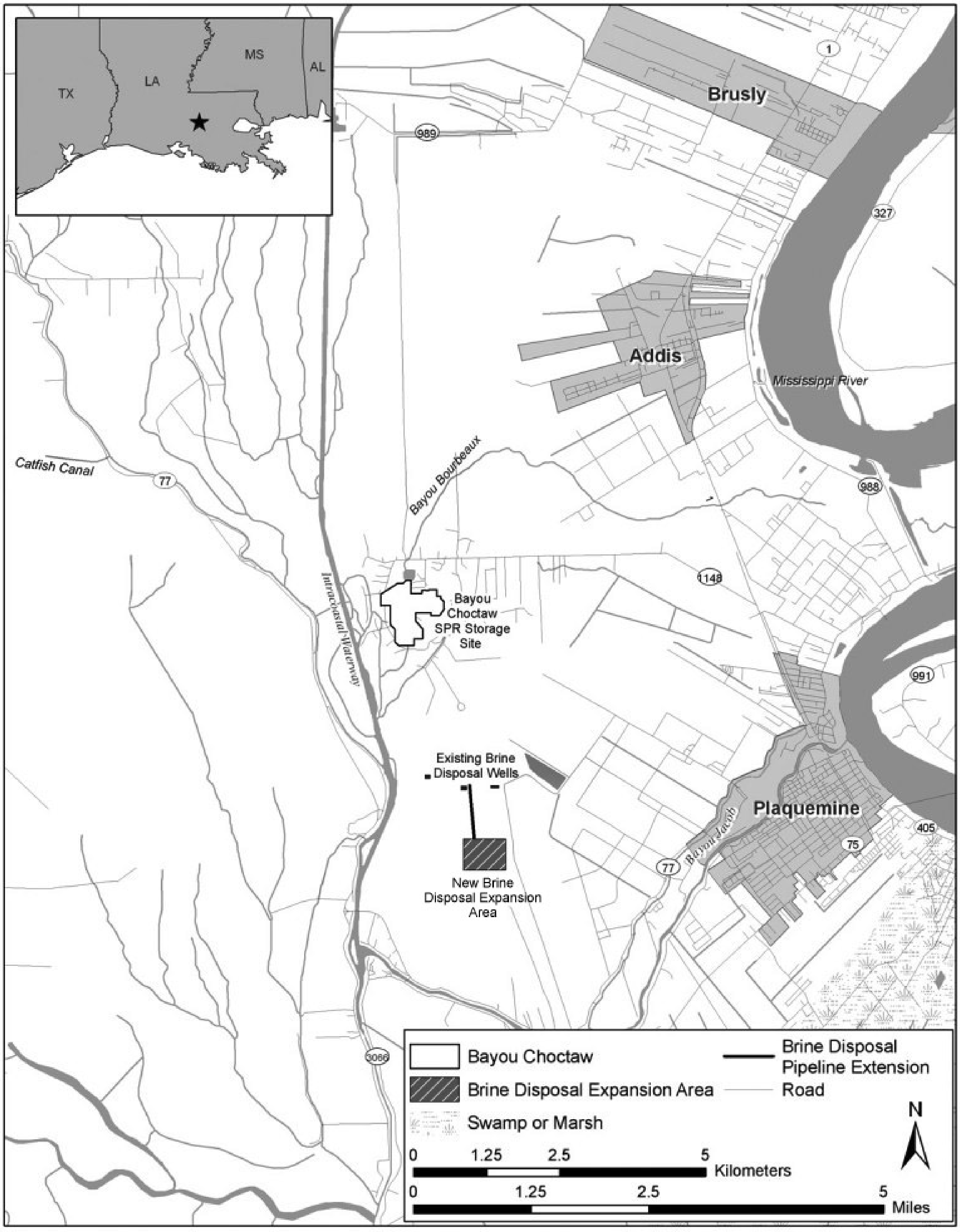
Figure S.3.6-1: Location of Bayou Choctaw Expansion Site and Proposed New Facilities



Big Hill, TX

The Big Hill SPR storage site is located in Jefferson County, TX, 17 miles (27 kilometers) southwest of Port Arthur. The existing site occupies approximately 250 acres (101 hectares). The surrounding area is predominantly rural with agricultural production as the primary land use. Figure S.3.6-2 shows the location of the Big Hill site and proposed new infrastructure. The site consists of low-to-moderate quality forest and wetlands.

West Hackberry, LA

The West Hackberry SPR storage site occupies a 565-acre (229-hectare) site in Cameron and Calcasieu Parishes in southwestern Louisiana. The site is located approximately 20 miles (32 kilometers) southwest of the city of Lake Charles and 16 miles (26 kilometers) north of the Gulf of Mexico (not shown in figure S.3.6-3). Figure S.3.6-3 shows the location of the West Hackberry site. The area is predominantly disturbed grassland habitat. Figure S.3.6-3 does not show any pipelines or other infrastructure for this site because no new infrastructure would be needed.

S.4 ALTERNATIVES ELIMINATED FROM DETAILED STUDY

As required by EPACT Section 303, DOE limited its review of potential new sites for expansion of the SPR to: (1) sites that DOE addressed in the 1992 draft EIS and (2) sites proposed by a state where DOE had previously studied a site. DOE eliminated from consideration the alternative locations in Louisiana, Texas, New Mexico, and Virginia identified during public scoping because the sites were not technically feasible and would violate the mandate of EPACT Section 303.

DOE eliminated the alternative of expanding capacity at Bryan Mound, TX, an existing SPR site, because the salt dome has no available capacity for additional storage. While the 1992 draft EIS addressed the potential new salt dome sites at Cote Blanche, LA, and Weeks Island, LA, DOE’s review of these sites for this EIS concluded that they are no longer viable due to the sale of the DOE’s Weeks Island crude oil pipeline and its subsequent conversion to natural gas transmission. The Cote Blanche site would have been connected by pipeline to the Weeks Island pipeline.

Subsequent to the publication of the draft EIS, DOE determined that the Clovelly 120-MMB alternative and the Clovelly 80- or 90-MMB and Bruinsburg 80-MMB alternatives are not feasible and therefore not reasonable. After the draft EIS was published, DOE completed additional studies of the geotechnical suitability of the Clovelly salt dome for SPR development. The dome's hourglass shape and its small size had required that DOE propose to place new SPR caverns for 120-MMB capacity below and in between Clovelly's existing caverns. This configuration has been found to present several risk factors to the integrity of the Clovelly caverns and infrastructure and overall operation of the proposed site.

Because of the potential mechanical interaction of the SPR caverns with the LOOP cavern field in the Clovelly dome formation, the maximum operating pressures for the SPR caverns would be greatly reduced to avoid severely damaging the bonding of the well casing within the salt formation. This reduction in maximum operating pressures would do the following:

- Substantially limit the maximum rate of filling and withdrawing oil from the caverns, and
- Reduce DOE’s ability to maintain the storage volume of the cavern. (Caverns at the depth DOE had proposed would incur high geological pressures that would cause the cavern volume to close or shrink, unless high pressures within the cavern are maintained.)

Figure S.3.6-2: Location of Big Hill Expansion Site and Proposed Infrastructure

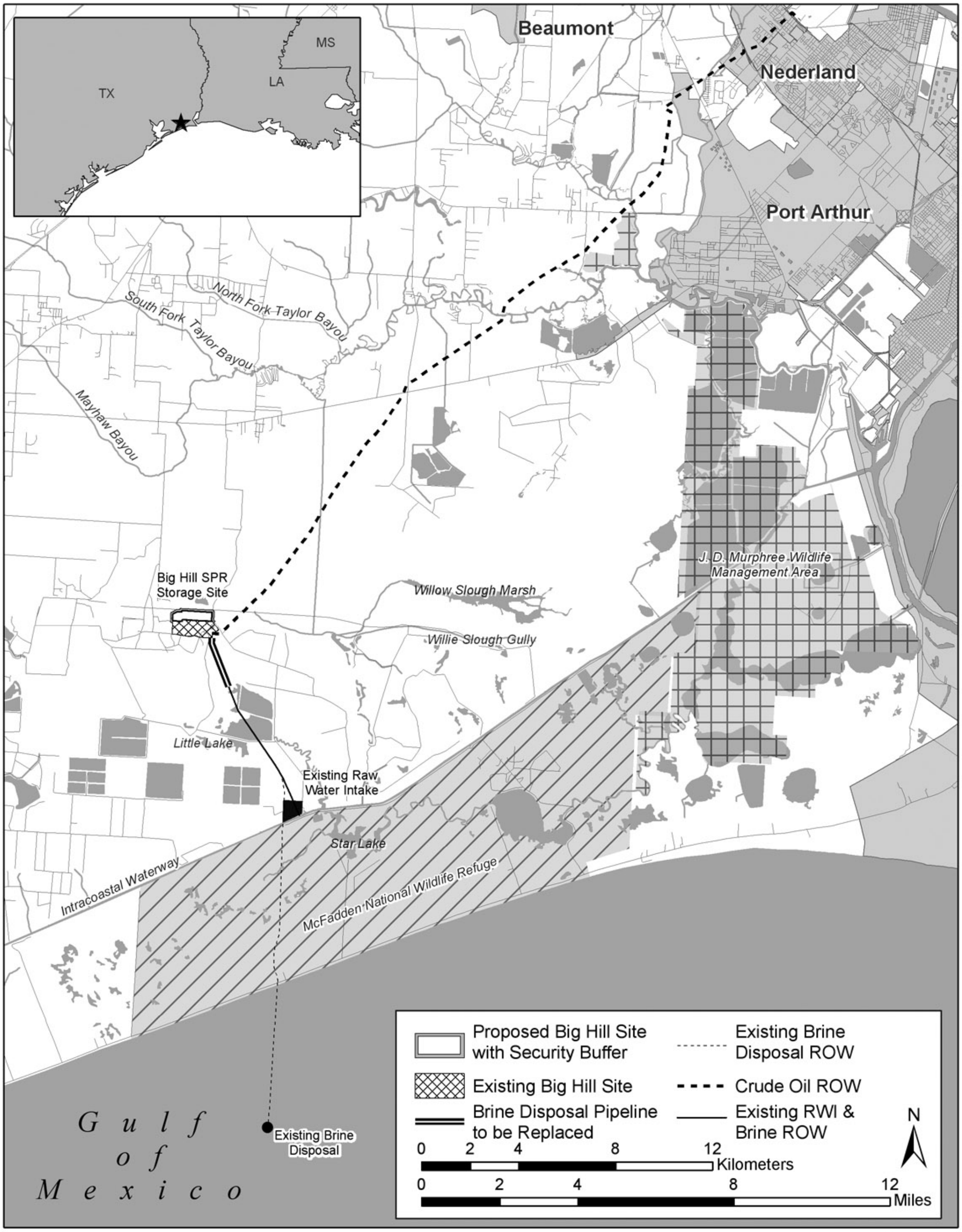


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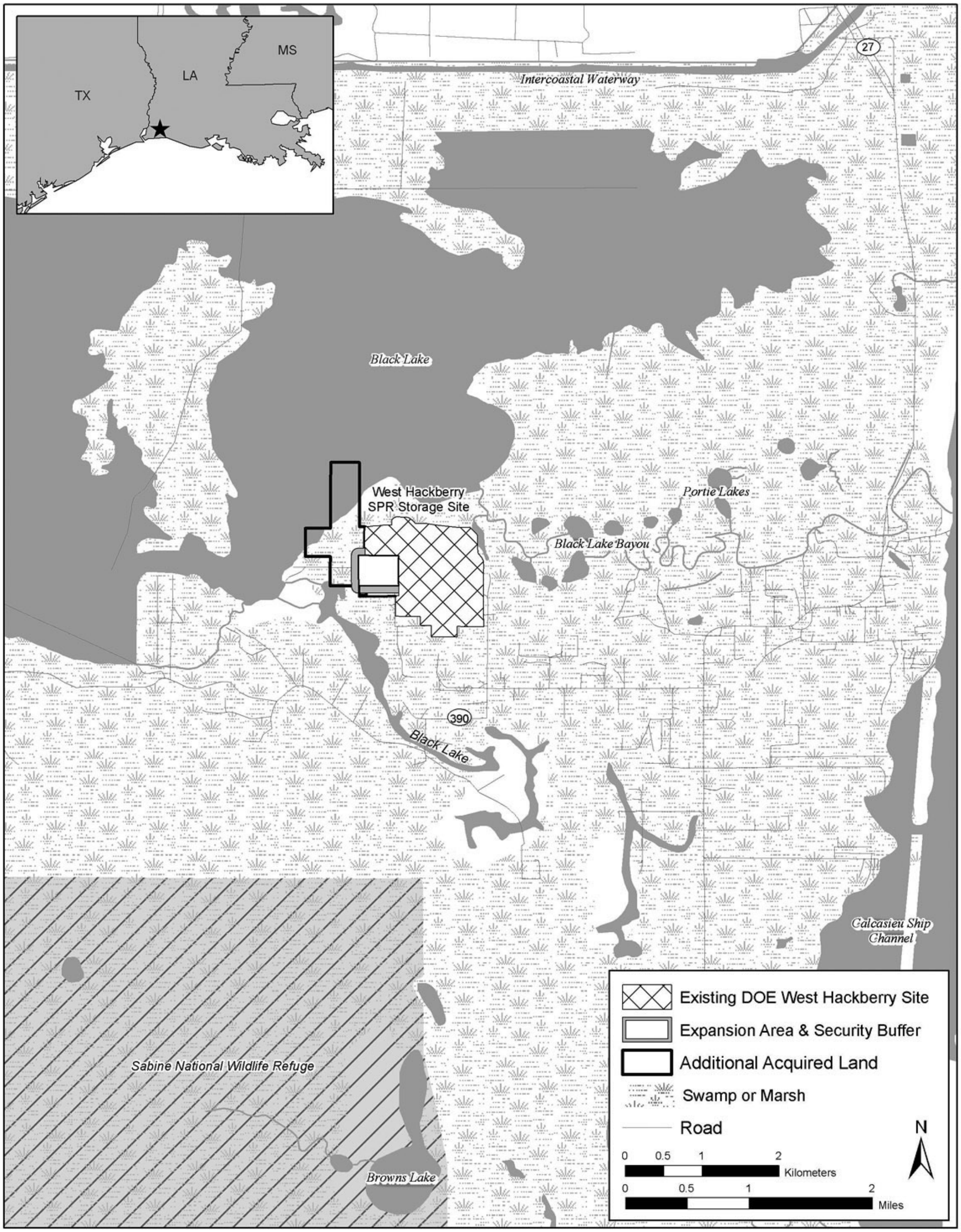
Figure S.3.6-3: Location of West Hackberry Expansion Site



ICF20060411SSH010

Because of these issues, development of the Clovelly 120 MMB alternative is no longer considered reasonable and feasible. DOE has removed the alternative from detailed consideration in the EIS.

In addition, DOE consulted with LOOP officials on whether an 80- or 90-MMB Clovelly facility, proposed in the draft EIS to be developed in conjunction with the Bruinsburg site, could be developed by constructing conventional SPR storage caverns entirely in the upper level of the unused portion of the salt dome around the existing LOOP caverns. LOOP indicated that it required space for three future caverns, which would leave space for only four to seven potential SPR caverns. That arrangement would provide only about 30 to 55 MMB of storage capacity. In addition, the arrangement would not meet DOE's minimum standoff distances from the edge of the dome and DOE's standard pillar-to-diameter ratio for the proposed caverns. Because of the small amount of overall capacity and the risk factors associated with cavern construction in the small salt dome, DOE does not consider this change in the conceptual plan for the Clovelly 80 MMB-Bruinsburg 80 MMB and the Clovelly 90 MMB-Bruinsburg 80 MMB alternatives to result in reasonable alternatives. Thus, DOE has removed these alternatives from detailed consideration in the EIS.

S.5 PUBLIC INVOLVEMENT

DOE published a Notice of Intent to Prepare an EIS on September 1, 2005 (70 FR 52088) and held four public scoping meetings. DOE received 67 scoping comment documents (comment letters and/or oral testimony) from 48 members of the public, companies, organizations, and government agencies. Section S.5.1 summarizes the major issues addressed in the scoping comments. Copies of the comment letters received during the scoping period and complete public scoping meeting transcripts are available from the Internet site http://www.fossil.energy.gov/programs/reserves/spr/expansion-eis.html.

DOE filed the draft EIS with the Environmental Protection Agency (EPA) on May 19, 2006. EPA published a Notice of Availability in the *Federal Register* on May 26, 2006 (71 FR 30400), starting the 45-day public comment period that ended on July 10, 2006. DOE received 93 written comment letters and 21 people testified at 5 public hearings for a total of 114 comment documents on the draft EIS from 108 members of the public, companies, organizations, and government agencies. Section S.5.2 summarizes the major issues raised by commenters and the resulting changes made by DOE to the final EIS. Copies of the comment letters and oral testimony received during the public comment period are available in appendix N and from the Internet site listed above. Also, chapter 8 presents the comments—organized by issue category—and the corresponding DOE responses.

S.5.1 Scoping Comments

This section summarizes the major scoping comments received by DOE on the Notice of Intent to prepare an EIS.

Public Health and Safety, Accidental Releases: Commenters stated that DOE needs to address public health issues and the potential impacts on health and safety. One concern was the cumulative and secondary impacts the project would present for the increased risks of terrorism or accidents because of proposals to build liquefied natural gas (LNG) facilities near the proposed Stratton Ridge site. The affected environment and analysis of potential environmental risks and public and occupational safety and health impacts are discussed in chapter 3, section 3.2 and cumulative impacts are discussed in chapter 4.

Land Use: Commenters asked that DOE examine various potential impacts including loss of prime farmland, adverse effects on coastal areas, and land use changes at storage sites, pipelines ROWs, and other facilities. Commenters expressed concern that the proposed locations of the caverns for the Richton and Stratton Ridge sites would preclude other uses of the salt domes or affect mineral rights and expressed concern that the proposed Stratton Ridge site would be located in the vicinity of security areas of existing and proposed industrial facilities. Affected land uses and site-specific analysis of potential land use impacts associated with the SPR sites are discussed in chapter 3, section 3.3. One commenter suggested that the EIS address impacts on the Gulf Islands National Seashore (GUIS), and this is addressed in section 3.3.5.

Geology: Commenters expressed concerns about cavern creep and subsidence that might be caused by the creation of additional oil storage caverns at the already extensively developed Stratton Ridge salt dome, and suggested that the EIS evaluate this potential for adverse impacts. The affected environment and site-specific analysis of potential geology and soils impacts for each SPR site are discussed in chapter 3, section 3.4.

Air Quality: Noting that the Bayou Choctaw, Big Hill, and Stratton Ridge sites are in air quality nonattainment areas for the 8-hour national ambient air quality standards for ozone and that they are subject to the Clean Air Act General Conformity rule and related state regulations, commenters asked that DOE estimate the potential emissions of volatile organic compounds and oxides of nitrogen during construction and operation at these sites and compare them to conformity threshold levels. Conformity analyses for the Bayou Choctaw, Big Hill, and Stratton Ridge sites are discussed in chapter 3, section 3.5. Other issues raised by commenters included cumulative air pollutant emissions and emissions from the oil blanket during solution mining. The affected environment and analysis of potential air quality impacts of construction and operation of the proposed action are discussed in chapter 3, section 3.5. The methodology for analyzing air quality impacts is discussed in appendix A. The related cumulative impacts are discussed in chapter 4.

Water Resources: Commenters requested that DOE evaluate the potential impacts of construction and operation of new oil storage caverns and underground injection wells on local aquifers, and the secondary and cumulative impacts of SPR expansion on water quality, including water salinity. Commenters expressed concern about potential impacts to rivers and coastal areas. Commenters also requested analyses of potential impacts of water withdrawal from freshwater bodies for SPR expansion and operation, runoff from construction and operation of SPR facilities, and brine disposal in the Gulf of Mexico. Commenters suggested alternate sources of RWI for the Stratton Ridge and Richton sites. The affected environment and analysis of potential impacts to water resources from construction and operation of the proposed action are discussed in chapter 3, section 3.6 and appendices B, C, and O. The related cumulative impacts are discussed in chapter 4.

Biological Resources: Commenters asked that the EIS analyze the potential primary, secondary, and cumulative impacts of SPR expansion on a variety of habitats and species. Habitats of particular concern included wetlands and essential fish habitat (EFH). Fauna of concern included shrimp, oysters, and native fish species including those that are commercially important; migratory marine species including sharks and billfishes; water birds; migratory birds; and some threatened and endangered, and candidate species such as the bald eagle, diamondback terrapin, gulf sturgeon, red-bellied turtle, brown pelican, and Louisiana black bear. Commenters identified specific biological resource areas (e.g., forested wetlands, wildlife refuges, national seashores, national forests, and benthic communities crossed by offshore brine disposal pipelines) or specific flora or fauna species (e.g., specific locations of bald eagle nesting areas) near specific SPR sites, pipeline ROWs, raw water withdrawal areas, and brine disposal areas.

The affected environment and potential impacts to biological resources from construction and operation of the proposed action are discussed in chapter 3, section 3.7 and appendices B, C, D, E, F, G, H, I, K, and O. The impact assessment methodology for plants, wetlands, and wildlife is described in section 3.7.1.1 and appendix B. Special status species (including threatened and endangered species, marine mammals, and managed fisheries) are discussed in section 3.7.1.2 and appendices B, C, D, E, F, G, H, I, K, and O; EFH is discussed in section 3.7.1.3 and appendix E. Special status areas (including national wildlife refuges, wilderness areas, Coastal Wetlands Planning, Protection and Restoration Act areas, and coastal natural resource areas) are discussed in section 3.7.1.4. Potential impacts associated with specific areas of concern and specific species of concern identified by commenters are addressed in the site-specific impact analyses in chapter 3, section 3.7 and appendices B, C, E, F, G, H, I, and O. The related cumulative impacts are discussed in chapter 4.

Socioeconomics: Commenters requested that DOE evaluate potential economic impacts on local communities, commercial and recreational fishing interests, tourism, and other economic interests in Louisiana, Mississippi, and Texas, particularly in areas affected by Hurricane Katrina. Similarly, commenters expressed concern about impacts to local industries by competition for workers and housing already in short supply. The affected environment and analysis of potential socioeconomic impacts of construction and operation of the proposed action are discussed in chapter 3, section 3.8.

Cultural Resources: Commenters addressed potential Native American concerns, particularly for the Richton and Bruinsburg sites. Commenters also identified themselves as having cultural affiliation with specific SPR sites, and requested that they be notified and that specific procedures be followed in the event that cultural artifacts are discovered during SPR site development. They also suggested the need for archaeological and cultural surveys at the Stratton Ridge, Richton, and Big Hill sites should these sites be selected by DOE. The site-specific cultural resources that could be affected and the potential impacts for each SPR site are discussed in chapter 3, section 3.9. Specific procedures that would be implemented by DOE for the selected sites are also discussed in section 3.9.

Environmental Justice: A commenter requested that DOE fully consider the environmental justice impacts of additional environmental risk and pollution associated with SPR expansion in low-income communities in light of the effects of Hurricane Katrina. Commenters also identified specific aspects (e.g., income level) of their communities. The affected environment and site-specific environmental justice impact analyses for each SPR site are presented in chapter 3, section 3.11 and appendix J.

Alternatives: Commenters proposed alternative locations for storage of crude oil. The suggestions included sites in Louisiana, Texas, New Mexico, and Virginia. A discussion of the proposed action and alternatives, including the statutory basis for selection of alternatives and alternatives considered but eliminated from detailed study, is included in chapter 2, section 2.6.

Irreversible and Irretrievable Commitment of Resources: A commenter expressed concern that development of SPR storage caverns would result in the irretrievable loss of salt resources that could otherwise be used for chlorine production. This issue is analyzed in chapter 3, section 3.3 and chapter 5.

Cumulative Impacts: Commenters requested that secondary and cumulative impacts of the proposed action and similar past, ongoing, or future actions, including cumulative impacts to water quality, biological resources, air quality, and socioeconomics, be addressed. Commenters identified specific actions (e.g., proposed LNG facilities, future oil and gas production and pipelines, commercial fishing) and requested that impacts of these actions be considered in the cumulative impacts analysis. Commenters also identified specific impacts (e.g., fish mortality caused by Hurricane Katrina) and requested that such impacts be considered in the cumulative impact analysis. Relevant actions and analysis of potential cumulative impacts of the proposed action are discussed in chapter 4.

Mitigation: Commenters requested that measures to avoid, minimize, and offset impacts (e.g., impacts to wetlands) of construction and operation of the proposed action be discussed in a mitigation section of the EIS. Commenters suggested specific mitigation measures for proposed SPR storage sites, pipeline ROWs, RWI areas, or brine disposal areas. The potential impacts and the associated mitigation measures are discussed in the relevant sections of the EIS (e.g., potential impacts and mitigation measures for impacts to wetlands are both discussed in section 3.7 and appendices B and O).

S.5.2 Public Review of Draft EIS

Section S.5.2.1 summarizes the major issues raised by commenters on the draft EIS. (To view these comments see www.fe.doegov/programs/reserves/spr/expansion-eis.html.) Section S.5.2.2 describes the major changes that DOE has made in the final EIS. (To view the draft EIS, see www.fe.doegov/programs/reserves/spr/expansion-eis.html.)

S.5.2.1 Major Issues Raised in Comments on Draft EIS

Use of the Leaf River: Commenters expressed concern that raw water withdrawal from the Leaf River during low flow conditions for the Richton alternatives would result in adverse water quality and endangered species impacts. They suggested that DOE consider other sources for water withdrawals for the Richton alternatives. DOE consulted with natural resource agencies, but identified no other practicable alternative for the entire proposed RWI withdrawal rate of 1.2 MMBD.

DOE has modified the Richton alternatives to reduce its dependence on the Leaf River by adding a supplemental water source, a RWI in the Gulf of Mexico at Pascagoula. The draft EIS identified a 16-inch (41-centimeter) diameter, 88-mile (142-kilometer) pipeline between Pascagoula and the Richton site to transport crude oil (to serve as blanket oil) from Pascagoula to Richton at the start of cavern development. DOE has changed this conceptual design by increasing the diameter of the pipeline to 36 inches (91 centimeters) so that the pipeline would also be available to transport sea water from the Gulf of Mexico to Richton during periods of low flow in the Leaf River, both for cavern development and for drawdown operations.

Other features of the conceptual design or use of pipelines between Pascagoula and the Richton site remain unchanged from the draft EIS. That is, once development of all the caverns has been completed, the 36-inch pipeline described above would discharge small volumes of brine associated with cavern filling as was described in the draft EIS for the 16-inch (41-centimeter) pipeline. A second, larger pipeline in the same ROW (48-inch [112-centimeter] diameter), as described in the draft EIS, would discharge brine during cavern development and transport crude oil during operation.

The Pascagoula RWI and associated pipeline would transport water from the Gulf of Mexico, if needed, for cavern development, maintenance, and drawdown as follows:

- During normal and high flow conditions, DOE would withdraw water only from the Leaf River.

- During low flow conditions, excluding emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico and reduce or terminate its withdrawal from the Leaf River so that it would not cause the Leaf River to be below the Minimum Instream Flow designated by regulatory agencies to protect special status species.

- If low flow conditions exist in the Leaf River during emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico and, as necessary to reach the oil drawdown rate of 1.0 MMBD, from the Leaf River even if it caused the Leaf River to be below the Minimum Instream Flow.

The supplemental water source at Pascagoula would be designed to provide 0.5 MMBD of supplemental water, rather than the full 1.2 MMBD for two reasons. First, expanding the RWI system capacity would involve substantial construction and operational costs, even though this extra capacity may never be needed during cavern development and drawdown. The costs would be higher, for example, because of a large diameter pipeline, high pumping capacity, and the electricity needed to pump water 88 miles. Second, due to its salinity, water from the Gulf of Mexico is less efficient in solution mining than fresh water from the Leaf River and its use would take more time than using freshwater, thereby increasing operational costs.

DOE has determined that withdrawal from the Leaf River during an emergency drawdown (declared as a National Emergency) may result in adverse impacts on water resources, may adversely affect aquatic communities, and may adversely affect species protected under the Endangered Species Act (ESA). In addition, withdrawal of water from the Leaf River at other times may adversely affect aquatic communities and protected species. If one of the Richton alternatives were selected, these potential impacts would require DOE to initiate formal consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries). During this consultation, DOE would develop a Water Conservation Plan as a mitigation measure. DOE also would consider supplemental water sources, such as water from underground sources, existing reservoirs, or river intakes during drawdown. DOE also would coordinate with the Mississippi Department of Environmental Quality to secure a Beneficial Use of Public Waters Permit, which would include withdrawal conditions.

Wetlands Impacts: Commenters stated that the Chacahoula and Stratton Ridge alternatives would have substantial adverse effects to wetlands. Commenters noted that the Clovelly alternative would be the environmentally preferable alternative because it would potentially affect the smallest amount of wetlands. Since the draft EIS was issued, however, DOE has determined that the Clovelly and Clovelly-Bruinsburg alternatives are not reasonable, as described above in section S.4. Commenters noted that DOE did not conduct Clean Water Act Section 404/401 permitting, delineate wetlands, or present a compensation plan during the preparation of the EIS and instead will wait until after the ROD. DOE determined that, to inform decisionmaking, general impacts to wetlands could be analyzed without conducting wetland delineations, and instead used National Wetlands Inventory data and conducted spot checks at each site. Also, in light of the broad geographic area covered by the alternatives, consultations with the U.S. Army Corps of Engineers (USACE) indicated that it would be a better use of USACE's and DOE's resources to wait until DOE selects an alternative in the ROD before delineating wetlands and initiating the Section 404/401 consultation and permitting process. DOE has added a conceptual wetland compensation plan (appendix O) that provides more information on possible mitigation strategies for wetland impacts.

Brine Discharge to Gulf of Mexico: Commenters requested additional analysis of the potential impacts of brine discharge into the Gulf of Mexico. Commenters also questioned the conclusion for the Richton alternatives that the increase in water salinity resulting from the brine discharge would be within natural salinity variation. The EIS presents an expanded analysis of brine discharge and explains that DOE would conduct additional modeling and monitoring of the brine discharge for the selected SPR alternative consistent with the permits needed from the state and Federal agencies.

Stratton Ridge Site Resource Conflicts: Commenters opposed SPR development of the Stratton Ridge storage site because it would conflict with Dow Chemical's desire to use salt that DOE would solution mine to create storage caverns. The commenters stated that loss of access to that salt would have a substantial adverse effect on Dow Chemical's long-term operations and would result in a loss of jobs in Brazoria County. Commenters also stated that construction of caverns at the Stratton Ridge site would result in irreversible and irretrievable loss of salt. DOE acknowledges that SPR development of the Stratton Ridge site could potentially conflict with Dow Chemical's future operations and thereby result in adverse socioeconomic impacts in Brazoria County. In addition, DOE acknowledges that solution mining of SPR caverns would result in the irreversible and irretrievable loss of salt.

Essential Fish Habitat: A commenter requested that DOE identify and examine impacts to onshore EFH for all alternatives and identify and examine impacts to seagrass near the brine disposal pipeline for the Richton alternatives. DOE conducted additional geographic information system analyses to identify and examine such potential impacts. As discussed in section 3.7 and appendix E, the underwater construction of an offshore brine pipeline and diffuser for Chacahoula, Richton, and Stratton Ridge may pass through EFH, which would permanently remove submerged aquatic vegetation and EFH within the ROW. Construction of onshore pipelines, RWI structures in the ICW, and the proposed new terminal and RWI at Pascagoula for the Richton alternatives would affect EFH. DOE would avoid direct impacts to submerged aquatic vegetation and EFH (if practicable) and minimize indirect impacts. DOE's consultation with NOAA Fisheries would include a plan to mitigate and compensate for impacts to EFH, which would be included as part of the Section 404/401 permit.

S.5.2.2 Major Changes to the Final EIS

This section summarizes major changes DOE made in the final EIS.

Elimination of Clovelly Site Alternatives: Subsequent to the publication of the draft EIS, DOE determined that the Clovelly 120 MMB alternative and the Clovelly 80 or 90 MMB and Bruinsburg 80 MMB alternatives are neither reasonable nor feasible for geotechnical issues. DOE has eliminated these alternatives from detailed consideration in the final EIS, as discussed in S.4 and section 2.6.

Raw Water Source for Richton Alternatives: As discussed in the discussion of the Leaf River in section S.5.2.1, DOE has modified the Richton alternatives to provide a supplemental source of water for cavern construction, maintenance, and drawdown. During low flow conditions in the Leaf River, DOE would use water from a new RWI structure in the Gulf of Mexico at Pascagoula.

Preferred Alternative: DOE identifies the Richton alternative (with expansion of the existing Bayou Choctaw, Big Hill, and West Hackberry sites) as the preferred alterative based on crude oil distribution system capabilities, environmental considerations, project risks, and project costs as discussed in sections 1.4.4 and 2.2.3.

Wetlands Impacts: DOE added Appendix O, Conceptual Compensation Plan for Impacts to Wetlands and Waters, to the final EIS in response to requests for additional information regarding potential compensation sites required by the Clean Water Act Section 404. DOE revised appendix B to incorporate updated conceptual designs for RWI structures at Bruinsburg and Richton, an additional access road at the Chacahoula storage site, additional filling of floodplains at the Bruinsburg storage site, and the change to the Richton site infrastructure, as noted above. DOE also incorporated additional information into sections 3.6 and 3.7 to identify and examine potential impacts to wetlands as a result of the new conceptual designs.

Essential Fish Habitat and Brine Discharge: DOE conducted additional geographic information system analyses to identify and examine potential impacts to onshore EFH and offshore EFH, such as submerged aquatic vegetation and impacts due to the added RWI at Pascagoula for the Richton alternatives. The results are included in sections 3.6 and 3.7 and appendix E. The EIS also presents expanded analyses of potential impacts of brine discharge in sections 3.6.2 and 3.7.2, and appendices C and E.

S.6 ENVIRONMENTAL CONSEQUENCES

This section discusses the potential environmental impacts of the proposed action across 10 resource areas. The largest potential impacts are to land use, water resources, biological resources, and cultural resources, as shown in table S.6-1 and discussed below.

Table S.6-1: Potential Resource Impacts by Alternative

Alternative (With Three Expansion Sites)[a,b]	Environmental Risks, Health, & Safety	Land Use	Geology and Soils	Air Quality	Water Resources	Biological Resources	Socioeconomics	Cultural Resources	Noise	Environmental Justice
1 − Bruinsburg	-	-	-	-	-	●	-	●	-	-
2 − Chacahoula	-	-	-	-	-	●	-	-	-	-
3 − Richton	-	-	-	-	●	●	-	-	-	-
4 − Stratton Ridge	-	●	-	-	-	●	-	-	-	-
5 − No-Action	-	-	-	-	-	-	-	-	-	-

● = Greatest potential resource impacts
[a] Under the alternatives with two expansion sites (Bayou Choctaw and Big Hill), the amount of wetlands affected would be 5 acres smaller, but none of the largest potential impacts would change.
[b] Includes storage sites and associated infrastructure.

- Land Use. For Stratton Ridge alternatives, the proposed action would create potential conflicts with Dow Chemical Company’s use of salt on the salt dome and where two ROWs for the Stratton Ridge site would pass through a national wildlife refuge.

- Water Resources. The Richton alternatives would use the Leaf River, which has a highly variable flow, to serve as the primary raw water source for the Richton storage site. DOE has determined that withdrawal of water from the Leaf River during an emergency drawdown may result in adverse impacts on water resources. DOE would not withdraw water below the Minimum Instream Flow established for the Leaf River that is protective of aquatic resources, except for an emergency drawdown declared as a National Emergency.

- Biological Resources. The primary biological resources that would be affected by the proposed action include wetlands and species protected under the Federal ESA or related state requirements. All alternatives would affect a variety of wetlands, and some of the wetlands at all new and existing sites are regionally rare. DOE would avoid wetlands, to the extent possible, but the impacts may be adverse. If avoidance were not possible, the adverse effects would be mitigated to some extent by the wetland compensation requirements of the Section 404/401 permit under the Clean Water Act. All alternatives, except the no-action alternative, may affect at least one federally listed endangered or threatened species. If the selected alternative could adversely impact any federally listed endangered or threatened species or adversely modify any designated critical habitat, DOE would initiate formal ESA Section 7 Consultation with USFWS or NOAA Fisheries. The RWI in the Leaf River for the Richton alternatives may adversely affect two federally listed species (the yellow-blotched map turtle and the Gulf sturgeon) and a Federal candidate species (the pearl darter). DOE would consider the pearl darter as a “listed species.” DOE would prepare a Biological Assessment for the three species and implement any recommendations in the Biological Opinion. DOE would develop a Water Conservation Plan to work in conjunction with the Minimum Instream Flow established to protect the aquatic resources. DOE has developed a revised conceptual plan for the Leaf River RWI that would reduce the potential for impingement and entrainment of aquatic species.

- Cultural Resources. SPR development under the Bruinsburg alternatives could result in potential adverse effects on the historic setting of the Civil War landing of the Union Army in Mississippi and an associated route of troop movements in an area that could become eligible for the National Register of Historic Places as a core study area.

The following text summarizes the potential impacts by resource area in the order listed in table S.6-1. In addition, tables S.6.11-1 and S.6.11-2 at the end of this section compare the potential impacts for each alternative.

S.6.1 Environmental Risks and Public and Occupational Safety and Health

The EIS evaluates and describes the potential environmental impacts of a release of oil, brine, and several hazardous materials. For this analysis, DOE considered risk to be the likelihood (or chance) of occurrence and its potential consequences.

The risk of an oil spill from SPR activities generally is greatest during transfer activities. The initial filling of storage facilities represents the greatest chance of spills associated with imports into the United States because subsequent drawdowns and refills would only replace a transfer of oil from interrupted imports. Thus, the analysis focuses on the likelihood of an oil spill during initial-fill activities.

The risks from oil spills would be similar for all action alternatives because the risks are primarily a function of the amount of oil transferred into SPR caverns, which would be a similar for all action alternatives. Based on historical spill statistics, the predicted oil spills would likely be a low volume (less than 100 barrels) of oil. The predicted number of oil spills would be approximately 16 spills during initial fill of the storage caverns.

The potential consequences of such infrequent, low-volume, accidental releases of oil would be minor. The releases generally would result in localized soil contamination at the storage sites and terminal locations, which would be contained and cleaned up. Elevated concentrations of oil constituents occurring in the water column and on the water surface immediately after a spill would decrease over time because of dispersion, dilution, and degradation. The rate of concentration decline would depend on the size and flushing rate of the water body affected, as discussed below. Although there is a low probability of an accidental oil spill, the consequences of a release could be significant if the release was large and/or if it migrated into a sensitive aquatic system or plant community. A large release of oil could result in mortality of plants and animals through chemical toxicity, physical smothering, respiratory interference, food and habitat loss, and inhalation or ingestion. Impacted communities can take decades to recover from a large release. A release of oil could cause significant and sometimes fatal physiological trauma to plants and animals, especially bird eggs, fish eggs, and fish larvae. While the spills would result in the release of some air contaminants, the contaminants would be released so infrequently and in such small quantities that they would be readily dispersed in the atmosphere and would have little effect on ambient air quality along site boundaries.

The risk of brine spills would be low for all action alternatives. The risk is primarily a function of the amount of brine disposed, and this amount is similar for all alternatives, excluding the no-action alternative. The total number of brine spills predicted for each alternative would range from 91 to 98 (see table 3.2.2-2). Based on historical data, however, these spills would mostly be of low volume (less than 50 barrels). Higher-volume brine spills, while possible, are very unlikely based on SPR experience. Unless the spills were large or sustained, neither of which is predicted, the brine contaminants would be diluted and dispersed into the surrounding area and water bodies by rain; soils and vegetation affected by changes in the mineral concentrations would quickly recover; and any impacts of changes in mineral concentrations on shallow groundwater and air quality would be small. While unlikely, a large discharge of brine into a sensitive aquatic system or plant community could have significant effects.

In addition to the brine spills associated with each action alternative, the Richton alternatives could result in spills of salt water from the Gulf of Mexico. If the Leaf River is unable, because of low flow conditions, to supply the full amount of water needed for cavern development and drawdown, a pipeline between Pascagoula and Richton would supply salt water from the Gulf of Mexico. Any spills of this water would have lower salinity (and lower potential impacts) than would be associated with spills of brine.

The risk of chemical spills and fire would be low and similar for all action alternatives because risk is primarily a function of the types of activities conducted. Activities are nearly identical for all alternatives, except for the no-action alternative. The occupational injuries also would be small and similar across action alternatives. For example, the rate of lost workdays due to injuries at new and expanded sites would be similar to the rate at existing SPR sites, which is 0.83 workdays per 200,000 worker hours. This rate is much lower than the Bureau of Labor Statistics average of 5.3 workdays per 200,000 worker hours.

Release of oil, brine, salt water, or hazardous materials could result from an accidental or deliberate system failure, with deliberate failures arising from sabotage or terrorism and accidental ones from design or construction flaws, human errors, or natural events. The EIS considers both minor and major releases so that the potential impacts of a terrorist action are captured within the EIS. Although the range of potential consequences can be described, the likelihood of a terrorism or sabotage event cannot be predicted or evaluated to the same degree.

S.6.2 Land Use

The analysis of land use addresses land use conflicts, visual resources, prime farmland, and coastal zone management. Each of these four topics is addressed below.

Possible Land Use Conflicts

The regulations for implementing the National Environmental Policy Act require agencies to discuss possible conflicts between the proposed action and the objectives of Federal, state, and local land use plans, policies, and controls (40 CFR 1502.16(c)). Each of the proposed alternatives would require the commitment of land for the development and operation of new and expansion sites and their infrastructure. The total area would range from the high end of 4,495 acres (1,819 hectares) for the Richton alternative with 3 expansion sites to the low end of 2,206 acres (893 hectares) for the Stratton Ridge alternative with 3 expansions sites. With 2 expansion sites, each alternative would require 81 fewer acres. Tables S.6.11-1 and S.6.11-2 identify the area required for the other alternatives.

At the expansion sites, the new storage facilities would be similar to existing facilities and therefore land use would not change substantially. Differences in land use conflicts among the alternatives would result from land use conflicts at new storage, pipeline, and other infrastructure sites. No substantial land use conflicts would arise for the Chacahoula site. For the other new sites, the following conflicts would arise for their infrastructure development.

- For the Bruinsburg site and associated infrastructure, the crude oil pipeline to Peetsville, MS, would cross the Natchez Trace National Scenic Trail and the Natchez Trace Parkway along an existing power line ROW. (All proposed pipelines would be underground except where they cross levees.)

The expansion of the ROW would require clearing vegetation and would slightly expand the existing land use of the ROW. The same pipeline would travel through private property contained within the proclamation boundary of the Homochitto National Forest for 6.8 miles (11 kilometers). (The proclamation boundary defines an area where the U.S. Forest Service may purchase land from willing sellers to expand the forest without further Congressional authorization.) About 5.6 miles (9 kilometers) would parallel an existing highway in a new corridor. While this would be a new land use, other land uses in the new ROW are unlikely to be substantively affected. The remainder of the pipeline through the proclamation area would be in an existing ROW.

- For the Richton site and associated infrastructure, the crude oil pipeline to Liberty, MS, would cross the Percy Quin State Park for about 0.5 miles (0.7 kilometers) in a new ROW. If one of the Richton alternatives is selected, DOE would work with the State of Mississippi to realign the pipeline to cross the park in an existing ROW where feasible. In addition, the brine disposal pipeline would pass through GUIS, between two islands that are also partially designated as a Federal wilderness area and in an area of the Mississippi Sound that is managed by the GUIS. The Pascagoula terminal, tank farm, refurbished docks, and RWI would be located at the Naval Station Pascagoula, a Base Realignment and Closure site for which the future uses have not been determined.

- For the Stratton Ridge site and associated infrastructure, approximately 3 miles (4.8 kilometers) of the RWI pipeline, brine disposal pipelines, and two power lines would cross the Brazoria National Wildlife Refuge and privately owned land in the refuge's proclamation area in the same new ROW. In addition, 4.7 miles (7.6 kilometers) of the crude oil pipeline would cross the refuge in an existing pipeline ROW. If one of the Stratton Ridge alternatives is selected, DOE would work with the USFWS to reduce these land use conflicts, such as by placing the power line underground. The Stratton Ridge site would conflict with Dow Chemical's desire to use the salt that DOE would solution mine to create SPR caverns. Dow has stated that loss of access to the salt would have a substantial adverse effect on Dow Chemical's long-term operations and the local economy.

Visual Resources

Construction activities at new SPR storage sites would result in temporary visual impacts and long-term changes in the existing landscape. These new facilities would appear industrial in nature and would conflict with surrounding natural vegetation. Any such impacts, however, would be minor because the new facilities would not be visible from residential or commercial areas and the sites would have limited public access. Expansion of the existing SPR facilities would not provide a large visual contrast with the existing landscape because of the existing industrial land use at these sites.

The construction of pipelines, power lines, and other infrastructure would have only minor visual impacts, with three exceptions:

- The development of the Bruinsburg site would have a visual impact on the historic Civil War landscape, as described in section S.6.8.

- As described under land use conflicts above, the ROWs for several sites would cross a national parkway, national scenic trail, national forest proclamation area, state forest, or national wildlife refuge. These ROWs would affect the views in these corridors. DOE would attempt to preserve the natural landscapes in these settings by using existing ROWs where feasible, placing pipelines underground, and otherwise working with other agencies to minimize the impacts.

- For the Stratton Ridge site and associated infrastructure, the RWI would be located along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. Recreational sightseers visiting the refuge might be sensitive to change in the visual quality, even though the RWI would be outside the refuge.

Farmland

SPR development activities would cause farmland conversion by shifting the use of land to nonfarm uses. Any prime or unique farmlands located on proposed SPR storage sites, RWI facilities, and oil distribution terminals would be permanently converted to nonfarm uses because the potential use of that land for agricultural purposes would be lost. The construction of pipelines and power lines would temporarily prohibit agricultural use of farmland within the construction easement during the construction period, which would be as long as up to 6 to 10 weeks at any specific location.

To assess these potential impacts, DOE, in consultation with the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), scored all of the individual sites and all of the alternatives using the farmland conversion impact rating. This scoring system is specified in the Farmland Protection Policy Act regulations (7 CFR Part 658). It considers a wide variety of factors related to potential farmland conversion impacts, including the amount of prime or unique farmland that would be converted, the amount of statewide and locally important farmland, the use of the land and nearby land, the distance to urban built-up areas and urban support services, on-farm investments, and compatibility with existing agricultural use. Under the regulations, "sites receiving a total score of less than 160 need not be given further consideration for protection and no additional sites need to be evaluated" (40 CFR 658.4(c)(2)). While all alternatives would affect farmlands, each alternative had a score below 160 out of 260 possible points and therefore need not be given further consideration for protection.[1]

Coastal Zone Management

The Stratton Ridge storage site and associated infrastructure would be in the coastal zone. The Bruinsburg, Chacahoula, Richton, and Bayou Choctaw storage sites would be outside the coastal zone, but some of the associated infrastructure would be in the coastal zone. The expansion site and infrastructure of Big Hill and the expansion site of West Hackberry would be in the coastal zone. DOE consulted with the coastal zone management agencies for all three states regarding compliance with the Federal Coastal Zone Management Act. The agencies prefer that DOE coordinate its consistency determination for the selected alternative through the USACE during the Clean Water Act Section 404 wetlands permitting process. USACE would then forward the determination to the coastal zone management agencies, which would conduct a consistency review and either object or concur with DOE's determination. This process satisfies the requirements of the Federal Coastal Zone Management Act.

S.6.3 Geology and Soils

Local subsidence, limited to the area above the proposed storage caverns, would range from about 2.6 to 6.1 feet (0.8 to 1.9 meters) over 30 years for the Bruinsburg, Richton, or Stratton Ridge storage sites and about 5 feet (1.5 meters) for the Chacahoula storage site. Local subsidence at expansion sites would be less than 3 inches (8 centimeters) per year. These depressions on dry land might cause minor ponding in the area overlying the caverns. Depressions in wetland areas would increase the zone of saturation closer to the surface or the depth of any standing water. The new caverns would be designed to not jeopardize the structure or integrity of existing caverns on the salt domes.

[1] The location of some of the proposed sites and their infrastructure changed slightly since DOE consulted with NRCS. These minor changes would not increase the score above 160 points for any site and its infrastructure.

S.6.4 Air Quality

The proposed action would generate low emissions of criteria pollutants. Emissions levels would be below levels of concern and below conformity determination thresholds in the ozone nonattainment areas at Bayou Choctaw, Big Hill, and Stratton Ridge. At the Stratton Ridge site, the conformity review conducted for this EIS estimates that the maximum emissions of volatile organic compounds would be slightly below the threshold that triggers a full conformity determination. Thus, if one of the Stratton Ridge alternatives is selected, DOE would conduct an additional conformity review using the final site design to determine whether thresholds would be exceeded and trigger a full conformity determination.

The largest source of greenhouse gas emissions for SPR expansion is carbon dioxide emitted from construction equipment and motor vehicles, and methane emitted from cavern leaching. During construction, the maximum annual average greenhouse gas emissions associated with any alternative would be less than 0.22 million tons of carbon dioxide equivalent. The emissions during SPR operations would be smaller, about one-third as much as during construction.

S.6.5 Water Resources

The analysis of water resources addresses potential impacts to surface water, groundwater, and floodplains. Each of these topics is discussed below.

Surface Water

The proposed new and expansion sites would withdraw water from nearby surface water bodies for use in cavern solution mining. Two of the proposed new sites (Chacahoula and Stratton Ridge) and two expansion sites (Big Hill and West Hackberry) would withdraw water from the ICW. The proposed new Bruinsburg site would withdraw water from the Mississippi River. One new site (Richton) and one expansion site (Bayou Choctaw) would withdraw water from other local surface water bodies, the Leaf River and Cavern Lake, respectively. The Richton site also would withdraw water from the Gulf of Mexico if the flow of the Leaf River is low. The water withdrawal from water bodies other than the Leaf River would represent a small amount of the average available water from the water body because the water bodies are large or tidal. For the proposed Richton site, the flow rate of the Leaf River is highly variable and withdrawal has the potential to be a significant fraction of the total river flow during drought periods. The amount needed for construction of the proposed site would come from the Leaf River and would be supplemented by water from the Gulf of Mexico during low flow conditions in the Leaf River. The withdrawal from the Leaf River would stop if flow reaches the Minimum Instream Flow established by the regulatory agencies. However, if a National Emergency is declared, which requires a drawdown of oil, DOE may have to withdraw from the Leaf River even when flow is below the Minimum Instream Flow, in order to meet DOE's proposed oil drawdown rate of 1.0 MMBD.

Brine from the solution mining of the salt caverns or from filling caverns with oil would be discharged into the Gulf of Mexico from the proposed SPR facilities, with the exception of Bruinsburg, Bayou Choctaw, and West Hackberry, where brine would be injected into deep subsurface aquifers via injection wells. All of the proposed brine diffuser locations in the Gulf of Mexico would be in waters of similar depths along the coastline (i.e., 30 feet [9 meters]) with placement at a depth that would not affect navigation. Small increases in salinity levels would occur from the discharge for all sites with brine discharge into the Gulf of Mexico. Modeling indicated a maximum of 4.7 parts per thousand extending 1.5 nautical miles (2.8 kilometers) out from the diffuser. This increase would be comparable to natural salinity variations in the Gulf of Mexico. However, for the Chacahoula site, brine discharged through the proposed diffuser may tend to pool at the sea bottom due to flow restrictions. The bottom of the Gulf of Mexico slopes gently seaward at all of the proposed diffuser locations except for Chacahoula, which is located in close proximity to a shoal area (Ship Shoal). Brine plume movement for the Chacahoula brine discharge could be restricted due to the bathymetry resulting from the presence of the shoal area. DOE would secure National Pollutant Discharge Elimination System (NPDES) discharge permits from the appropriate state agency for the brine discharge into the Gulf.

All alternatives would involve construction of multiple pipelines that would cross surface water bodies ranging from large rivers to small streams. Construction activities across these surface water bodies may cause temporary stream bed or stream bank erosion, suspension of sediments, and possibly siltation in the water channel. The proposed pipeline surface water crossings would require a Section 404/401 permit from the USACE and appropriate state agency. These permits would require engineering methods to reduce any erosion or sediment impacts, and may require compensation for the loss of aquatic resources.

Pipelines for the Bruinsburg, Richton, and Stratton Ridge sites would pass through and may cross surface water bodies in established wellhead protection areas. These areas are established around surface water or groundwater supply sources to guard against contaminants entering the drinking water supply. Given the required permitting process and other measures that would be taken to guard against pipeline leakage, the pipelines are unlikely to discharge contamination into the wellhead protection areas.

The brine or oil discharges into surface water described above are potential impacts under Environmental Risks and Public and Occupational Safety and Health and Biological Resources.

Groundwater

As previously mentioned, brine from Bruinsburg, Bayou Choctaw, and West Hackberry would be injected into deep saline aquifers via injection wells. West Hackberry would use an existing brine injection system, which would result in a very small increased risk to the underlying sole source aquifer. Bayou Choctaw would use existing and proposed new injection wells. At Bruinsburg, DOE would construct new injection wells.

The potential for brine to leak into shallow water source aquifers is very low for all sites. Brine injection wells would be sealed and pressure-tested to ensure that leakage would not occur. DOE also would implement a shallow groundwater-monitoring program at each site to ensure protection of groundwater quality. Additionally, each site has confined aquifers that are separated by impermeable strata, so impacts to groundwater associated with the disposal of brine by deep well injection would be minimal. At Bayou Choctaw, the proposed receiving formation for injection of brine is below any aquifers containing fresh or slightly saline water. The West Hackberry expansion would use the existing SPR brine disposal facilities, which have the capacity needed for expanding the site. At Bruinsburg, the total disposal capacity of the proposed injection formations and the pressure build-up likely to occur as a result of brine injection are currently unknown. If DOE were to select one of the Bruinsburg alternatives, the total disposal capacity and pressure build-up would be determined during the development of the detailed design and adjusted accordingly. If needed, brine would be injected in both the Sparta and Wilcox formations. Brine injected into these aquifers would travel further downgradient into increasingly saline portions of the aquifers, and away from the portions of the aquifers that constitute current or potential sources of fresh water.

Pipelines associated with the Bruinsburg, Richton, and Stratton Ridge sites would cross areas with state programs (e.g., wellhead protection areas) to protect against contamination of particular groundwater sources of drinking water. Given the required permitting process and other measures that would be taken to guard against pipeline leakage, the pipelines are unlikely to discharge contamination into the wellhead protection areas.

Floodplains

A substantial portion of the proposed storage sites and associated infrastructure of each alternative would be located in the 100-year and 500-year floodplains. Between 84 acres (34 hectares) under the Richton alternatives and 307 acres (124 hectares) under the Bruinsburg alternatives of the 100-year floodplain would be permanently affected. Between 27 acres (11 hectares) under the Chacahoula or Richton alternatives and 213 acres (86 hectares) under the Stratton Ridge alternatives of the 500-year floodplain would be permanently affected. The amount of onsite construction would vary by site, with the greatest amount of floodplain disturbance at the Stratton Ridge and Bruinsburg storage sites. Offsite pipeline construction would affect floodplains only during construction. Areas would be restored to grade following construction. Pipeline construction associated with the Chacahoula alternatives would cross the largest area of floodplains.

While some impacts to flood storage and flooding attenuation would occur, impacts generally would be limited because most of the infrastructure on the affected floodplains would be built below ground. The primary impacts would result from aboveground facility construction and placing fill for the new caverns at Bruinsburg, Chacahoula, Stratton Ridge, Bayou Choctaw, and Big Hill. These fill areas, however, would each constitute only a small proportion of the total area of the floodplain where they are located. The Chacahoula, Stratton Ridge, and Big Hill sites would be located in floodplains that extend over hundreds of acres in coastal basins. The Bruinsburg and Bayou Choctaw sites would be located in an extensive floodplain area associated with the Mississippi River. Thus, fill areas developed as part of the proposed action at these sites would not have significant impact on the flood storage capacity or hydraulic function of the related floodplains.

DOE would comply fully with applicable local and state guidelines, regulations, and permit requirements regarding floodplain construction. In general, DOE would be required to evaluate the impact of placing fill or structures in the 100-year floodplain and demonstrate that the proposed fill and structures would not increase the base flood elevation. Based on the factors discussed above and in detail in section 3.6 and appendix B, DOE expects that overall impacts to floodplain hydraulic function, lives, and property in the area, would not be significant.

S.6.6 Biological Resources

The analysis of biological resources addresses potential impacts to wetland, threatened and endangered species, special status areas such as parks, national wildlife refuges, and EFH. Each of these topics is addressed below.

Plants, Wetlands, and Wildlife

Each alternative would result in the clearing, grading, and filling of a variety of upland and wetland communities on the salt dome, at the ancillary facilities, security buffers, and in the ROWs. Filled wetlands would cause a permanent loss of all functions and values of the wetlands.

For each alternative, the construction and operation of ROWs would cause temporary impacts to wetlands within the construction easement, such as by clearing and equipment use, and permanent impacts within the permanently maintained ROW, such as by converting forested or scrub-shrub wetland communities to emergent wetlands. The impacts to wetlands within the ROWs and security buffer would include the loss or impairment of some wetland functions and values, such as aesthetics, some wildlife habitat, water quality, and biological productivity. Other functions and values, such as flood attenuation, groundwater recharge, some wildlife habitat and food production, may not be affected.

DOE would complete a wetland delineation for the selected alternative and secure a jurisdictional determination or confirmation of the wetlands boundaries from the USACE. For all filling of wetlands, temporary construction disturbance, and permanent conversion of wetlands from one type to another, DOE would secure a Clean Water Act Section 404/401 permit from the USACE and appropriate state agency. The impact to wetlands for each alternative other than the no-action alternative would be a potential adverse effect. DOE would prepare a wetland compensation plan to mitigate the impacts to wetlands, as described in appendix B, section B.4 and appendix O.

Table S.6.6-1 summarizes potential wetland acreage affected by each alternative with three expansion sites: Bayou Choctaw, Big Hill, and West Hackberry. In this table, the potentially affected wetland acreage is listed for forested, scrub-shrub, and emergent or other types of wetlands at the SPR storage sites, associated ancillary facilities, security buffers, and ROWs (such as for each site's associated utility lines, access roads, and pipelines for RWI, brine disposal, and crude oil). In table S.6.6-1:

- **Permanently Lost (Filled) Wetlands** are wetlands that would be filled to support wellheads and other structures.
- **Permanently Converted and/or Periodically Disturbed Wetlands** are wetlands within a security buffer or permanently maintained ROW. Forested and scrub-shrub wetlands would be permanently converted to emergent wetlands by cutting trees and shrubs. Emergent wetlands would re-establish in these areas, but periodic clearing would prevent trees and shrubs from growing back. This category also includes emergent wetlands that would be cleared during construction and periodically disturbed by maintenance clearing activities.
- **Temporarily Affected Wetlands** are wetlands that would be temporarily affected by construction in a ROW, such as wetlands within a temporary construction easement. Forested, scrub-shrub, and emergent wetlands would be cleared, but would be allowed to re-establish. Wetlands could be disturbed by construction activities such as equipment and material storage, construction traffic, and some grading. DOE would restore original contours, replace the original hydric topsoil in the disturbed area where practical, and seed with native species. Re-establishment of scrub-shrub or forested wetlands may take 5 to 25 years depending on the type of wetland affected. Emergent and other wetland types would return to the pre-existing conditions shortly after restoring original contours, seeding, and implementation of best management practices.

Appendix B presents a detailed discussion of the wetland types and impacts associated with each site and alternative.

The Bruinsburg alternatives would potentially affect about 708 acres (287 hectares) of wetlands. This includes a permanent loss through filling of about 156 acres (63 hectares) and a permanent conversion of about 123 acres (50 hectares) of relatively rare and ecologically important forested wetlands. About 118 acres (48 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROWs.

The Chacahoula alternatives would potentially affect 2,502 acres (1,013 hectares) of wetlands. About 182 acres (74 hectares) of ecologically important forested wetlands would be filled and about 699 acres (283 hectares) of forested wetlands would be permanently converted to emergent wetland. About 503 acres (204 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROW.

Table S.6.6-1: Potential Acreage of Wetlands Affected by Alternatives with Three Expansion Sites

Alternative[a]	Permanently Lost (Filled) Wetlands			Permanently Converted and/or Periodically Disturbed Wetlands			Temporarily Affected Wetlands			Total Potentially Affected Wetlands
	Forested	Scrub-Shrub	Emergent/ Other Wetlands[b]	Forested Converted to Emergent	Scrub-Shrub Converted to Emergent	Emergent/ Other Wetlands[b] Periodically Disturbed	Forested	Scrub-Shrub	Emergent/ Other Wetlands[b]	
Bruinsburg	156	9	7	123	26	81	118	28	160	708
Chacahoula	182	0	11	699	22	366	505	34	683	2502
Richton	59	0	54	295	79	163	506	114	287	1557
Stratton Ridge	227	16	49	70	8	183	9	4	275	841

[a] Under the alternatives with two expansion sites (Bayou Choctaw and Big Hill, but not West Hackberry), the amount of permanently converted scrub-shrub wetlands and the total acreage of potentially affected wetlands would be lower by 5 acres.

[b] Emergent/other wetlands include the following type of wetlands: Palustrine – emergent, Estuarine – emergent, Palustrine – aquatic bed, Lacustrine, Riverine, Marine, Palustrine – unconsolidated bottom, and Palustrine – open water.

The Richton alternatives would potentially affect 1,557 acres (630 hectares) of wetlands. The majority of the wetland areas affected (more than 1,400 acres [583 hectares]) in association with the Richton alternatives would be located in the long pipeline ROWs, which total over 200 miles and which pass through forested and emergent wetlands. The Richton alternatives would permanently fill about 59 acres (24 hectares) of forested wetlands and about 295 acres (119 hectares) of forested wetlands would be permanently converted to emergent wetlands. About 506 acres (205 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROWs.

The Stratton Ridge alternatives would potentially affect 841 acres (349 hectares) of wetlands. This includes a permanent loss through filling of 227 acres (92 hectares) of relatively rare and ecologically important forested wetlands. About 70 acres (28 hectares) of forested wetlands would be permanently converted to emergent wetlands. About 9 acres (4 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROWs.

Threatened and Endangered Species

Each new site and associated infrastructure may affect one to five federally listed species. No federally listed endangered or threatened species would be affected at expansion sites. The following summarizes potential impacts for the proposed new sites.

Bruinsburg Site and Associated Infrastructure

- Fat pocketbook mussel, a federally endangered species, may be affected by the Bruinsburg ROW in-stream construction in Coles and Fairchild creeks.

- Pallid sturgeon, a federally endangered species, may be affected by the in-river construction and operation of the Bruinsburg RWI structure.

Chacahoula Site and Associated Infrastructure

- Bald eagle, a federally threatened species, may be affected by the development and operation of the Chacahoula site and construction along the Chacahoula ROWs. Potential foraging, roosting, and nesting habitat may be impacted.

- Brown pelican, a federally endangered species, may be affected by the construction along the Chacahoula ROW to LOOP. Roosting habitat may be affected.

Richton Site and Associated Infrastructure

- Gopher tortoise, a federally threatened species, may be affected by the construction along the Richton ROWs, which may result in a loss of habitat and tortoises.

- Black pine snake, a Federal candidate species, may be affected by the construction along the Richton ROWs, which may result in a loss of habitat and snakes.

- Yellow blotched map turtle, a federally listed species, may be adversely affected by the in-water construction and operation of the Richton RWI structure on the Leaf River. A loss of habitat, impingement and entrainment of juvenile turtles, and alteration of the hydrologic regime or water quality in the Leaf River may occur.

- Gulf sturgeon, a federally listed species, may be adversely affected by the in-water construction and operation of the Richton RWI structure at the Leaf River, and may be affected by the brine discharge pipeline in the Mississippi Sound and the operation of the RWI at Pascagoula. The RWI may adversely affect designated critical habitat and may adversely affect the population through impingement and entrainment of eggs and juvenile sturgeon and alteration of water quality and the hydrologic regime in the Leaf River.

- Pearl darter, a Federal candidate species, may be adversely affected by the in-water construction and operation of the Richton RWI structure. The RWI may result in a loss of habitat, impingement and entrainment of pearl darters, or alteration of the water quality and hydrologic regime in the Leaf River.

Stratton Ridge Site and Associated Infrastructure

- Bald eagle, a federally threatened species, may be affected by the development and operation of the Stratton Ridge site. Construction along the Stratton Ridge ROWs may affect potential foraging, roosting, and nesting habitat.

In accordance with Section 7 of the ESA, DOE has consulted with the USFWS and has identified the federally listed species that the proposed action would not affect and the federally listed species that the proposed action may affect. Upon the selection of an alternative, DOE would continue consultations with USFWS and NOAA Fisheries in accordance with Section 7 of the ESA.

Special Status Area

Expansion sites and the Chacahoula site and associated infrastructure would not affect any special status areas. The Bruinsburg site and associated infrastructure would involve a ROW crossing of the Natchez Trace Parkway. In addition, the crude oil ROW to Peetsville for the Bruinsburg site would pass through the proclamation area of the Homochitto National Forest. The Richton site and associated infrastructure would involve a ROW crossing of the Percy Quin State Park and the brine discharge pipeline would cross a managed area of the GUIS Seashore. The Stratton Ridge site would involve two ROWs that would pass through the Brazoria National Wildlife Refuge. The biological impacts on the special status areas would include temporary and permanent changes in the vegetative communities along the construction and permanent ROWs, respectively.

For issues involving the Natchez Trace Parkway, Homochitto National Forest, Brazoria National Wildlife Refuge, GUIS, and Percy Quin State Park, DOE would coordinate with the National Park Service (NPS), the U.S. Forest Service, the USFWS, NOAA Fisheries, and Mississippi to minimize the impacts to important natural resources.

Essential Fish Habitat

The Big Hill, Chacahoula, Richton, and Stratton Ridge sites would require developing new offshore brine disposal systems and pipelines and structures that could affect onshore and offshore EFH. The underwater construction of an offshore brine pipeline and diffuser for these sites would pass through EFH and would temporarily increase suspended sediments and cause marine species to leave the area. Construction of onshore pipelines and some RWI structures would temporarily affect estuarine and tidally influenced palustrine wetlands in a similar manner. Some EFH would be permanently destroyed with the construction of RWI structures on the ICW and a terminal and RWI structure at Pascagoula for the Richton alternatives.

The operation of the offshore diffusers would cause minor increases in the salinity concentrations under the Chacahoula, Stratton Ridge, and Richton alternatives around discharge points in the Gulf of Mexico. The estimated salinity concentrations would increase by up to 4.7 parts per thousand around the diffusers and would affect EFH. Some marine species may avoid the areas with increased salinity concentrations; however, the increase in the salinity concentration would typically be within the normal salinity concentration range of the Gulf of Mexico. Appendix C discusses the brine plume modeling that DOE completed and appendix E describes potential impacts associated with onshore and offshore construction and brine diffusion on EFH.

S.6.7 Socioeconomics

The proposed action would require a peak construction work force of approximately 230 to 550 employees at the new storage site and infrastructure, plus another 250 to 350 employees for the expansion sites and their infrastructure. The operations workforce would be about 75 to 100 employees at each site and about 25 additional employees at each expansion site. This employment would create positive local economic benefits under all alternatives.

While the proposed storage sites and infrastructure generally are located in or near rural communities, they are close (e.g., 20 to 45 miles [32 to 72 kilometers]) to more populated urban areas. Most workers would come from these relatively close areas. In-migration to the areas near the storage sites would be small relative to the regional population. Thus, the proposed action would create no noticeable increase in competition for labor, traffic, or demand for housing and public infrastructure and services.

The development of the Stratton Ridge site could cause a loss of jobs if Dow Chemical would be unable to access the salt that DOE would solution mine to create SPR caverns.

S.6.8 Cultural Resources

The proposed action would have the potential to damage or destroy archaeological sites, Native American cultural sites, or historic buildings or structures or to change the characteristics of a property that would diminish qualities that contribute to its historic significance or cultural importance. Native American archaeological sites have been recorded or may be present at all of the proposed new and expansion sites and associated pipelines and other infrastructure.

SPR development at the Bruinsburg site could result in potential adverse effects on the historic setting of the Civil War landing of the Union Army in Mississippi and an associated route of troop movements in an area that could become eligible for the National Register of Historic Places as a core study area. The floodplain where the Bruinsburg storage caverns would be developed is the site where the Union Army, under General Grant, disembarked after crossing the Mississippi River on April 30, 1863, to begin the invasion of Mississippi that culminated in the surrender of Vicksburg on July 4, 1863. A portion of the Bruinsburg site is likely to contain archaeological remains of troop presence. Remains of at least one of the ships that sank during the invasion are likely to lie northwest of the facility boundary. The historic Bruinsburg Road is reportedly still visible on the floodplain and along the route of the climb up to the escarpment.

Construction activities on the floodplain where the Bruinsburg storage caverns would be built might affect remains associated with the troop landing or prehistoric sites and would affect the setting and feeling of the troop-landing site. Construction activities on the escarpment where the rest of the storage site facilities would be built could affect remains associated with the historic line of the march of the Vicksburg campaign or prehistoric sites.

Under the terms of a programmatic agreement with the State Historic Preservation Officer (SHPO) in each state and the Advisory Council on Historic Preservation, DOE would identify and resolve adverse effects to historic properties in locations selected for expansion or new development. At those locations, DOE would conduct field reconnaissance and additional documentary research and consultations as appropriate to identify cultural resources including historic properties, that is, archaeological or historical sites, structures, districts, or landscapes that are eligible for listing in the National Register of Historic Places. For identified historic properties, DOE would assess potential project effects and resolve adverse effects in consultation with the SHPOs and the tribes that are concurring parties to the programmatic agreement.

Resolution of adverse effects may include measures such as rerouting a pipeline segment or shifting a surface facility footprint to avoid a historic property, thus no longer affecting it. Where avoidance is not possible, measures to mitigate disturbance or destruction of historic properties may include data recovery from an archaeological site or detailed documentation of a building or structure sufficient for the Historic American Buildings Survey or Historic Architectural and Engineering Records. These efforts might be followed with preparation of educational materials written to inform the public about the information gained from archaeological excavations or drawings and photographs of historic structures or other resources. Measures to address visual impacts or other alterations to the setting and feeling of an historic property might include use of vegetation or other methods to screen project facilities from visitors to the historic property. If screening is not possible, the preconstruction setting might be documented with photographs or video, with the resulting materials used to provide public access through interpretive displays or deposition in historical archives.

Specific to the Bruinsburg alternatives, several measures could mitigate the effects of altering the setting at the Union Army troop-landing site, which is already changed from the original site because the river channel moved westerly and the town of Bruinsburg was abandoned. The mitigation measures could include improved access for history students to the area by the access road to the new facility, possibly including construction of a viewpoint on the descent of the escarpment. In addition, another mitigation measure might be financial support to the NPS interpretive program. Currently, access is possible only by special permission from the private landowner; interpretive signs are posted only along public roads, not at the actual site. Damage or destruction of archaeological remains associated with the landing and troop movements would be mitigated through avoidance, if possible, or data would be recovered if damage or destruction of the remains were not avoidable. The current conceptual design for the site, with most buildings and other surface structures on the escarpment, would minimize the effect on the landing area.

S.6.9 Noise

Noise from constructing the proposed storage sites would be audible to the closest receptors for the proposed new and expansion storage sites. The estimated noise levels, however, would have minor impacts because the noise levels would be only slightly greater than the estimated ambient noise levels. The construction noise impacts along the pipelines and at other infrastructure locations also would be small. The level of noise from operations and maintenance activities would be lower than from construction activities. At several proposed storage sites, the noise levels would not be audible, that is, they would be lower than estimated ambient noise levels.

S.6.10 Environmental Justice

The potentially affected populations for each alternative include low-income, Black or African American, Native American or Alaska Native, Asian, and Hispanic or Latino populations. The Stratton Ridge site and associated infrastructure also includes Native Hawaiian or Other Pacific Islander populations. None of these populations would have impacts that appreciably exceed the impacts to the general population. Furthermore, none of the populations would be affected in different ways than the general population, such as by having unique exposure pathways, unique rates of exposure, or special sensitivities, or by using natural resources differently. Thus, there would be no disproportionately high and adverse impacts to minority or low-income populations.

S.6.11 Comparison of Alternatives

This section contains two tables that identify potential impacts in each resource area.

- Table S.6.11-1 describes the potential impacts for each alternative with three expansion sites, which would be Bayou Choctaw, Big Hill, and West Hackberry, and for the no-action alternative.

- Table S.6.11-2 addresses the difference between the alternatives in the first table (excluding the no action alternative), which have three expansion sites, and the remaining alternatives, which have just two expansion sites. In other words, the second table focuses on the differences associated with not expanding West Hackberry and increasing the expansion capacity at Big Hill. (It does not address Bayou Choctaw because the same expansion capacity would be developed at this site under both sets of alternatives.) As shown in the table, the differences between having three versus two expansion sites would be the same for each alternative.

S.7 CUMULATIVE IMPACTS

Other past, present, and reasonably foreseeable projects that could cause cumulative impacts in combination with the proposed action include projects such as pipeline construction, oil and gas development, roads, flood control, and real estate development in general. Both the largest direct effects and the most important cumulative impacts would be to wetlands. DOE determined that all candidate alternatives except the No Action would have a potentially adverse cumulative effect on wetlands. The EIS assesses the cumulative effects to water resources, but found negligible effects. DOE does not expect the cumulative effects to threatened and endangered species to be significant for any alternative, except for the Richton alternatives, which may have a cumulative adverse effect on the Gulf sturgeon, pearl darter, and yellow-blotched map turtle.

The Chacahoula alternatives would affect the most acres of wetlands of any alternative in combination with other projects in the same ecosystem. Louisiana has lost substantial amounts of wetlands associated with agricultural activities, land development, natural land subsidence, and erosive forces over many decades.

For the Bruinsburg site and associated infrastructure, with the exception of one of the proposed crude oil pipelines and a new casino affecting the same wetlands, there are no other potential projects nearby. There are no existing or proposed projects near the Richton site and associated infrastructure that would have a meaningful cumulative effect. In general, however, Mississippi wetlands have been under significant development pressure in recent decades due to agricultural activities and more recently from residential and commercial coastal development.

The proposed Stratton Ridge storage site is the last remaining major undeveloped area on the Stratton Ridge dome and there is some competition for this land for oil and gas development. The Freeport LNG project is currently under construction on the Stratton Ridge salt dome, which is in close proximity to the proposed site of the DOE caverns. The natural gas storage cavern will be a major development in the area and will create cumulative pipeline construction and site development impacts on wetlands and EFH with the potential SPR site.

Several highway-widening projects would intersect the pipelines near the Stratton Ridge site and associated infrastructure and may cause localized cumulative effects to wetlands. In general, the coastal wetlands of Texas have also come under similar pressures as Louisiana and Mississippi.

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Environmental Risks and Public and Occupational Safety and Health	Possible oil spills during initial fill. 16 oil spills predicted. Possible brine spills during the solution mining of caverns and fill. 91-98 brine spills predicted. Most oil, brine, or hazardous materials spills would be small and occur at storage sites where they would be controlled and kept from sensitive areas. Project lifetime risks would be low. Low likelihood of fire, based on historical operating data for existing SPR sites. There have been approximately 10 reportable fire incidents at SPR sites since 1992. None resulted in environmental impacts or long-term consequences to SPR operations. Number of occupational injuries (0.83 workdays per 200,000 worker hours) would be less than similar industries, based on SPR experience.	Same impacts as under Bruinsburg alternative. .	Same impacts as under Bruinsburg alternative, except as noted below. Possible salt water spills if water from Leaf River is supplemented with water from Gulf of Mexico for cavern development or drawdown.	Same impacts as under Bruinsburg alternative.	No impact.
Land Use: Land Use Conflicts	3,485 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs. Potential minor conflict where pipeline would cross Natchez Trace National Scenic Trail and Natchez Parkway in an expanded existing ROW and where pipeline would cross 6.8 miles of proclamation area of Homochitto National Forest.	2,901 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs. No potential land use conflicts.	4,495 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs. The terminal, tank farm, refurbished docks, and RWI at Pascagoula would be at a the former Naval Station Pascagoula, a Base Realignment and Closure site for which the future uses have not been determined.	2,206 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs. Potential conflict with Dow Chemical's desire to use same salt. Potential conflict where the pipelines and power lines would cross 3 miles and pipeline would cross 4.7 miles of Brazoria National Wildlife Refuge in existing and new ROWs, respectively.	No impact.
Land Use: Visual Resources	Potential visual impacts due to changes in historic Civil War landscape. Potential changes in vegetation where Bruinsburg pipeline ROW would cross Natchez Trace National Scenic Trail, Natchez Trail Parkway, and proclamation area of Homochitto National Forest.	No substantial visual impacts because of limited changes in viewshed, limited access, and lack of proximity to areas with visual sensitivity.	Same visual impacts as Chacahoula. Brine discharge pipeline would cross GUIS Managed Area.	Potential visual impact due to changes in vegetation and new power lines from ROW across Brazoria National Wildlife Refuge. Potential visual impacts from RWI across ICW from the Refuge.	No impact.
Land Use: Farmland Conversion	Would not have a substantial impact in converting prime and unique farmland to non-agricultural use. Farmland impact score under Farmland Protection Act regulations (7 CFR Part 658) is below level where further consideration of farmland protection is required.	Same farmland conversion impact as under Bruinsburg alternative.	Same farmland conversion impact as under Bruinsburg alternative.	Same farmland conversion impact as under Bruinsburg alternative.	No impact.
Land Use: Coastal Zone Management	The Bruinsburg site and associated infrastructure would not be in the coastal zone. The Big Hill site and infrastructure and West Hackberry site and infrastructure would be in coastal zones. DOE and the state coastal zone agency would use the Clean Water Act Section 404 wetlands permitting process to reach a determination on coastal consistency.	Some of the Chacahoula infrastructure, Big Hill site and infrastructure, and West Hackberry site and infrastructure would be in coastal zones. Same coastal zone determination process as under Bruinsburg alternative.	Some of the Richton infrastructure, Big Hill site and infrastructure, and West Hackberry site and infrastructure would be in coastal zones. Same coastal zone determination process as under Bruinsburg alternative.	The Stratton Ridge site and infrastructure, Big Hill site and infrastructure, and West Hackberry site and infrastructure would be in coastal zones. Same coastal zone determination process as under Bruinsburg alternative.	No impact.
Geology and Soils	Potential minor surface subsidence (2.6 to 6.1 feet over 30 years) at the Bruinsburg site. Cavern construction and use would not interfere with use of other caverns on the salt dome. Local subsidence at expansion sites would be less than 3 inches per year.	Potential minor surface subsidence (approximately 5 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. Local subsidence at expansion sites would be less than 3 inches per year.	Potential minor surface subsidence (2.6 to 6.1 feet, over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. Local subsidence at expansion sites would be less than 3 inches per year.	Potential minor surface subsidence (2.6 to 6.1 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. Local subsidence at expansion sites would be less than 3 inches per year.	No potential subsidence, except at new and existing sites where natural geologic conditions or current or future infrastructure would contribute to local subsidence.

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Air Quality	Low airborne emission levels from construction activities would not exceed National Ambient Air Quality Standards. Emissions levels would be below levels of concern, including below conformity determination thresholds in the ozone nonattainment areas at Bayou Choctaw and Big Hill. Low levels of emissions of greenhouse gases from construction equipment and motor vehicles.	Same air quality impacts as under Bruinsburg alternative.	Same air quality impacts as under Bruinsburg alternative.	Same as Bruinsburg, except that emission levels of volatile organic compounds would be just below the conformity determination threshold in the ozone nonattainment areas at Stratton Ridge. Because estimated levels are only slightly below the level that triggers a conformity determination process, DOE would conduct additional analysis based on the detailed design if one of the Stratton Ridge alternatives is selected.	No impact.
Water Resources: Surface Water	Construction activities would cause temporary and minor erosion and sedimentation. DOE would secure an Erosion and Sediment Control Permit and NPDES stormwater permit for construction activities. DOE would also secure a Clean Water Act Section 404 permit and Section 401 Water Quality Certificate for construction activities in jurisdictional water bodies. Construction and operation would potentially affect 35 water bodies for the Bruinsburg site and infrastructure and 12, 4, and 3 water bodies for the expansions at Bayou Choctaw, Big Hill, and West Hackberry, respectively. There would be a potential for significant adverse water quality impacts if a brine or oil release occurred and traveled into a water body. The risk of such a release is small based on the history of existing SPR facilities.	Same erosion and sedimentation impacts as under Bruinsburg alternative. Same requirements as under Bruinsburg alternative for construction activities in jurisdictional water bodies. Chacahoula site and infrastructure would potentially affect 18 water bodies. Same water bodies for expansion sites as under Bruinsburg alternative. Same spill risk as under Bruinsburg alternative.	Same erosion and sedimentation impacts as under Bruinsburg alternative. Same requirements as under Bruinsburg alternative for construction activities in jurisdictional water bodies. Richton site and infrastructure would potentially affect 63 water bodies. Same water bodies for expansion sites as under Bruinsburg alternative. Same spill risk as under Bruinsburg alternative.	Same erosion and sedimentation impacts as under Bruinsburg alternative. Same requirements as under Bruinsburg alternative for construction activities in jurisdictional water bodies. Stratton Ridge site and infrastructure would potentially affect 17 water bodies. Same water bodies for expansion sites as under Bruinsburg alternative. Same spill risk as under Bruinsburg alternative.	No impact.
	Bruinsburg RWI would withdraw from the Mississippi River 50 million gallons per day for 4 to 5 years, which is a small fraction of the river's flow.	Chacahoula RWI would withdraw 50 million gallons per day for 4 to 5 years from the ICW, a tidally influenced water body. Withdrawal would not significantly change the ICW water flow or volume, but may cause a slight upstream migration of the salinity gradient by less than 1 part per thousand.	Richton RWI would withdraw 46 million gallons per day from the Leaf River during normal and high flow conditions. During low flow conditions, DOE would supplement the Leaf River withdrawal with up to 23 million gallons per day from the Gulf of Mexico to withdraw a total of up to 46 million gallons per day. Regulatory agencies would establish a Minimum Instream Flow for the Leaf River. DOE also would secure a Beneficial Use of Public Waters Permit from Mississippi. DOE would terminate Leaf River withdrawals if the flows reach the Minimum Instream Flow, except during an oil drawdown that is required by a National Emergency. The Leaf River withdrawal during drawdown may have an adverse effect on water resources. If DOE is required to limit its withdrawals from the Leaf River during cavern construction, the construction period may extend beyond 4 to 5 years because the volume of water from the Gulf of Mexico may be smaller than the reduction in the volume from the Leaf River and a greater volume of saltwater than freshwater is needed in solution mining.	Stratton Ridge RWI would withdraw 42 million gallons per day for 4 to 5 years from the ICW, a tidally influenced water body. Withdrawal would not significantly change the ICW water flow or volume, but may cause a slight upstream migration of the salinity gradient by less than 1 part per thousand.	

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Water Resources: Surface Water (continued)	Big Hill and West Hackberry expansions would use existing RWIs from the ICW, a tidally influenced water body, without changing existing water body conditions. Bayou Choctaw would withdraw 25 million gallons per day from Cavern Lake, which is fed by the ICW, for up to 3 years. Withdrawals would not significantly alter the flow or volume of water, but may cause a slight upstream migration of the salinity gradient by less than 1 part per thousand.	The impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be same as under Bruinsburg alternative.	Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be same as under Bruinsburg alternative.	Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be same as under Bruinsburg alternative.	
	Big Hill expansion would discharge brine into Gulf of Mexico using existing brine diffusers and within existing NPDES permitted limits. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge, but increase would be within natural salinity variation.	Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative.	Impact of Big Hill brine discharge would be the same as under Bruinsburg alternative.	Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative.	
Water Resources: Groundwater	Bruinsburg pipelines would cross multiple source water protection areas with programs protecting against contaminating groundwater that is used as a source of drinking water; however, risk of groundwater contamination from pipeline spills would be low.	Chacahoula pipelines would not cross source water protection areas.	Richton pipelines would be constructed through and adjacent to several source water protection areas; however, risk of groundwater contamination from pipeline spills would be low.	Stratton Ridge pipelines would be constructed through and adjacent to several areas serving public water systems or important to groundwater recharge; however, risk of groundwater contamination from pipeline spills would be low.	No impact.
	Bruinsburg, Bayou Choctaw, and West Hackberry would use deep-aquifer brine injection. These sites have confined aquifers separated by impermeable strata. The proposed brine injection wells would be permitted by U.S. EPA and/or appropriate state agency.	Bayou Choctaw and West Hackberry would use deep-aquifer brine injection. These sites have confined aquifers separated by impermeable strata. The proposed brine injection wells would be permitted by U.S. EPA and/or appropriate state agency.	Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative.	Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative.	
	At Bruinsburg, the total disposal capacity of the proposed injection formations and the pressure build-up likely to occur as a result of brine injection are currently unknown. If DOE were to select one of the Bruinsburg alternatives, the total disposal capacity and pressure build-up would be determined during the development of the detailed design, which would be adjusted accordingly.				
Water Resources: Floodplains	Construction of Bruinsburg storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 307 acres of 100-year floodplain and 49 acres of 500-year floodplain. Buildings at Bruinsburg would not be in floodplain. Wellheads, well pads, and roads would involve placing fill or infrastructure in a floodplain.	Construction of Chacahoula storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 185 acres of 100-year floodplain and 27 acres of 500-year floodplain, much of which would be filled. Some interior areas of the storage site would not be filled and would retain their flood storage capacity. The entire storage site at Chacahoula is located in a vast floodplain that extends to the Gulf of Mexico.	Construction of Richton storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 84 acres of 100-year floodplain and 27 acres of 500-year floodplain. Construction of tanks and other infrastructure at Pascagoula terminal would involve placing fill within a floodplain.	Construction of Stratton Ridge storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 165 acres of 100-year floodplain and 213 acres of 500-year floodplain. Wellheads, well pads, and roads would involve placing fill or infrastructure in a floodplain.	No impact.
	DOE would comply with floodplain protection requirements during design and construction so that the base flood elevation and downstream land uses would not be significantly affected.	Site floodplain requirements and impacts would be same as under Bruinsburg alternative.	Site floodplain requirements and impacts would be same as under Bruinsburg alternative.	Site floodplain requirements and impacts would be same as under Bruinsburg alternative.	
	ROWs for the Bruinsburg site and 3 expansion sites would temporarily affect 49 miles of 100-year floodplain and 7 miles of 500-year floodplain. Floodplain would not be permanently affected by the ROWs because no aboveground fill or structures would be placed in the floodplain after construction is complete.	ROWs for the Chacahoula site and 3 expansion sites would temporarily affect 110 miles of 100-year and 3 miles of 500-year floodplain.	ROWs for the Richton site and 3 expansion sites would temporarily affect 46 miles of 100-year floodplain and 6 miles of 500-year floodplain.	ROWs for the Stratton Ridge site and 3 expansion sites would temporarily affect 60 miles of 100-year and 11 miles of 500-year floodplain.	

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Water Resources: Floodplains (continued)	The filling and loss of floodplain area would reduce the flood storage area in the immediate watershed, and cumulatively in the larger watersheds. Floodplain area loss also would result in loss of habitat for certain species as the filling would alter the existing habitat and ecosystem. Permits may require that any loss of floodplains be compensated for in another area within the watershed.	ROW floodplain impacts would be same as under Bruinsburg alternative.	ROW floodplain impacts would be same as under Bruinsburg alternative.	ROW floodplain impacts would be same as under Bruinsburg alternative.	
Biological Resources: Wetlands	Construction of Bruinsburg storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 172 acres of wetlands, including 91 acres of ecologically important palustrine forested wetland for the Bruinsburg storage site area. The type of palustrine forested wetland is bald cypress forest, which is relatively rare and ecologically and economically important.	Construction of Chacahoula site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 193 acres of wetlands, including 128 acres of relatively rare and ecologically important palustrine forested wetland for the Chacahoula storage site area. The type of palustrine forested wetland is bald cypress forest, which is relatively rare and ecologically and economically important.	Construction of Richton storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 113 acres of wetlands, including 43 acres of disturbed low value estuarine wetlands at the Pascagoula terminal site.	Construction of Stratton Ridge storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 292 acres of wetlands, including up to 192 acres of ecologically important palustrine forested wetland for the Stratton Ridge storage site area. The type of palustrine forested wetland is bottomland hardwood, which is relatively rare and ecologically important.	No impact.
	Security buffer at Bruinsburg, West Hackberry, and Big Hill storage sites would cause a permanent conversion of 19 acres of forested and scrub-shrub wetlands to emergent wetlands.	The clearing of an additional 213 acres of palustrine forested wetlands is necessary for the security buffer at Chacahoula. The security buffer at West Hackberry and Big Hill storage sites would cause permanent conversion of 7 acres to emergent wetlands or open water.	Security buffer at Richton, Big Hill, and West Hackberry storage sites would cause a permanent conversion of 9 acres of forested and scrub-shrub wetlands to emergent wetlands.	Security buffer at Stratton Ridge, West Hackberry, and Big Hill storage sites would cause a permanent conversion of 80 acres of forested and scrub-shrub wetlands to emergent wetlands.	
	Proposed ROWs for Bruinsburg and 3 expansion sites would affect 211 acres of wetlands within the permanently maintained easement and 306 acres within the temporary construction easement.	Proposed ROWs for Chacahoula and 3 expansion sites would affect 867 acres of wetlands within the permanently maintained easement and 1,222 acres within the temporary construction easement.	The proposed ROWs for Richton and the 3 expansion sites would affect 527 acres of wetlands within the permanently maintained easement and 907 acres within the temporary construction easement.	The proposed ROWs for Stratton Ridge and the 3 expansion sites would affect 181 acres of wetlands within the permanently maintained easement and 288 acres within the temporary construction easement.	
	Wetlands in the permanently maintained easement would be converted to emergent wetlands and would be periodically maintained to suppress woody species. Wetlands within the temporary construction easement would be cleared during construction, but would re-establish within 5-25 years depending on the type of wetland affected.	The general nature of the wetland impacts and re-establishment periods would be same as under Bruinsburg alternative.	The general nature of the wetland impacts and re-establishment periods would be same as under Bruinsburg alternative.	The general nature of the wetland impacts and re-establishment periods would be same as under Bruinsburg alternative.	
	Impact from permanent filling of wetlands and permanent conversion would be a potentially adverse effect because of the size and the regional importance of the forested wetlands, but would be mitigated. DOE would complete a wetland delineation, secure a jurisdictional determination, and secure Clean Water Act Section 404/401 permit for all impacts to wetlands. DOE would develop a comprehensive plan to further avoid and minimize wetland impacts and to mitigate for unavoidable impacts to wetlands by creating, restoring, or preserving wetlands, contributing a fee in lieu of creating, restoring, or preserving wetlands, or purchasing credits from a mitigation bank.	The impact from the permanent filling of wetlands and permanent conversion would be same as under Bruinsburg alternative.	The impact from ROWs is a potentially adverse effect because of the size of the area (over 600 acres) of palustrine forested and scrub-shrub wetlands. The impact would be mitigated. DOE would undertake the same wetland mitigation activities as under Bruinsburg alternative.	The impact from the permanent filling of wetlands and permanent conversion is a potentially adverse effect because of the size and the regional importance of the forested wetlands. Some of the forested wetlands at the Stratton Ridge site have relatively low ecological value because of invasion by exotic plants and animals. DOE would undertake the same wetland mitigation activities as under Bruinsburg alternative.	

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Biological Resources: Threatened and Endangered Species	Proposed ROW for Bruinsburg may affect the fat pocketbook mussel, a federally endangered species, which may be present in Coles and Fairchild Creeks. Proposed RWI for the Bruinsburg site may affect the pallid sturgeon, a federally endangered species that lives in the Mississippi River, because of the potential for impingement and entrainment of juvenile sturgeon. DOE would initiate formal ESA Section 7 Consultations with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect these species or designated critical habitat. Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.	Proposed site storage area for the Chacahoula site and all proposed ROWs may affect the bald eagle, a federally threatened species that is proposed for de-listing, by removing potential foraging, roosting, and nesting habitat. Proposed ROW for the crude oil pipeline to Clovelly may affect the brown pelican, which is a federally endangered species. The brown pelican has roosting habitat near the proposed ROW. DOE would initiate formal ESA Section 7 Consultations with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect these species or designated critical habitat. Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.	The proposed storage site, ROWs, and RWI may affect the federally threatened gopher tortoise and the Federal candidate black pine snake. Potential impacts include loss of habitat or individuals from the construction. The proposed RWI at Pascagoula and brine discharge pipeline would be located in designated critical habitat for the Gulf sturgeon in the Mississippi Sound. Proposed RWI on Leaf River may adversely affect the federally listed yellow blotched map turtle and Gulf sturgeon, and the Federal candidate pearl darter. The adverse affect may occur because of the potential for impingement and entrainment of individuals and because the withdrawal could change the hydrological regime and water quality preferred by these species. RWI would be located within the segment of the Leaf River, which is designated as critical habitat for the Gulf sturgeon. DOE has modified the conceptual plan for the Leaf River RWI structure to reduce the potential for impingement and entrainment of aquatic species. To mitigate, regulatory agencies would establish a Minimum Instream Flow and DOE would develop a Water Conservation Plan in consultation with the regulatory agencies that protects the listed and candidate species. The withdrawal from the Leaf River would be supplemented by a withdrawal from the Gulf of Mexico at Pascagoula during low flow conditions in the Leaf River. The Pascagoula RWI may affect the federally listed Gulf Sturgeon. The withdrawal from the Leaf River would be terminated if the flows reach the Minimum Instream Flow, except during oil drawdown under a National Emergency. DOE would initiate formal ESA Section 7 consultations with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect a listed species or designated critical habitat. Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.	The proposed site storage area for the Stratton Ridge site, ROWs, and RWI may affect the bald eagle, a federally threatened species that is proposed for de-listing, by removing potential foraging, roosting, and nesting habitat. The bald eagle has not been reported within the corridor. DOE would initiate formal ESA Section 7 consultations with USFWS and prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect these species or designated critical habitat. Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.	No impact.
Biological Resources: Special Status Areas	The pipeline ROW to the Peetsville terminal would cross Natchez Trace Parkway, which is managed by the NPS. The proposed ROW follows existing utility and road corridors and is already disturbed. DOE would coordinate with the NPS to minimize the impacts to important natural resources.	No special status areas would be affected by this alternative.	Pipeline to Liberty terminal would pass through 0.5 miles of the Percy Quin State Park. DOE would coordinate with the State Park to select a route that would minimize the impacts to important natural and recreational resources. Brine disposal pipeline would cross managed area of the GUIS. The easement for the pipeline ROW would require a permit/consent from GUIS. DOE would coordinate with the NPS to minimize impacts to fish and wildlife resources and secure approval for the easement.	Crude oil pipeline ROW to Texas City and RWI, brine, and power line ROW would each pass through a portion of the Brazoria National Wildlife Refuge. RWI would be located across the ICW from the Refuge. RWI construction and operations may affect sensitive wildlife and migrating birds that inhabit or stop at the Refuge. DOE would coordinate with USFWS and negotiate a final route and construction approach that minimizes the impact to natural resources. DOE would bury the power line through the Refuge and use noise attenuation, down-shielded and low mast lighting at RWI to minimize impacts.	No impact.

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Biological Resources: Special Status Areas (continued)	Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas.		Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas.	Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas.	
Biological Resources: Essential Fish Habitat	Big Hill expansion would cause minor salinity changes from the brine discharge to a small area of EFH in the Gulf of Mexico (modeling indicated a maximum increase of 4.7 parts per thousand). Impact to EFH would not be adverse because the increase in salinity would typically be within the natural variability. Impacts to EFH would be temporary; the potentially affected area would represent a very small fraction of the total EFH in the Gulf of Mexico; and the dependent fishery species are generally tolerant of wider salinity changes than the predicted increase due to the brine discharge. Big Hill expansion would cause a temporary impact to about 5 acres of EFH due to pipeline construction.	Big Hill expansion site would have EFH impacts the same as the impacts from Big Hill under Bruinsburg alternative. Chacahoula would discharge brine near Ship Shoal, an important fishing area. A small salinity increase that may be above the natural variation may be experienced at Ship Shoal. Chacahoula would affect about 1,067 acres of EFH, most of which would be a temporary impact due to pipeline construction.	Big Hill expansion site would have EFH impacts the same as the impacts from Big Hill under Bruinsburg alternative. Richton would affect about 183 acres of EFH due to temporary impacts from construction and to about 43 acres of fill for a new terminal and RWI at Pascagoula. Brine pipeline construction may affect submerged aquatic vegetation. DOE would coordinate with NOAA Fisheries and GUIS to minimize impacts to EFH and mitigate for permanent impacts to EFH.	Big Hill expansion site would have EFH impacts the same as the impacts from Big Hill under Bruinsburg alternative. Stratton Ridge would temporarily affect about 92 acres of EFH during construction of pipelines and would permanently affect about 17 acres due to the RWI, which is a permanent structure. Seventeen acres of EFH would be permanently affected due to the construction and operation of a RWI structure.	No impact.
Socioeconomics	Peak construction workforce of 474 for Bruinsburg site and its infrastructure. Peak construction workforce of 100 to 350 employees at expansion sites. Operations and maintenance workforce of 75 to 100 employees at Bruinsburg site and an additional 25 employees at each expansion site. Positive local economic benefits from increased employment. Small in-migration relative to regional population. No noticeable increase in competition for employment, traffic, or demand for housing or public infrastructure or services.	Peak construction workforce of 445 for Chacahoula and its infrastructure. Same expansion site workforce as under Bruinsburg alternative. Same operations and maintenance workforce as under Bruinsburg alternative. Similar socioeconomic impacts as under Bruinsburg alternative.	Peak construction workforce of 499 for Richton and its infrastructure. Same expansion site workforce as under Bruinsburg alternative. Same operations and maintenance workforce as under Bruinsburg alternative. Similar socioeconomic impacts as under Bruinsburg alternative.	Peak construction workforce of 431 for Stratton Ridge and its infrastructure. Same expansion site workforce as under Bruinsburg alternative. Same operations and maintenance workforce as under Bruinsburg alternative. Similar socioeconomic impacts as under Bruinsburg alternative, with exception of potential loss of jobs if Dow Chemical cannot access salt.	No impact; additional economic impact would not be generated.
Cultural Resources	Adverse effects to archaeological remains of Civil War activity at Bruinsburg, which could be mitigated. Residual (after mitigation) adverse effects on setting of Civil War landing area and march route. Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated.	Likely adverse effects to Native American and historic sites along Chacahoula pipeline routes, which could be mitigated. Similar cultural resource impacts as under Bruinsburg alternative.	Adverse effects to Native American archaeological sites within the Richton facility boundary, which could be mitigated. Likely adverse effects to Native American archeological sites along Richton pipelines, which could be mitigated. Possible residual effects to the feeling and setting of historic districts along pipelines and at terminal. Similar cultural resource impacts as under Bruinsburg alternative.	Adverse effects to Native American archaeological sites at the Stratton Ridge facility and along pipelines, which could be mitigated. Possible residual effects to any historic settings along pipelines. Similar cultural resource impacts as under Bruinsburg alternative.	No impact.
Noise	Noise from construction activities at the new and expansion sites would be audible, but the impacts would be minor. Noise from operations and maintenance activities would be audible only at the expansion storage sites, where the impacts would be minor. Noise from construction and operations and maintenance activities at the pipelines, terminals, and other infrastructure would have minor impacts.	Similar noise impacts as under Bruinsburg alternative, except that noise from operations and maintenance activities at the new site would be audible, but the impacts would be minor.	Similar noise impacts as under Chacahoula alternative.	Similar noise impacts as under Chacahoula alternative.	No impact.

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Environmental Justice	The potentially affected populations include low-income, Black or African American, Native American or Alaska Native, Asian, and Hispanic or Latino populations. None of these populations would have impacts that appreciably exceed the impacts to the general population, or would be affected in different ways than the general population. Thus, there would be no disproportionately high and adverse impacts to low-income or minority populations.	Same environmental justice impacts as under Bruinsburg alternative.	Same environmental justice impacts as under Bruinsburg alternative.	Same environmental justice impacts as under Bruinsburg alternative, except that the potentially affected communities also include Native Hawaiian or Other Pacific Islander communities.	No impact.

1 mile = 1.609 kilometers

1 acre = 0.405 hectares

1 gallon = 0.0037854 cubic inches

1 inch = 2.54 centimeters

Table S.6.11-2: Differences in Potential Impacts for Alternatives with Two Expansion Sites (Comparison with Table S.6.11-1)

Resource	Bruinsburg, Chacahoula, Richton, or Stratton Ridge
Environmental Risks and Public and Occupational Safety and Health	Slightly more (less than 0.1) predicted oil spills than presented in table S.6.11-1. 7 more predicted oil spills than presented in table S.6.11-1. No other notable differences.
Land Use: Land Use Conflicts	81 fewer acres (33 hectares) than the value presented in table S.6.11-1. No change in land use conflicts as presented in table S.6.11-1.
Land Use: Visual Resources	No notable difference from table S.6.11-1.
Land Use: Farmland	No notable difference from table S.6.11-1.
Land Use: Coastal Zone Management	Less impact because the coastal zone associated with West Hackberry would not be affected.
Geology and Soils	No notable difference from table S.6.11-1.
Air Quality	No notable difference from table S.6.11-1.
Water Resources: Surface Water	Up to three water bodies would not be affected because construction and operation would not occur at West Hackberry.
Water Resources: Groundwater	No increased risk to the sole source aquifer at West Hackberry because brine disposal would not increase.
Water Resources: Floodplains	No notable difference from table S.6.11-1.
Biological Resources: Plants, Wetlands, and Wildlife	5 fewer acres (2 hectares) of affected wetlands from the value presented in table S.6.11-1.
Biological Resources: Threatened and Endangered Species	No notable difference from table S.6.11-1.
Biological Resources: Special Status Areas	No notable difference from table S.6.11-1.
Biological Resources: Essential Fish Habitat	No notable difference from table S.6.11-1.
Socioeconomics	Less impact because construction workforce of up to 100 and increased operations and maintenance workforce would not be required for West Hackberry.
Cultural Resources	Less impact because Native American sites at West Hackberry would not be affected.
Noise	No notable difference from table S.6.11-1.
Environmental Justice	No notable difference from table S.6.11-1.

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List of Acronyms and Abbreviations

CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1990
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
EFH	essential fish habitat
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPACT	Energy Policy Act of 2005
EPCA	Energy Policy and Conservation Act
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FTA	Federal Transit Administration
GIS	geographic information system
GUIS	Gulf Islands National Seashore
HUD	U.S. Department of Housing and Urban Development
ICW	Intracoastal Waterway
LDEQ	Louisiana Department of Environmental Quality
LNG	liquefied natural gas
LOOP	Louisiana Offshore Oil Port
MDEQ	Mississippi Department of Environmental Quality
MEAS	Mississippi Embayment Aquifer Systems
MMB	million barrels
MMBD	million barrels per day
MMS	Minerals Management Service
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
NMHC	non-methane hydrocarbons
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOAA	National Oceanographic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NSR	New Source Review
PM	particulate matter
ROD	Record of Decision
ROW	right-of-way
RWI	raw water intake
SAV	submerged aquatic vegetation
SHPO	State Historic Preservation Officer

SPCC	Spill Prevention, Control, and Countermeasures
SPR	Strategic Petroleum Reserve
SWPA	source water protection area
TPWD	Texas Parks and Wildlife Department
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound

Glossary

To help readers more fully understand this Environmental Impact Statement, we have used bold type for technical and scientific terms, as well as plain English terms used differently in this context, the first time each appears in the text. This Glossary provides a full definition of each of those terms. In some cases, the definition of the term also appears in a highlighted box near the first occurrence of the term in the text.

TERM	DEFINITION
7Q10	The 7-day average low stream flow over a 10-year period.
8-hour ozone standard	A national ambient air quality standard for ground-level ozone, the primary constituent of smog. The standard is set at 0.08 parts per million and is measured as the 3-year average of an annual 4th-highest daily maximum 8-hour ozone concentration.
A-weighted decibel (dBA)	A frequency-weighted noise unit that is widely used for traffic and industrial noise measurements. The A-weighted decibel scale approximates the frequency response of the human ear and thus correlates well with loudness.
Alluvial	Relating to, composed of, or found in the clay, silt, sand, gravel, or similar detritus material deposited by running water.
Anadromous fish	Fish that spend most of their lives in salt water but migrate into freshwater tributaries to spawn (e.g., Gulf sturgeon and Alabama shad).
Anhydrite	A mineral, anhydrous calcium sulfate (chemical formula $CaSO_4$), occurring naturally in salt deposits. Anhydrite is much less soluble than salt, so anhydrite solids must be removed from brine before the brine can be disposed of in the ocean or injected into underground wells.
Aquifer	A body of rock or soil that is capable of transmitting groundwater and yielding usable quantities of water to wells or springs.
Base flood	A flood that has a 1 percent chance of occurrence in any given year (also known as a 100-year flood).
Basement fault	The fault that displaces basement rocks (metamorphic and igneous rocks underlying the sedimentary rocks) and originated prior to deposition of overlying sedimentary rocks. Such faults may or may not extend upward into overlying strata, depending upon their history of rejuvenation.
Bathymetry	The measurement of water depths in oceans, seas, and lakes.
Benthic	Of, relating to, or occurring at the bottom of a body of water.
Berm	A horizontal, narrow ledge at the bottom or top of an embankment used to stabilize the slope by intercepting sliding earth.

TERM	DEFINITION
Borehole	A hole made by drilling into the ground to study stratification, to release underground pressures, or to construct a production well, a disposal well, or a storage cavern in salt rock.
Brine	Water with a salt concentration greater than 35 parts per thousand. Sea water has a similar average concentration. In comparison, discharged brine has a typical concentration of 263 parts per thousand.
Brine pond	Lined pond where brine is disposed and impounded so that solids and contaminants, such as oil, can settle.
Bulkhead	Retaining walls designed to hold or prevent the sliding of soil caused by erosion and wave action.
Caliper	An instrument used to measure the diameter of a drill hole to determine the hardness or softness of the individual rocks.
Caliper pig	An electronic device that moves through the inside of a pipeline to determine by acoustical means the thickness of the pipeline wall.
Candidate species	Plants and animals native to the United States for which the U.S. Fish and Wildlife Service or the National Marine Fisheries Service has sufficient information on biological vulnerability and threats to justify proposing addition to the threatened and endangered species list, but cannot do so immediately because other species have a higher priority for listing. The Services determine the relative listing priority of candidate species in accordance with general listing priority guidelines published in the *Federal Register*. (See endangered species and threatened species.)
Canopy	Overhanging plants shading the surface below them (such as large trees).
Caprock	A layer of rock that is often found covering some or all of a salt dome. Caprock is chemically derived rock composed of anhydrite and other insoluble components of the salt that remain when the salt is washed away by groundwater and other forces.
Casing	Steel pipe used in oil wells to seal off fluids from the borehole and to prevent the walls of the hole from sloughing off or caving. There may be several strings of casing in a well, one inside the other.
Cavern	An underground chamber or cavity created in a salt dome by solution mining and used for storing the petroleum.
Clay	Soil consisting of inorganic material, the grains of which have diameters smaller than 0.005 millimeters.
Concentric cased wells	Concentric cased wells are two wells, one located within the other. The two wells are separated by an inner casing and an outer casing, and the casings form two concentric rings.

TERM	DEFINITION
Creep	In engineering usage, creep is any general, slow displacement under load.
Critical habitat	Habitat essential to the conservation of an endangered or threatened species that has been designated so by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures outlined in the Endangered Species Act and its implementing regulations (50 CFR Part 424). The lists of critical habitats can be found in 50 CFR 17.95 (fish and wildlife), 50 CFR 17.96 (plants), and 50 CFR 226 (marine species).
Crustaceans	A class of aquatic invertebrate organisms with a hard external skeleton.
Day Night Average Noise Level	A 24-hour average of noise levels.
Decibel (db)	A unit for expressing the relative intensity of sounds on a logarithmic scale from zero (the average least perceptible sound) to about 130 (the average level at which sound causes pain to humans).
Design value	A pollutant concentration, based on ambient measurement, which describes the air quality status of a given area. Areas in which the design value exceeds the NAAQS may result in a nonattainment designation for the area.
Diffuser	The structure at the end of a pipeline that disperses an effluent discharge into a receiving water body by the action of jet dilution through a series of ports.
Drawdown	The process of removing oil from a storage cavern by displacing the oil with water or brine.
Drilling mud	A mixture of clays, chemicals, and water that is pumped down a drill pipe to lubricate and cool the drilling bit, to flush out the cuttings, and to stabilize the sides of a hole being drilled.
Easement	An easement is a right held by one party to make specific, limited use of land owned by another party. An easement is granted by the owner of the property for the convenience or ease of the party using the property. Common easements include the right to pass across the property or the right to construct a pipeline under the land or a power line over the land.
Ecoregion	A region containing relatively similar ecological systems as determined by variations in climate, vegetation, and landform.
Ecosystem	A community of organisms and their physical environment interacting as an ecological unit.

TERM	DEFINITION
Endangered species	Plants or animals that are in danger of extinction through all or a significant portion of their habitat ranges and that have been listed as endangered by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures outlined in the Endangered Species Act and its implementing regulations (50 CFR Part 424). The lists of endangered species can be found in 50 CFR 17.11 (wildlife), 50 CFR 17.12 (plants), and 50 CFR 222.23(a) (marine organisms). The states considered in this EIS also list species as endangered.
Entrainment	The incidental trapping of fish and other aquatic organisms within part of an intake structure during periods of intake water withdrawl.
Estuarine system	Deep water habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean. Ocean water is at least occasionally diluted by freshwater runoff from the land, and their interplay results in a nutrient trap making the estuarine system more productive than either freshwater or marine systems.
Estuary	A semi-enclosed coastal body of water which has a free connection with the open sea and within which seawater is measurably diluted with fresh water.
Floodplains	The lowlands and relatively flat areas adjoining inland and coastal waters with the flood-prone areas of offshore islands. Floodplains include, at a minimum, that area with at least a 1-percent chance of being inundated by a flood in any given year.
Fluvial deltaic	Produced by the action of a stream or river and in the typical form of the Greek letter delta.
Grubbing	Clearing of land by digging up roots or stumps.
Headcutting	A process of streambed degradation triggered by a disturbance of loose streambed substrate.
Historic property	As defined in 36 CFR 800.16 of the National Historic Preservation Act, "historic property means any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meets the National Register criteria."
Hydrostatic test	Test of strength and leak-resistance of a vessel, pipe, or other hollow equipment using internal pressurization with a test liquid.
Impingement	The trapping of fish and other aquatic organisms on the outer part of an intake structure or against a screening device during periods of intake water withdrawl.

TERM	DEFINITION
In-migration	The movement of people into a given geographic area.
Invertebrate	An animal lacking a backbone and internal skeleton.
Level equivalents (Leq)	Level of noise (in decibels) averaged over a specified period of time.
Laydown yard	Storage area for equipment and materials to be used for maintenance or construction.
Lithic scatter	A distribution of cultural items that consists primarily of lithic (i.e., stone) material. The scatter may include formed tools such as points or knives, or it may contain only chipping debris from tool-making activities.
Marsh	A transitional land-water area with more or less continuously waterlogged soil characterized by aquatic and grass-like vegetation, but without an accumulation of peat.
Metropolitan Statistical Area (MSA)	A metropolitan statistical area is an area containing a recognized population nucleus (such as a city) and adjacent communities (sometimes considered suburbs) that have a high degree of integration with that nucleus. One of the major purposes in defining MSAs is to provide a nationally consistent definition for collecting, tabulating, and publishing federal statistics for a set of geographical areas.
Midden soil	Soil that has been changed by long-term human occupation; it typically contains bits of charcoal and other organic materials derived from human use. Midden soil is often darker in color and has a looser texture than surrounding soils. Archaeologists consider midden soil as evidence that a site was used for long-term residence or revisited regularly over many years, rather than reflecting short-term activities.
Normal fault	A fault in which the hanging wall has apparently gone down with relation to the footwall.
Oil blanket	A quantity of oil that is used during the development of storage caverns in salt domes. The oil is injected into the cavern, where it floats on top of the water used during solution mining and blankets the cavern roof, thereby preventing the water from dissolving salt at the top of the cavern.
Overhang	The part of the salt that projects out laterally from the top of a salt dome and is like the cap of a mushroom.
Overstory	The tallest spatially dominant species in a forest; usually composed of coniferous or deciduous tree species.
Palustrine	Of, pertaining to, or living in, a marsh or swamp; marshy.

TERM	DEFINITION
Palustrine wetland	All non-tidal wetlands dominated by trees, shrubs, or persistent emergent vegetation. Includes wetlands traditionally called marshes, swamps, or bogs.
Particulate matter	Any material suspended in the air in the form of minute solid particles or liquid droplets, especially when considered as an atmospheric pollutant. A number following denotes the upper limit of the diameter of particles included. Thus, PM10 includes only those particles equal to or less than 10 micrometers (0.0004 inch) in diameter; PM2.5 includes only those particles equal to or less than 2.5 micrometers (0.0001 inch) in diameter.
Perennial plant	A plant with a lifespan of two or more years.
Permeability	Capacity for transmitting a fluid a given distance through an interval of time.
Piercement	A dome or anticlinal fold in which a mobile plastic core (i.e., salt) has ruptured the more brittle overlying rock. Also known as a diapir, dipiric fold, piercement dome, or piercing fold.
Pig	A cylindrical device (3- to 7-feet long) inserted in a pipeline for the purpose of sweeping the line clean of water, rust, or other foreign matter.
Pigging	In pigging operations, inspection and cleaning devices called pigs are sent through pipelines to check the condition of pipelines and clean them. Caliper pigging is used to determine the thickness of pipeline walls.
Phytoplankton	Passively floating or weakly mobile, microscopic aquatic plants.
Plug	To fill a well’s borehole with cement or other impervious matter to prevent the flow of water, gas, or oil from one strata to another when a well is abandoned; to place a permanent obstruction at the junction of a saline water body and pipeline ROW to prevent salt water intrusion into fresh water or to prevent the formation of new water courses.
Proclamation Boundary	An area where the Forest Service may purchase land from willing sellers to expand the forest without further Congressional authorization.
Radial Fault	A fault belonging to a system that radiates from a point.
Raw water	Raw water is fresh surface water or salt water that is supplied to a site from a substantial water source.
Right-of-way (ROW)	The right held by one person over another person's land for a specific use; rights of tenants are excluded. The strip of land for which permission has been granted to build and maintain a linear structure, such as a road, railroad, pipeline, or transmission line.

TERM	DEFINITION
Rip rapping	Rip rapping is the process by which rocks or other materials (rip rap) are placed along the banks of a body of water to prevent erosion.
Riverine	Relating to, formed by, or resembling a river.
Rock salt formation	See salt dome.
Salinization	To treat or impregnate with salt.
Salt dome	A subsurface geologic structure consisting of a vertical cylinder of salt that may be anywhere from 0.5 to 6 miles (1 to 10 kilometers) across and up to 20,000 feet (6,100 meters) deep. Domes are formed when salt from buried salt pans flows upward due to its buoyancy.
Scrub-shrub	Areas dominated by woody vegetation less than 6 meters (20 feet) tall, which includes true shrubs and young trees.
Seismic	Related to the activity of naturally or artificially induced earthquakes or earth vibrations, where the seismic waves are the elastic waves produced by these vibrations.
Shear zone	A tabular area of rock that has been crushed and broken into fragments by many parallel fractures resulting from shear strain; often becomes a channel for underground fluids and the seat of ore deposition.
Shell middens	A subtype of midden soil that has been altered by human occupation. Shell midden includes large amounts of fragmented mollusk shell mixed with charcoal and other organic materials derived from human use. Archaeologists interpret shell midden sites as the result of long-term residence or regular reuse, where the debris from a shellfish-rich diet has become part of the site.
Shell scatters	Distributions of cultural material that consist primarily of shell fragments. Shell scatters do not contain the visibly and texturally different soil of shell middens, and they are interpreted as the result of short-term use or use for only a single activity (such as shellfish harvesting) rather than residence.
Silt	Soil consisting of inorganic material, the grains of which have diameters between 0.0625 mm and 0.2 mm.
Skimmer	A self-propelled, boat-like oil spill clean-up device that removes spilled oil from the surface of a water body into a tank.
Soil liquefaction	Process that occurs when saturated sediments are shaken by an earthquake. The soil can lose its strength and cause the collapse of structures with foundations in the sediment.
Solution mining	The process of creating space in rock salt by dissolving the salt with injected water and removing the resultant brine.

TERM	DEFINITION
Special status species	State and federally listed threatened, endangered, and candidate species; marine mammals; migratory birds; federally managed fisheries; and Forest Service's Regional Forester Sensitive Species.
Spoil	Dirt or rock that has been removed from its original location, destroying the composition of the soil in the process.
Spud barge	A flat-decked floating structure that has devices similar to legs, called spuds, which are lowered from underneath the barge and pushed into the waterway floor to anchor the structure in place.
Stratigraphic	Dealing with the origin, composition, distribution, and succession of geological strata.
Submerged Aquatic Vegetation (SAV)	Underwater aquatic rooted plants.
Subsidence	The geological sinking or downward settling of an area on the Earth's surface, resulting in the formation of a depression.
Sump	The space below the bottom end of a well pipe where liquid collects.
Surfactant	A soluble compound that reduces the surface tension of liquids, or reduces interfacial tension between two liquids or a liquid and a solid.
Sweeping Velocity	The velocity of the water flowing parallel and adjacent to the RWI screen surface.
Tank farm	A facility that temporarily stores petroleum in large tanks connected to a pipeline.
Threatened species	Any plants or animals that are likely to become endangered species within the foreseeable future throughout all or a significant portion of their habitat ranges and which have been listed as threatened by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures set out in the Endangered Species Act and its implementing regulations (50 CFR Part 424). (See endangered species.) The lists of threatened species can be found at 50 CFR 17.11 (wildlife), 17.12 (plants), and 227.4 (marine organisms). The states considered in this EIS also list species as threatened.
Understory	Low-lying vegetation growing beneath the overstory of a forest; usually composed of herbaceous plants, shrubs, and small saplings.
Uplands	Generally dry land that is different from lowlands, marsh, swamp, and wetlands.
Volatile organic compound (VOC)	Any organic compound that participates in atmospheric photochemical reactions; also a nationally regulated air pollutant.

TERM	DEFINITION
Wetlands	An area that is inundated by surface water or groundwater with a frequency sufficient to support, and under normal circumstances would support, a prevalence of vegetative or aquatic life that requires saturated- or seasonally saturated-soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas (e.g., sloughs, potholes, wet meadows, river overflow areas, mudflats, and natural ponds).
Zooplankton	Passively floating or weakly mobile microscopic aquatic animals.

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Chapter 1. Purpose and Need for Action

1.1 BACKGROUND

> **Glossary Terms:** To help readers more fully understand this Environmental Impact Statement (EIS), we have used bold type for technical and scientific terms the first time each appears in the text. The Glossary provides a full definition of each of these terms. In some cases, the definition of the term also appears in a highlighted text box near the first occurrence of the term in the text.

The Strategic Petroleum Reserve (SPR) is a national stockpile of petroleum (crude oil). Following the 1973-74 oil embargo, the SPR was established pursuant to the Energy Policy and Conservation Act (EPCA) of 1975 to protect the United States from interruption in petroleum supplies that would be detrimental to our energy security, national security, and economy. The SPR currently consists of four underground oil storage facilities along the Gulf Coast—two in Louisiana (Bayou Choctaw and West Hackberry) and two in Texas (Big Hill and Bryan Mound)—and an administrative facility in New Orleans, LA. At the storage facilities, crude oil is stored in caverns constructed by the **solution mining** of **rock salt formations (salt domes)**. The four SPR facilities have a combined storage capacity of 727 million barrels (MMB) and an inventory of 688.5 MMB as of November 10, 2006.

If the United States is confronted with an economically threatening disruption in oil supplies, the President can use the SPR as an emergency response tool, transferring oil from the SPR into the commercial oil distribution systems. The SPR has been used twice under these conditions. First, at the beginning of Operation Desert Storm in 1991, the United States joined its allies in assuring the adequacy of global oil supplies when war broke out in the Persian Gulf. An emergency sale of SPR crude oil was announced the day the war began. The second instance was in September 2005 after Hurricane Katrina devastated oil production, distribution, and refining facilities in the Gulf region of Louisiana and Mississippi. In addition to national energy emergencies, crude oil has been withdrawn many times from the SPR sites for other reasons. Small quantities of oil are routinely pumped from the storage caverns to test the reserve's equipment. In addition, oil has been removed from the caverns under the authority of the 1975 statute to "exchange" SPR crude oil with oil from private companies, by which the SPR ultimately receives more oil than it released.

The U.S. Department of Energy (DOE) conducted planning activities for the expansion of SPR's capacity to 1 billion barrels under congressional directives in 1988 and 1990. The expansion planning directive in 1988 resulted in an initial plan entitled *Report to Congress on Expansion of the Strategic Petroleum Reserve to One Billion Barrels* (DOE 1989b). The expansion planning directive in 1990 likewise resulted in a plan called *Report to Congress on Candidate Sites for Expansion of the Strategic Petroleum Reserve to One Billion Barrels* (DOE 1991b) and the preparation of *Draft Environmental Impact Statement on the Expansion of the Strategic Petroleum Reserve, DOE/EIS–0165–D* in 1992, which assessed 5 candidate sites for the expansion of the SPR to 1 billion barrels: Big Hill, TX; Stratton Ridge, TX; Weeks Island, LA; Cote Blanche, LA; and Richton, MS (DOE 1992a). DOE/EIS–0165–D is available on the DOE Fossil Energy Web site at http://www.fossil.energy.gov/programs/reserves/spr/expansion-eis.html. Prior to completion of the final EIS, DOE notified Congress that due to the existence of a large unfilled capacity in the SPR, DOE would be deferring any site selection decisions and expansion of the SPR until such time that the oil inventory of the SPR supported the need for further capacity development.

> Vertical lines in left margin indicate where text in the draft EIS has been deleted, revised, or supplemented in this final EIS. Changes are not indicated in chapter 8, appendix N, or appendix O as these sections are new to the final EIS.

1.2 PURPOSE AND NEED

On August 8, 2005, the President signed the Energy Policy Act of 2005 (EPACT). Section 303 of EPACT states that:

> "Not later than 1 year after the date of enactment of this Act, the Secretary shall complete a proceeding to select, from sites that the Secretary has previously studied, sites necessary to enable acquisition by the Secretary of the full authorized volume of the Strategic Petroleum Reserve."

EPACT section 301(c) directs the Secretary to "… acquire petroleum in quantities sufficient to fill …" the SPR to 1 billion barrels, which is what was authorized by congressional directives. Thus, the purpose and need for agency action is to select and develop the sites to expand SPR capacity from 727 MMB to 1 billion barrels, that is, to add 273 MMB of capacity.

1.3 DOE ALTERNATIVES

As outlined more completely in chapter 2 of this document, DOE has analyzed potential impacts from a new site at Bruinsburg, MS; Chacahoula, LA; Richton, MS; and Stratton Ridge, TX and from expanding capacity at Bayou Choctaw, LA, Big Hill, TX, and West Hackberry, LA. DOE has eliminated alternatives that were analyzed in the draft EIS that involved a potential new site in Clovelly, LA. DOE has identified the Richton alternative with expansion of the Bayou Choctaw, Big Hill, and West Hackberry sites as its preferred alternative.

1.4 NATIONAL ENVIRONMENTAL POLICY ACT AND PUBLIC INVOLVEMENT

DOE has determined that the expansion of the SPR required by EPACT constitutes a major Federal action that is subject to the National Environmental Policy Act (NEPA). This EIS document has been prepared in accordance with NEPA, the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Parts 1500–1508), DOE NEPA regulations (10 CFR Part 1021) and **wetland** and **floodplain** regulations (10 CFR 1022). This EIS assesses the potential environmental impacts of the development of new SPR sites and the expansion of existing SPR sites and their associated infrastructures.

1.4.1 Scoping and Public Involvement

DOE published a Notice of Intent (NOI) to Prepare an EIS on September 1, 2005 (70 FR 52088). The NOI invited interested agencies, organizations, Native American tribes, and members of the public to submit comments or suggestions to assist DOE in identifying significant environmental issues and determining the appropriate scope of the EIS. The notice also identified the dates and locations of public scoping meetings and stated that the public scoping period would run from September 1 to October 14, 2005.

As a result of the effects of Hurricanes Katrina and Rita on the Gulf Coast region, DOE issued a Notice to Extend the Public Scoping Period and Reschedule Public Scoping Meetings, extending the scoping period by 2 weeks until October 28, 2005 (70 FR 56649, September 28, 2005). In the notice, DOE provided new dates and locations for the public scoping meetings and announced the cancellation of the public scoping meetings in Hattiesburg and Pascagoula, MS, because the meeting facilities were no longer available. Instead, DOE held a meeting in Jackson, MS. DOE contacted everyone on the project mailing list about these changes and published six newspaper advertisements and two online advertisements for both the Jackson, MS, meeting and the Houma, LA, meeting.

On October 27, 2005, Governor Haley Barbour of Mississippi requested the Secretary of Energy to include a new site in the EIS. In response, DOE extended the public scoping period until December 19, 2005 (70 FR 70600, November 22, 2005) and scheduled another scoping meeting. Overall, DOE held four public scoping meetings, as shown in table 1.4.1-1.

Table 1.4.1-1: Scoping Meetings

Location	Date	Proposed Sites Close to Meeting Location	Attendance	Speakers
Lake Jackson, TX	October 11, 2005	Stratton Ridge, TX	16	0
Jackson, MS	October 17, 2005	Richton, MS	24	4
Houma, LA	October 18, 2005	Chacahoula, LA	19	3
Port Gibson, MS	December 7, 2005	Bruinsburg, MS	21	7

The public scoping meetings were attended by approximately 80 people, some of whom provided oral and written comments. During the scoping period, DOE also met with Federal and state agencies with jurisdiction over the proposed new and existing SPR expansion sites in Louisiana, Mississippi, and Texas. At these meetings, DOE received comments from the agencies on environmental issues to be analyzed. See appendix K for additional information regarding agency consultation.

1.4.2 Summary of Scoping Comments

DOE received 67 scoping comment documents (letters and/or oral testimony) from 48 members of the public, companies, organizations, and government agencies. Comments focused mainly, but not exclusively, on the impacts of the construction and operation of the SPR facilities on water, land, and marine resources, and on various habitats of land and marine species. The following paragraphs summarize the major scoping comments received by DOE on the NOI to prepare an EIS. Unless otherwise noted, the discussions and analyses included in the EIS address the core topics of these comments. Copies of the comment letters received during the scoping period and complete public scoping meeting transcripts are available from the Internet site: http://www.fossil.energy.gov/programs/reserves/spr/expansion-eis.html.

Public Health and Safety, Accidental Releases: Commenters stated that DOE needs to address public health issues and the potential impacts on health and safety. One concern was the cumulative and secondary impacts the project would present for the increased risks of terrorism or accidents because of proposals to build liquefied natural gas (LNG) facilities near the proposed Stratton Ridge site. The affected environment and analysis of potential environmental risks and public and occupational safety and health impacts are discussed in chapter 3, section 3.2 and cumulative impacts are discussed in chapter 4.

Land Use: Commenters asked that DOE examine various potential impacts including loss of prime farmland, adverse effects on coastal areas, and land use changes at storage sites, pipelines **rights-of-way** (ROWs), and other facilities. Commenters expressed concern that the proposed locations of the caverns for the Richton and Stratton Ridge sites would preclude other uses of the salt domes or affect mineral rights and expressed concern that the proposed Stratton Ridge site would be located in the vicinity of security areas of existing and proposed industrial facilities. Affected land uses and site-specific analysis of potential land use impacts associated with the SPR sites are discussed in chapter 3, section 3.3. One commenter suggested that the EIS address impacts on the Gulf Islands National Seashore (GUIS), and this is addressed in section 3.3.5.

Geology: Commenters expressed concerns about cavern **creep** and **subsidence** that might be caused by the creation of additional oil storage caverns at the already extensively developed Stratton Ridge salt dome, and suggested that the EIS evaluate this potential for adverse impacts. The affected environment and site-specific analysis of potential geology and soils impacts for each SPR site are discussed in chapter 3, section 3.4.

Air Quality: Noting that the Bayou Choctaw, Big Hill, and Stratton Ridge sites are in air quality nonattainment areas for the **8-hour ozone ambient standards for ozone** and that they are subject to the Clean Air Act General Conformity rule and related state regulations, commenters asked that DOE estimate the potential emissions of **volatile organic compounds** (VOCs) and oxides of nitrogen during construction and operation at these sites and compare them to conformity threshold levels. Conformity analyses for the Bayou Choctaw, Big Hill, and Stratton Ridge sites are discussed in chapter 3, section 3.5. Other issues raised by commenters included cumulative air pollutant emissions and emissions from the **oil blanket** during solution mining. The affected environment and analysis of potential air quality impacts of construction and operation of the proposed action are discussed in chapter 3, section 3.5. The methodology for analyzing air quality impacts is discussed in appendix A. The related cumulative impacts are discussed in chapter 4.

Water Resources: Commenters requested that DOE evaluate the potential impacts of construction and operation of new oil storage **caverns** and underground injection wells on local **aquifers**, and the secondary and cumulative impacts of SPR expansion on **wetlands** and water quality, including water salinity. Commenters expressed concern about potential impacts to rivers and coastal areas. Commenters also requested analyses of potential impacts of water withdrawal from freshwater bodies for SPR expansion and operation, runoff from construction and operation of SPR facilities, and **brine** disposal in the Gulf of Mexico. Commenters suggested alternate sources of **raw water intake** (RWI) for the Stratton Ridge and Richton sites. The affected environment and analysis of potential impacts to water resources from construction and operation of the proposed action are discussed in chapter 3, section 3.6 and appendices B, C, and O. The related cumulative impacts are discussed in chapter 4.

Biological Resources: Commenters asked that the EIS analyze the potential primary, secondary, and cumulative impacts of SPR expansion on a variety of habitats and species. Habitats of particular concern included wetlands and essential fish habitat (EFH). Fauna of concern included shrimp, oysters, and native fish species including those that are commercially important; migratory marine species including sharks and billfishes; water birds; migratory birds; and some threatened and **endangered species** such as the bald eagle, diamondback terrapin, Gulf sturgeon, red-bellied turtle, brown pelican, and Louisiana black bear, and also **candidate species**. Commenters identified specific biological resource areas (e.g., forested wetlands, wildlife refuges, national seashores, national forests, and **benthic** communities crossed by offshore brine disposal pipelines) or specific flora or fauna species (e.g., specific locations of bald eagle nesting areas) near specific SPR sites, pipeline rights-of-way, raw water withdrawal areas, and brine disposal areas.

The affected environment and potential impacts to biological resources from construction and operation of the proposed action are discussed in chapter 3, section 3.7, and appendices B, C, D, E, F, G, H, I, K, and O. The impact assessment methodology for plants, wetlands, and wildlife is described in section 3.7.1.1 and appendix B. **Special status species** (including threatened and endangered species, marine mammals, and managed fisheries) are discussed in section 3.7.1.2 and appendices B, C, D, E, F, G, H, I, K, and O. EFH is discussed in section 3.7.1.3 and appendix E. Special status areas (including national wildlife refuges, wilderness areas, Coastal Wetlands Planning, Protection and Restoration Act areas, and coastal natural resource areas) are discussed in section 3.7.1.4. Potential impacts associated with specific areas of concern and specific species of concern identified by commenters are addressed in the site-specific impact analyses in chapter 3, section 3.7 and appendices B, C, E, F, G, H, I, and O. The related cumulative impacts are discussed in chapter 4.

Socioeconomics: Commenters requested that DOE evaluate potential economic impacts on local communities, commercial and recreational fishing interests, tourism, and other economic interests in Louisiana, Mississippi, and Texas, particularly in areas affected by Hurricane Katrina. Similarly, commenters expressed concern about impacts to local industries by competition for workers and housing already in short supply. The affected environment and analysis of potential socioeconomic impacts of construction and operation of the proposed action are discussed in chapter 3, section 3.8.

Cultural Resources: Commenters addressed potential Native American concerns, particularly for the Richton and Bruinsburg sites. Commenters also identified themselves as having cultural affiliation with specific SPR sites, and requested that they be notified and that specific procedures be followed in the event that cultural artifacts are discovered during SPR site development. They also suggested the need for archaeological and cultural surveys at the Stratton Ridge, Richton, and Big Hill sites should these sites be selected by DOE. The site-specific cultural resources that could be affected environment and the potential impacts for each SPR site are discussed in chapter 3, section 3.9. Specific procedures that would be implemented by DOE for the selected sites are also discussed in section 3.9.

Environmental Justice: A commenter requested that DOE fully consider the environmental justice impacts of additional environmental risk and pollution associated with SPR expansion in low-income communities in light of the effects of Hurricane Katrina. Commenters also identified specific aspects (e.g., income level) of their communities. The affected environment and site-specific environmental justice impact analyses for each SPR site are presented in chapter 3, section 3.11 and appendix J.

Alternatives: Commenters proposed alternative locations for storage of crude oil. The suggestions included sites in Louisiana, Texas, New Mexico, and Virginia. A discussion of the proposed action and alternatives, including the statutory basis for selection of alternatives and alternatives considered but eliminated from detailed study, is included in sections S.3 and S.4 and chapter 2, section 2.6.

Irreversible and Irretrievable Commitment of Resources: A commenter expressed concern that development of SPR storage caverns would result in the irretrievable loss of salt resources that could otherwise be used for chlorine production. This issue is analyzed in chapter 3, section 3.3 and chapter 5.

Cumulative Impacts: Commenters requested that secondary and cumulative impacts of the proposed action and similar past, ongoing, or future actions, including cumulative impacts to water quality, biological resources, air quality, and socioeconomics, be addressed. Commenters identified specific actions (e.g., proposed LNG facilities, future oil and gas production and pipelines, commercial fishing) and requested that impacts of these actions be considered in the cumulative impacts analysis. Commenters also identified specific impacts (e.g., fish mortality caused by Hurricane Katrina) and requested that such impacts be considered in the cumulative impact analysis. Relevant actions and analysis of potential cumulative impacts of the proposed action are discussed in chapter 4.

Mitigation: Commenters requested that measures to avoid, minimize, and offset impacts (e.g., impacts to wetlands) of construction and operation of the proposed action be discussed in a mitigation section of the EIS. Commenters suggested specific mitigation measures for proposed SPR storage sites, pipeline ROWs, RWI areas, or brine disposal areas. The potential impacts and the associated mitigation measures are discussed in the relevant sections of the EIS (e.g., potential impacts and mitigation measures for impacts to wetlands are both discussed in section 3.7 and appendices B and O).

1.4.3 Draft EIS Public Comment Period

DOE filed the draft EIS with the Environmental Protection Agency (EPA) on Friday, May 19, 2006. EPA published a Notice of Availability in the *Federal Register* on May 26, 2006 (71 FR 30400), starting the 45-day public comment period that ended July 10, 2006. DOE held public hearings to receive comments on the draft EIS in the following five locations:

Table 1.4.3-1: Public Hearings on the Draft EIS

Location	Date	Proposed Sites Close to Hearings Location	Attendance	Speakers
Pascagoula, MS	June 20, 2006	Richton, MS	7	4
Richton, MS	June 21, 2006	Richton, MS	21	1
Port Gibson, MS	June 22, 2006	Bruinsburg, MS	12	3
Lake Jackson, TX	June 27, 2006	Stratton Ridge, TX	48	10
Houma, LA	June 28, 2006	Chacahoula, LA	17	3

The public hearings were attended by approximately 105 people, some of whom provided oral and written comments. See appendix N for the transcripts of these hearings.

1.4.4 Public Review of the Draft EIS and Changes to the Final EIS

DOE received 93 written comment letters and 21 people testified at 5 public hearings for a total of 114 comment documents on the draft EIS from 108 members of the public, companies, organizations, and government agencies. Comments focused mainly, but not exclusively, on the potential impacts of the construction and operation of the SPR facilities on water, land, and marine resources and on various habitats of land and marine species. Section 1.4.4.1 summarizes the major issues raised by commenters on the draft EIS. (To view these comments see www.fe.doegov/programs/reserves/spr/expansion-eis.html or appendix N.) Section 1.4.4.2 describes the major changes that DOE has made in the final EIS. (To view the draft EIS, see www.fe.doegov/ programs/reserves/spr/expansion-eis.html.) In addition, chapter 8 presents the comments—organized by issue category—and the corresponding DOE responses.

1.4.4.1 Major Issues Raised in Comments on Draft EIS

Use of the Leaf River: Commenters expressed concern that raw water withdrawal from the Leaf River during low flow conditions for the Richton alternatives would result in adverse water quality and endangered species impacts. They suggested that DOE consider other sources for water withdrawals for the Richton alternatives. DOE consulted with natural resource agencies, but identified no other practicable alternative for the entire proposed RWI withdrawal rate of 1.2 MMBD.

DOE has modified the Richton alternatives to reduce its dependence on the Leaf River by adding a supplemental water source, a RWI in the Gulf of Mexico at Pascagoula. The draft EIS identified a 16-inch (41-centimeter) diameter, 88-mile (142-kilometer) pipeline between Pascagoula and the Richton site to transport crude oil (to serve as blanket oil) from Pascagoula to Richton at the start of cavern development. DOE has changed this conceptual design by increasing the diameter of the pipeline to 36 inches (91 centimeters) so that the pipeline would also be available to transport sea water from the Gulf of Mexico to Richton during periods of low flow in the Leaf River, both for cavern development and for drawdown operations.

Other features of the conceptual design or use of pipelines between Pascagoula and the Richton site remain unchanged from the draft EIS. That is, once development of all the caverns has been completed, the 36-inch pipeline described above would discharge small volumes of brine associated with cavern filling as was described in the draft EIS for the 16-inch (41-centimeter) pipeline. A second, larger pipeline in the same ROW (48-inch [112-centimeter] diameter), as described in the draft EIS, would discharge brine during cavern development and transport crude oil during operation.

The Pascagoula RWI and associated pipeline would transport water from the Gulf of Mexico, if needed, for cavern development, maintenance, and drawdown as follows:

- During normal and high flow conditions, DOE would withdraw water only from the Leaf River.
- During low flow conditions, excluding emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico and reduce or terminate its withdrawal from the Leaf River so that it would not cause the Leaf River to be below the Minimum Instream Flow designated by regulatory agencies to protect special status species.
- If low flow conditions exist in the Leaf River during emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico and, as necessary to reach the oil drawdown rate of 1.0 MMBD, from the Leaf River even if it caused the Leaf River to be below the Minimum Instream Flow.

The supplemental water source at Pascagoula would be designed to provide 0.5 MMBD of supplemental water, rather than the full 1.2 MMBD for two reasons. First, expanding the RWI system capacity would involve substantial construction and operational costs, even though this extra capacity may never be needed during cavern development and drawdown. The costs would be higher, for example, because of a large diameter pipeline, high pumping capacity, and the electricity needed to pump water 88 miles. Second, due to its salinity, water from the Gulf of Mexico is less efficient in solution mining than fresh water from the Leaf River and its use would take more time than using freshwater, thereby increasing operational costs.

DOE has determined that withdrawal from the Leaf River during an emergency drawdown (declared as a National Emergency) may result in adverse impacts on water resources, may adversely affect aquatic communities, and may adversely affect species protected under the Endangered Species Act (ESA). In addition, withdrawal of water from the Leaf River at other times may adversely affect aquatic communities and protected species. If one of the Richton alternatives were selected, these potential impacts would require DOE to initiate formal consultation with U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries). During this consultation, DOE would develop a Water Conservation Plan as a mitigation measure. DOE also would consider supplemental water sources, such as water from underground sources, existing reservoirs, or river intakes during drawdown. DOE also would coordinate with the Mississippi Department of Environmental Quality (MDEQ) to secure a Beneficial Use of Public Waters Permit, which would include withdrawal conditions.

Wetlands Impacts: Commenters stated that the Chacahoula and Stratton Ridge alternatives would have substantial adverse effects to wetlands. Commenters noted that the Clovelly alternative would be the environmentally preferable alternative because it would potentially affect the smallest amount of wetlands. Since the draft EIS was issued, however, DOE has determined that the Clovelly and Clovelly-Bruinsburg alternatives are not reasonable, as described above in section S.4. Commenters noted that DOE did not conduct Clean Water Act Section 404/401 permitting, delineate wetlands, or present a compensation plan during the preparation of the EIS and instead will wait until after the Record of

Decision (ROD). DOE determined that, to inform decisionmaking, general impacts to wetlands could be analyzed without conducting wetland delineations, and instead used National Wetlands Inventory data and conducted spot checks at each site. Also, in light of the broad geographic area covered by the alternatives, consultations with the U.S. Army Corps of Engineers (USACE) indicated that it would be a better use of USACE's and DOE's resources to wait until DOE selects an alternative in the ROD before delineating wetlands and initiating the Section 404/401 consultation and permitting process. DOE has added a conceptual wetland compensation plan (appendix O) that provides more information on possible mitigation strategies for wetland impacts.

Brine Discharge to Gulf of Mexico: Commenters requested additional analysis of the potential impacts of brine discharge into the Gulf of Mexico. Commenters also questioned the conclusion for the Richton alternatives that the increase in water salinity resulting from the brine discharge would be within natural salinity variation. The EIS presents an expanded analysis of brine discharge and explains that DOE would conduct additional modeling and monitoring of the brine discharge for the selected SPR alternative consistent with the permits needed from the state and Federal agencies.

Stratton Ridge Site Resource Conflicts: Commenters opposed SPR development of the Stratton Ridge storage site because it would conflict with Dow Chemical's desire to use salt that DOE would solution mine to create storage caverns. The commenters stated that loss of access to that salt would have a substantial adverse effect on Dow Chemical's long-term operations and would result in a loss of jobs in Brazoria County. Commenters also stated that construction of caverns at the Stratton Ridge site would result in irreversible and irretrievable loss of salt. DOE acknowledges that SPR development of the Stratton Ridge site could potentially conflict with Dow Chemical's future operations and thereby result in adverse socioeconomic impacts in Brazoria County. In addition, DOE acknowledges that solution mining of SPR caverns would result in the irreversible and irretrievable loss of salt.

Essential Fish Habitat: A commenter requested that DOE identify and examine impacts to onshore EFH for all alternatives and identify and examine impacts to seagrass near the brine disposal pipeline for the Richton alternative. DOE conducted additional geographic information system (GIS) analyses to identify and examine such potential impacts. As discussed in section 3.7 and appendix E, the underwater construction of an offshore brine pipeline and **diffuser** for Chacahoula, Richton, and Stratton Ridge may pass through EFH, which would permanently remove **submerged aquatic vegetation** (SAV) and EFH within the ROW. Construction of onshore pipelines, RWI structures in the Intercoastal Waterway (ICW), and the proposed new terminal and RWI in Pascagoula for the Richton alternative would affect EFH. DOE would avoid direct impacts to SAV and EFH (if practicable) and minimize indirect impacts. DOE's consultation with NOAA Fisheries would include a plan to mitigate and compensate for impacts to EFH, which would be included as part of the Section 404/401 permit.

1.4.4.2 Major Changes to the Final EIS

This section summarizes major changes DOE made in the final EIS.

Elimination of Clovelly Site Alternatives: Subsequent to the publication of the draft EIS, DOE determined that the Clovelly 120 MMB alternative and the Clovelly 80 or 90 MMB and Bruinsburg 80 MMB alternatives are neither reasonable nor feasible for geotechnical issues. DOE has eliminated these alternatives from detailed consideration in the final EIS, as discussed in S.4 and section 2.6.

Raw Water Source for Richton Alternatives: As discussed in the discussion of the Leaf River in section S.5.2.1, DOE has modified the Richton alternatives to provide a supplemental source of water for cavern construction, maintenance, and drawdown. During low flow conditions in the Leaf River, DOE would use water from a new RWI structure in the Gulf of Mexico at Pascagoula.

Preferred Alternative: DOE identifies the Richton alternative (with expansion of the existing Bayou Choctaw, Big Hill, and West Hackberry sites) as the preferred alterative based on crude oil distribution system capabilities, environmental considerations, project risks, and project costs as discussed in sections 1.4.4 and 2.2.3.

Wetlands Impacts: DOE added Appendix O Conceptual Compensation Plan for Impacts to Wetlands and Waters to the final EIS in response to requests for additional information regarding potential compensation sites required by the Clean Water Act Section 404. DOE revised appendix B to incorporate updated conceptual designs for RWI structures at Bruinsburg and Richton, an additional access road at the Chacahoula storage site, additional filling of floodplains at the Bruinsburg storage site, and the change to the Richton site infrastructure, as noted above. DOE also incorporated additional information into sections 3.6 and 3.7 to identify and examine potential impacts to wetlands as a result of the new conceptual designs.

Essential Fish Habitat and Brine Discharge: DOE conducted additional geographic information system analyses to identify and examine potential impacts to onshore EFH and offshore EFH, such as submerged aquatic vegetation and impacts due to the added RWI at Pascagoula for the Richton alternatives. The results are included in sections 3.6 and 3.7 and appendix E. The EIS also presents expanded analyses of potential impacts of brine discharge in sections 3.6.2 and 3.7.2, and appendices C and E.

1.4.5 Final Environmental Impact Statement and Record of Decision

DOE prepared this final EIS following the public comment period and after considering the comments received on the draft EIS. DOE considered all comments received during the public comment period, and also considered those after the comment period ended to the extent possible. These comments and responses are included in chapter 8 and appendix N.

A number of comments on the draft EIS requested that DOE change the document, conduct additional analyses, or provide additional information concerning potential impacts. DOE has made revisions or provided additional information where appropriate. These revisions are not a result of any significant new circumstances or information that became available since publication of the draft EIS, nor do they change the conclusions reached in the draft EIS.

The final EIS has been distributed to individuals and organizations that received the draft EIS and to others upon request (see chapter 7).

1.5 DOE DECISION

No decision on the proposed action will be made by DOE until a minimum of 30 days after the Environmental Protection Agency's notice of availability of the final EIS. After this period, DOE will issue a ROD concerning the proposed action. The ROD will notify the public of the alternative that DOE has selected and the reasons for that decision. In addition to the environmental consequences described in the EIS, DOE may evaluate other issues such as cost, oil distribution capability, and risk in making its decisions. DOE will publish the ROD in the Federal Register and post it on the DOE Fossil Energy Web site at http://www.fossil.energy.gov/ programs/reserves/spr/expansion-eis.html.

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Chapter 2. Proposed Action and Alternatives

2.1 INTRODUCTION

The proposed action and alternatives are described below in section 2.2. Sections 2.3 through 2.5 describe the activities necessary to construct and operate a typical SPR storage site, the associated infrastructure, and the facilities needed at each potential new site and expansion site. Section 2.6 discusses the alternatives that have been eliminated from detailed study. Section 2.7 compares the potential environmental impacts of the alternatives.

2.2 PROPOSED ACTION

EPACT Section 303 states that in evaluating sites for SPR expansion, DOE:

> "[s]hall first consider and give preference to the five sites which the Secretary previously addressed in the Draft Environmental Impact Statement, DOE/EIS-0165-D. However, the Secretary, in his discretion may select other sites as proposed by a State where a site has been previously studied by the Secretary to meet the full authorized volume of the Strategic Petroleum Reserve [1 billion barrels]."

EPACT Section 301(e) directs the Secretary to "… acquire petroleum in quantities sufficient to fill …" the SPR to 1 billion barrels, which is what was authorized by congressional directives. Consistent with these mandates, DOE's proposed action is to develop one or two new SPR sites, to expand petroleum storage capacity at two or three existing SPR sites, and to fill the SPR to its full authorized volume of 1 billion barrels. Sections 2.2.1 and 2.2.2 describe the potential new SPR sites and the potential expansion of existing SPR sites, respectively.

2.2.1 Potential New Sites

As required by EPACT Section 303, DOE has limited its review of potential new sites for expansion of the SPR to: (1) sites that DOE addressed in the 1992 draft EIS and (2) sites proposed by a state in which DOE has previously studied a site. The following five sites meet those conditions and were considered in the draft EIS:

- Richton, MS, and Stratton Ridge, TX, which were addressed in the 1992 draft EIS;
- Chacahoula and Clovelly, LA, which the Governor of Louisiana requested the Secretary of Energy consider; and
- Bruinsburg, MS, which the Governor of Mississippi requested that the Secretary of Energy consider.

Subsequent to the publication of the draft EIS, DOE determined that use of the Clovelly site, located at the Louisiana Offshore Oil Port's (LOOP's) Clovelly facility, is not feasible and thus not reasonable for geotechnical issues. DOE therefore removed the site from detailed consideration in the EIS.

Recent **seismic** surveys of the Bruinsburg salt dome indicate that it may not be able to provide the needed storage capability; however, it is retained as a potential new site (Rautman et al. 2006).

While the 1992 draft EIS addressed the potential new salt dome sites at Cote Blanche, LA, and Weeks Island, LA, DOE's preliminary review of these sites for this EIS concluded that they are no longer viable due to the sale of the DOE's Weeks Island crude oil pipeline and its subsequent conversion to natural gas transmission. The Cote Blanche site would have been connected by pipeline to the Weeks Island pipeline.

2.2.2 Potential Expansion Sites

In addition to potential new sites, this EIS considers expanding the following three existing SPR sites:

- Big Hill, TX, which was addressed in the 1992 draft EIS; and
- Bayou Choctaw and West Hackberry, LA, which the Governor of Louisiana requested that the Secretary of Energy consider.

Figure 2.2.2-1 shows the location of the proposed new and expansion sites and their associated crude oil distribution complexes. The existing SPR site at Bryan Mound was not considered for expansion because the salt dome has no capacity available for additional storage caverns.

2.2.3 Alternatives

In developing the range of reasonable alternatives to fulfill its proposed action, DOE first considered expansions of three existing storage sites, which would capitalize on existing site infrastructure and operations and thereby minimize development time and construction and operations costs. DOE, however, cannot reach its goal of 273 additional MMB by expanding capacity only at existing sites. The amount of new capacity that is reasonable to develop at an existing site is limited by the physical size of the salt dome, the site's infrastructure for cavern development, and the availability of the commercial petroleum distribution infrastructure to support the increased rate of oil withdrawal from the site.

DOE has the capability to expand three of its existing sites as follows:

- Bayou Choctaw is the SPR's smallest storage site with only 6 caverns and a current storage capacity of 76 MMB. The salt dome is small and DOE currently shares the salt dome with a commercial storage operating company. The potential for expansion is very limited due to the size of the salt dome. DOE has the capability of developing 2 additional caverns on its current property, which would expand the site's capacity by 20 MMB. Other than developing two new caverns, DOE would have to acquire existing commercial storage caverns on the salt dome to increase capacity at Bayou Choctaw. Therefore, DOE has considered the potential expansion of 20 MMB at the Bayou Choctaw site.

- The West Hackberry storage site has a current capacity of 227 MMB and could also be expanded by acquiring land and developing or acquiring additional caverns. However, the West Hackberry site no longer has the offshore brine disposal system necessary to support a cavern development operation. There are 3 existing commercial caverns on the salt dome that could be acquired to increase the site capacity by 15 MMB, to a total capacity of 242 MMB, without developing new caverns. Therefore, DOE has considered the maximum potential expansion of 15 MMB at the West Hackberry site.

- The Big Hill storage site has a current capacity of 170 MMB and could be easily expanded by acquiring land and developing several additional caverns. However, DOE does not desire to expand its sites beyond 250 MMB due to the very high drawdown rates necessary to withdraw the oil in a timely manner and the lack of existing commercial infrastructure to accommodate oil distribution at those rates. Therefore, DOE has considered the maximum expansion of 80 to 96

MMB at Big Hill. (The Big Hill expansion of 96 MMB is considered an alternative to the West Hackberry expansion of 15 MMB.)

To achieve the full 1 billion barrels, DOE will be required to construct a new site with a capacity of 160 MMB with a drawdown rate of 1.0 MMBD. A 160-MMB site provides the needed capability to store 2 crude oil segregations at the site and the 7-8 caverns of each crude type to achieve a site drawdown rate of 1.0 MMBD.

Four potential new sites were designated for consideration in this EIS: Bruinsburg, MS; Chachoula, LA; Richton, MS; and Stratton Ridge, TX. From these various possibilities, DOE proposes the alternatives for combined new and expanded storage sites as set forth in table 2.2.3-1. In addition, under the no-action alternative, the SPR would not be expanded, and it would continue to operate with a 727-MMB capacity. No expansion sites or new sites would be constructed, and DOE would violate the requirements of EPACT.

DOE has analyzed the potential impact of its proposed action for each potential new and expansion site location separately. This will permit the public and DOE decisionmakers to understand the impacts unique to each site and each combination of sites. In its ROD, DOE will determine which combination of sites best meets the Department's goal of 273 MMB of additional capacity.

As shown in table 2.2.3-1, for each alternative except for no-action, there are 2 scenarios for expanding the SPR to achieve the 1,000 MMB of storage capacity. The following subsections review the proposed new SPR sites and the existing SPR sites proposed for expansion.

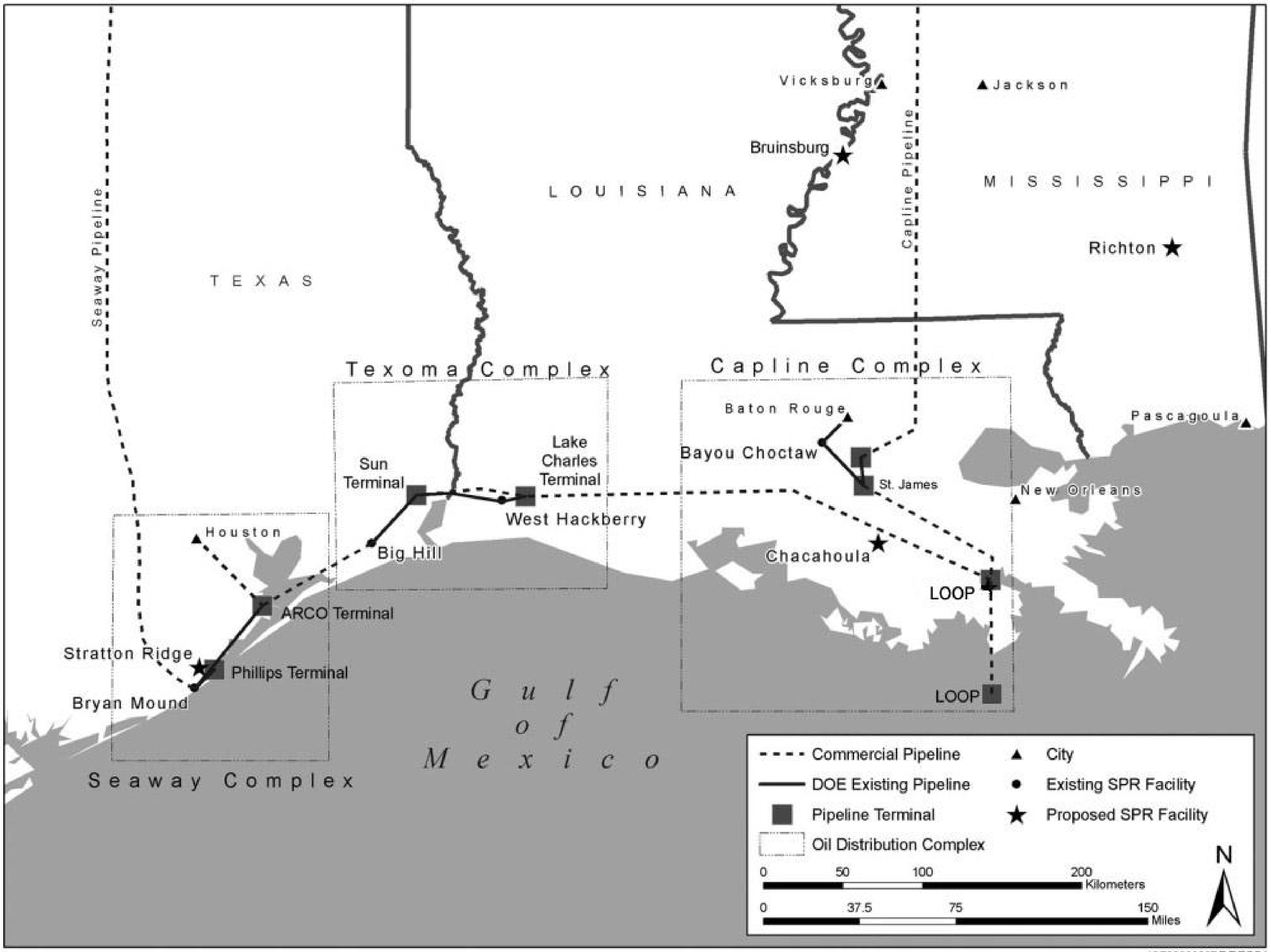
Table 2.2.3-1: Alternatives

<table>
<tr><th>New Sites and Capacity</th><th>Expansion Sites and Added Capacity</th><th>Total New Capacity*</th></tr>
<tr><td>Bruinsburg, MS (160 MMB)</td><td rowspan="4"><u>115 MMB</u>
Bayou Choctaw (20 MMB)
Big Hill (80 MMB)
West Hackberry (15 MMB)
OR
<u>116 MMB</u>
Bayou Choctaw (20 MMB)
Big Hill (96 MMB)</td><td rowspan="4">275 MMB
or
276 MMB</td></tr>
<tr><td>Chacahoula, LA (160 MMB)</td></tr>
<tr><td>Richton, MS (160 MMB)</td></tr>
<tr><td>Stratton Ridge, TX (160 MMB)</td></tr>
<tr><td>No-action alternative</td><td>None</td><td>None</td></tr>
</table>

* DOE would not fill the SPR beyond 1 billion barrels if it developed more than 273 MMB of new capacity.

The CEQ regulations require an agency to identify its preferred alternative or alternatives, if one or more exists, in the draft EIS and identify such alternative in the final EIS. DOE identifies the Richton site (with expansion of the Bayou Choctaw, Big Hill, and West Hackberry sites) as the preferred alternative based on crude oil distribution system capabilities, environmental considerations, project risks, and project costs. However, the three commercial caverns at the West Hackberry site were recently sold to Sempra Pipelines and Storage and ProLiance Transportation and Storage. As a result, DOE may not be able to acquire the West Hackberry site caverns at a reasonable cost. DOE will weigh the cost of expansion at the West Hackberry site as a factor in selecting sites.

Figure 2.2.2-1: Existing and Proposed SPR Facility Locations and Crude Oil Distribution Complexes



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2.3 BACKGROUND ON CONSTRUCTION AND OPERATION OF SPR STORAGE SITES

> **Salt domes** are subsurface geologic structures consisting of a vertical cylinder of salt, and may be anywhere from 0.5 to 6 miles (1 to 10 kilometers) across and up to 20,000 feet (6,100 meters) deep. Domes are formed when salt from buried salt pans flow upward due to its buoyancy.

An SPR storage site would consist of a number of individual systems that would play a role in storing and distributing oil. Crude oil storage caverns would be created in large salt domes. To create these storage caverns, **raw water** would be brought to the site through a RWI system. This raw water would be pumped into the salt dome to dissolve the salt in a process known as solution mining. Raw water would be supplied to expansion sites and new sites from surface water sources. This water would dissolve the salt and produce a brine solution, which would be disposed of through a brine disposal system. The systems and processes used to construct and operate SPR sites are described below and illustrated in figure 2.3-1 and figure 2.3-2. After a cavern has been successfully created, oil would be pumped in for storage through the crude oil distribution system until it would be removed through a process called drawdown and then redistributed.

> **Raw water** is fresh surface water or salt water that is supplied to the site from a substantial water source.

> **Brine** is water with a salt concentration greater than 35 parts per thousand. Sea water has a similar average concentration. In comparison discharged brine has a typical concentration of 263 parts per thousand.

Solution-mined caverns in salt domes have been used to store liquids and gases for more than half a century. In the early 1950s, salt caverns were first used to store crude oil in England and liquid petroleum gas in the United States, Canada, and several European countries. Natural gases began being stored in salt caverns in the United States and Canada in the 1960s. DOE has been using solution mining to develop caverns in the salt domes along the Gulf Coast since the 1970s, and it began filling the SPR salt caverns with crude oil in 1978.

2.3.1 Cavern Creation, Fill, and Drawdown System

Developing a cavern would take approximately 2 years, although multiple caverns can be created simultaneously. Because the caverns would be created simultaneously, it would take up to 5 years to complete the development of sixteen 10 MMB caverns. (The Richton alternatives may take longer, however, as is described in section 2.4.3.) The top of each cavern generally would be located between 1,500 feet and 3,500 feet (460 meters and 1,607 meters) below the ground. Each cavern would be designed to hold 6.7 to 12 MMB of crude oil.

> **Concentric cased wells** are two wells, one located within the other. The two wells are separated by an inner casing and an outer casing, and the casings form two concentric rings.

> **A sump** is the space below the bottom end of a well pipe where liquid collects.

> Approximately 7 MMB of brine are created for every 1 MMB of cavern space created.

DOE would use a four-stage solution-mining process to create a cavern (figure 2.3-1). First, DOE would drill a pair of **concentric cased wells** into the salt dome, and then pump water through the wells until the **sumps** from each coalesce into a single sump so that water can be pumped down one well and brine displaced out through the other (figure 2.3-1, step I). During this process, **drilling mud** (which is not a hazardous waste) would be generated and deposited onsite, and brine would be discharged in one of two ways. Brine would be discharged into the Gulf of Mexico in accordance with the terms of applicable permits at any new site (except Bruinsburg) and the expansion at Big Hill. For the

Bruinsburg, Bayou Choctaw, and West Hackberry sites, brine would be disposed of via injection wells that inject brine into deep non-potable groundwater aquifer systems. Brine disposal is described in section 2.3.3. As solution mining proceeds, any insolubles in the brine would drop to the bottom of the cavern.

The second stage would involve developing the cavern chimney, which is the narrow upper part of the cavern illustrated in figure 2.3-1, step II. Water would flow into the well at the bottom of the developing cavern, and brine resulting from leached cavern walls would be pumped out at the top. DOE would carefully control upward cavern development to produce the desired cavern size and shape. This would be done by regulating water flow and varying the position of the injection piping.

In the third stage of cavern development, cavity growth would be directed downward by injecting a quantity of oil that floats on the water and blankets the cavern roof, thereby protecting the cavity from further upward solution mining (see figure 2.3-1, step III). This process works because the chemical composition of water differs from that of crude oil. Water is a polar substance, and it breaks the ionic bonds between the sodium and chloride, causing salt dissolution. In contrast, crude oil is nonpolar and does not break the bonds and dissolve salt. Thus, when the oil is injected and floats on the water at the top of the cavern, it prevents the water from dissolving salt at the top wall of the cavern toward the ground surface.

In the fourth stage of cavern development, the body of the cavern would be enlarged to its planned capacity by lowering the water injection point in the cavern (see figure 2.3-1, step IV).

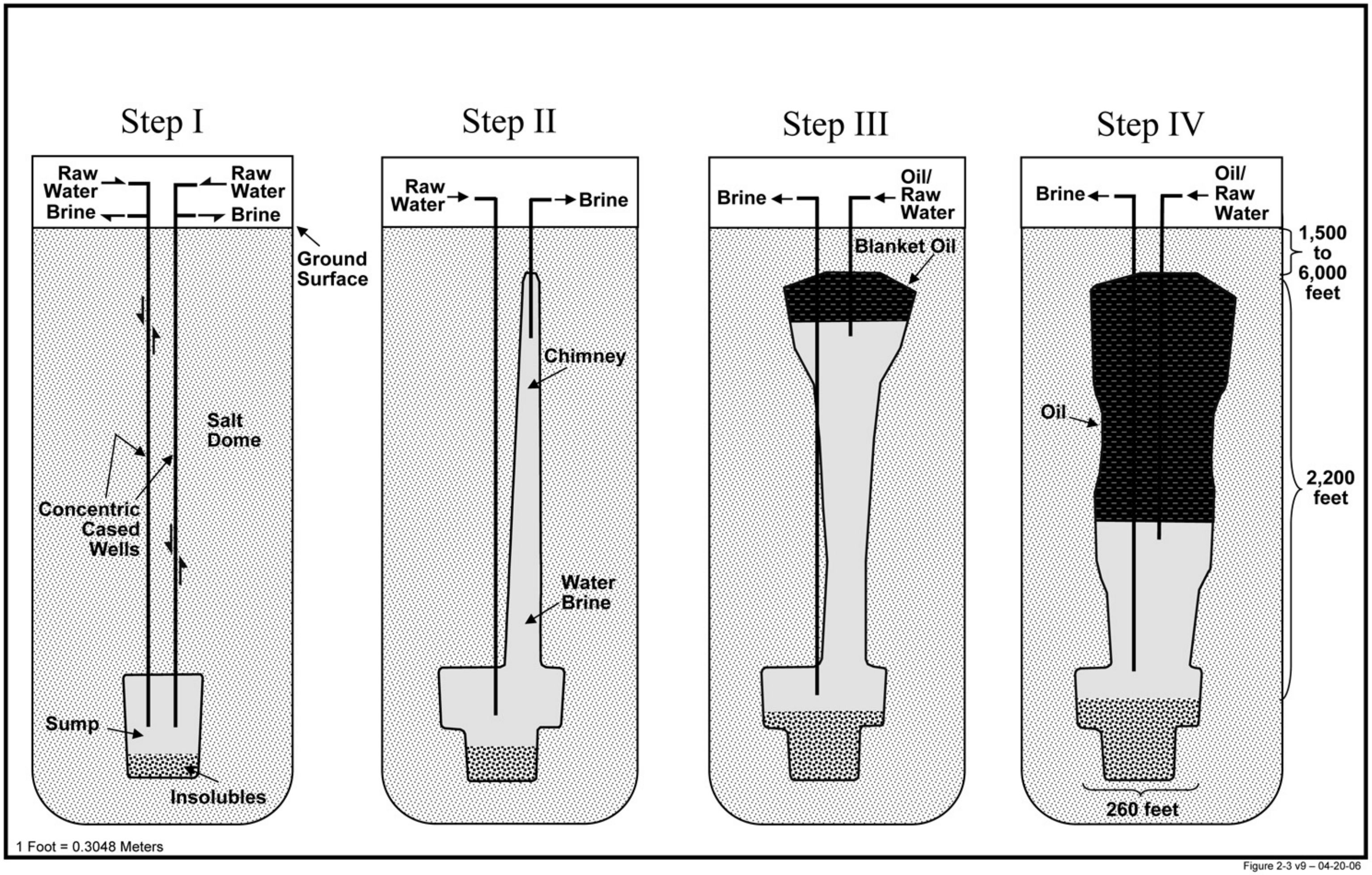
DOE would monitor the cavern development process using computer and sonar instruments. After the initial cavity is created, a sonar **caliper** survey would verify that the cavern is developing as planned. During solution mining, DOE would use computer modeling to predict the size and shape of the cavern. The water injection level would be adjusted to create the desired size and shape. DOE would use sonar surveys two more times to measure each cavern and adjust the computer model accordingly. Upon completion, each cavern would be roughly cylindrical in shape, tapering slightly inward from top to bottom. A typical SPR storage cavern, with a planned storage capacity of 10 MMB, would be leached (solution mined) to an 11–MMB volume, approximately 2,200 feet (670 meters) high and 260 feet (79 meters) wide at the widest point (see figure 2.3-1).

DOE would test the structural integrity of the caverns in two phases. The first phase would involve two **hydrostatic tests** of each well in a cavern. This phase is designed to check the pressure-drop response of the entire cavern to gross leakage. The second phase would employ a nitrogen well-leak test on each well. This test, which would last at least 5 days, is designed to detect small leaks in the well walls and wellhead. DOE would approve a cavern for oil storage only if the testing demonstrates that total leakage would be less than 100 barrels of oil per year for each well entering the cavern. This is within the accuracy of current accepted evaluation techniques.

The fact that oil floats on water is the underlying mechanism used to move oil in and out of the SPR caverns. After completing integrity testing, DOE would fill the cavern with oil through one well as the brine is displaced from the second well (see figure 2.3-2). Oil would be delivered to the site through pipelines. Oil in the caverns would be stored until drawdown.

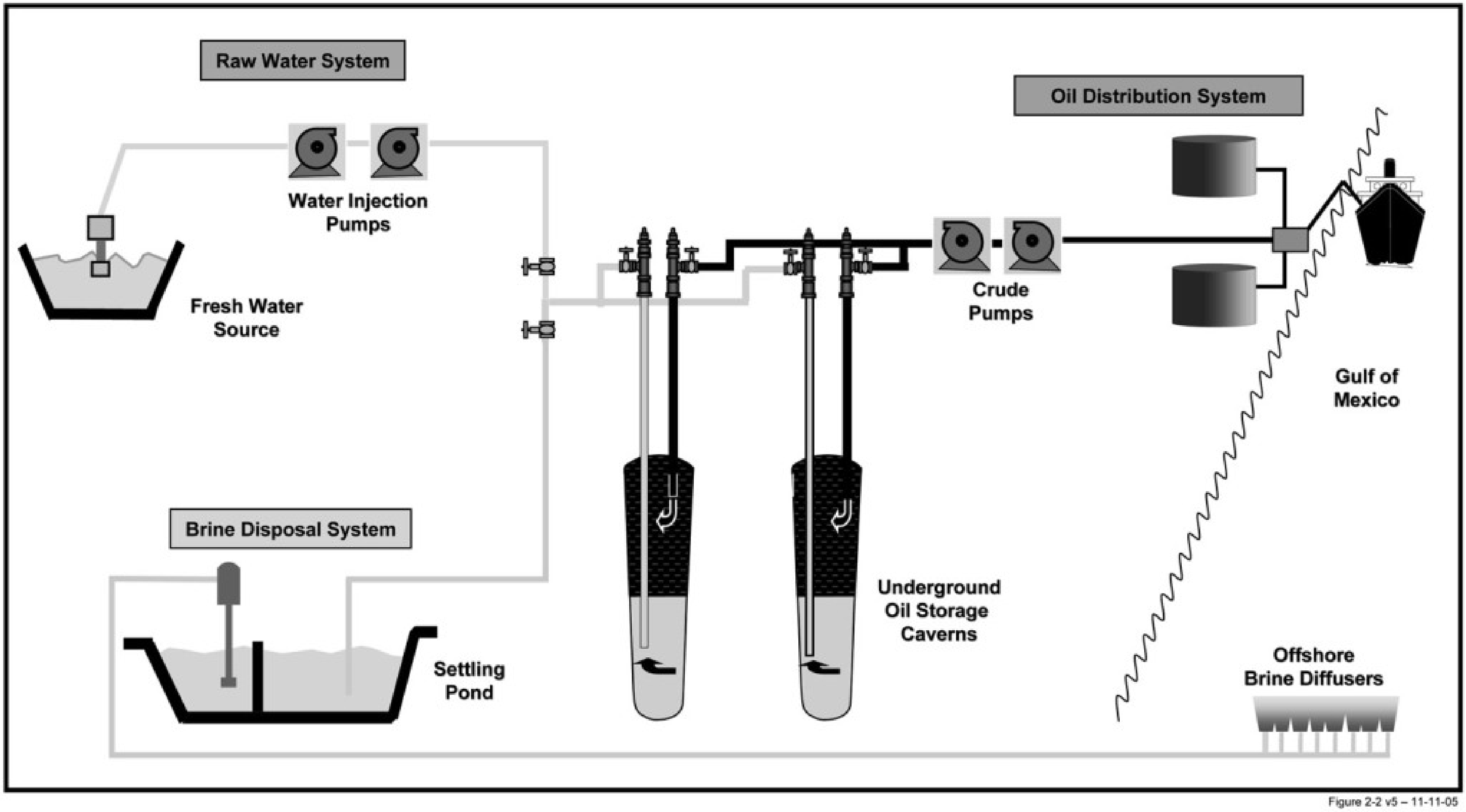
> Besides being the most economical way to store oil for long periods of time, the use of salt caverns is also one of the most environmentally secure. The salt walls of the storage caverns are “self-healing.” Extreme geologic pressures make the salt walls rock hard. If any cracks were to develop, they would be closed almost instantly. In addition, the natural temperature difference between the top of the caverns and the bottom keeps the crude oil continuously circulating, helping maintain the oil at a consistent quality.

Figure 2.3-1: Cavern Creation in Construction of a Typical SPR Cavern



1 foot = 0.3048 Meters

Figure 2.3-2: Filling a Typical SPR Storage Site



During drawdown, oil would be displaced by water and pumped through the site's transfer metering station and distribution pipeline to the receiving terminal. Heat exchangers onsite would be used to cool the oil to prevent release of VOCs, hydrogen sulfide, and benzene when the oil is delivered from the storage sites into tanks at terminals. (Long-term storage in underground salt domes heats oil above the temperature at which it is originally stored.)

The layout of the caverns would depend on site characteristics, but generally it would reflect the current cavern layout at the Big Hill site (see section 2.5.2.). Cavern spacing would be based on specific criteria detailed in the Level III Design Criteria for the SPR that ensure cavern integrity and stability (DOE 2001a). These criteria detail minimum cavern center-to-center spacing, cavern pillar thickness, distances from the pillar thickness to the edge of the dome and to the property line, distance between the top of the cavern roof to the top of the salt, and the ratio of pillar thickness to final cavern diameter. A safety factor is also specified to allow for **borehole** deviation when drilling and for uncertainties regarding proximity to the edge of the dome.

A dike would surround the wellhead area at each cavern to contain and control any spills that might result from a manifold failure or blowout. Drains would be located on either side of the dike. The containment area would have the capacity to remove accumulated rainwater and would be drained to the stormwater drainage system.

2.3.2 Raw Water Intake System

The RWI system would supply raw water for both cavern solution mining and oil drawdown activities. The main component of this system, the RWI structure, would be located on a water source with sufficient flow to supply up to 1.2 MMBD or 50 million gallons per day of water for cavern solution mining and drawdown. A typical RWI structure would be a steel and concrete platform sufficiently elevated to withstand a 100-year flood (see figure 2.3.2-1). All RWI facilities would be sited on a 3.7 acre (1.5 hectare) parcel and would include a 0.3 acre (0.1 hectare) RWI structure, a 0.2 acre (0.1 hectare) helipad, and onsite roads and parking areas. The 3.7 acre (1.5 hectare) parcel would be fenced and would be surrounded by a 300 foot (91 meter) cleared security buffer for a total area of 16 acres (6.5 hectares). It would have four up to 1,500-horsepower, vertical, centrifugal pumps, each with a capacity of approximately 0.46 MMBD to remove water from the water source. The water then would be transported through a pipeline to the SPR storage site. After the water reaches the site, 3,500-horsepower injection pumps would pump it to the caverns for solution mining or drawdown operations.

> **Rip rapping** is the process by which rocks or other materials (rip rap) are placed along the banks of a body of water to prevent erosion.

A typical RWI structure, which would be used at Chacahoula, Stratton Ridge, and the Richton Pascagoula RWI, would have a concrete sump on an intake channel or a pier equipped with bar racks and traveling screens to remove debris and return aquatic life to the water source. The effective cross section of the screens would be sufficient to ensure a maximum intake velocity of 0.5 feet (0.15 meters) per second. The intake channel would be **rip rapped** according to USACE permit requirements to prevent shore erosion. The landward portion of the structure would be surrounded by a fence with security lights.

In the final EIS, DOE modified the conceptual design for the Bruinsburg RWI on the Mississippi River and the Richton RWI on the Leaf River, the only two RWIs on naturally flowing rivers. The modified RWIs would reduce potential effects on aquatic resources by using a series of cylindrical screens located in the stream channel and oriented parallel to the river flow. To further reduce the potential impacts of the RWI on the Leaf River, DOE modified its conceptual design to reduce potential for **impingement** and **entrainment** of aquatic organisms. (See Figure 2.4.3-3.) In addition, the final EIS adds a second RWI at

Pascagoula for Richton. This RWI structure would be located in the Gulf of Mexico at an existing dock. It is designed based on the typical RWI structure, as described above. (See Figure 2.4.3-4.)

In addition to the RWI pumps, two sealed, firewater, vertical, centrifugal, 100-horsepower pumps would maintain pressure in the RWI structure when the intake pumps are not operating. These pumps also would provide water at the RWI structure in case of fire. Power to the RWI would be provided on parallel, high-voltage, 34.5-kilovolt power lines supported on self-weathering 75-foot (23-meter) steel monopoles, however, based on the local power distribution system 115-kilovolt or 138 kilovolt power lines may be used. Typically, the new power line ROW would be built from the storage site to the RWI along a ROW shared with the raw water pipeline. The ROWs for parallel 34.5-kilovolt power lines would be 60 feet (18 meters), and for parallel 115-kilovolt or 138 kilovolt power lines would be 150 feet (46 meters). Power to the RWI would be provided from the storage site substation or from nearby existing power lines.

2.3.3 Brine Disposal System

Anhydrites are mineral, anhydrous calcium sulfates (chemical formula $CaSO_4$), occurring naturally in salt deposits. Anhydrite is much less soluble than salt, so anhydrite solids must be removed from brine before brine can be disposed of in the ocean or injected into underground wells.

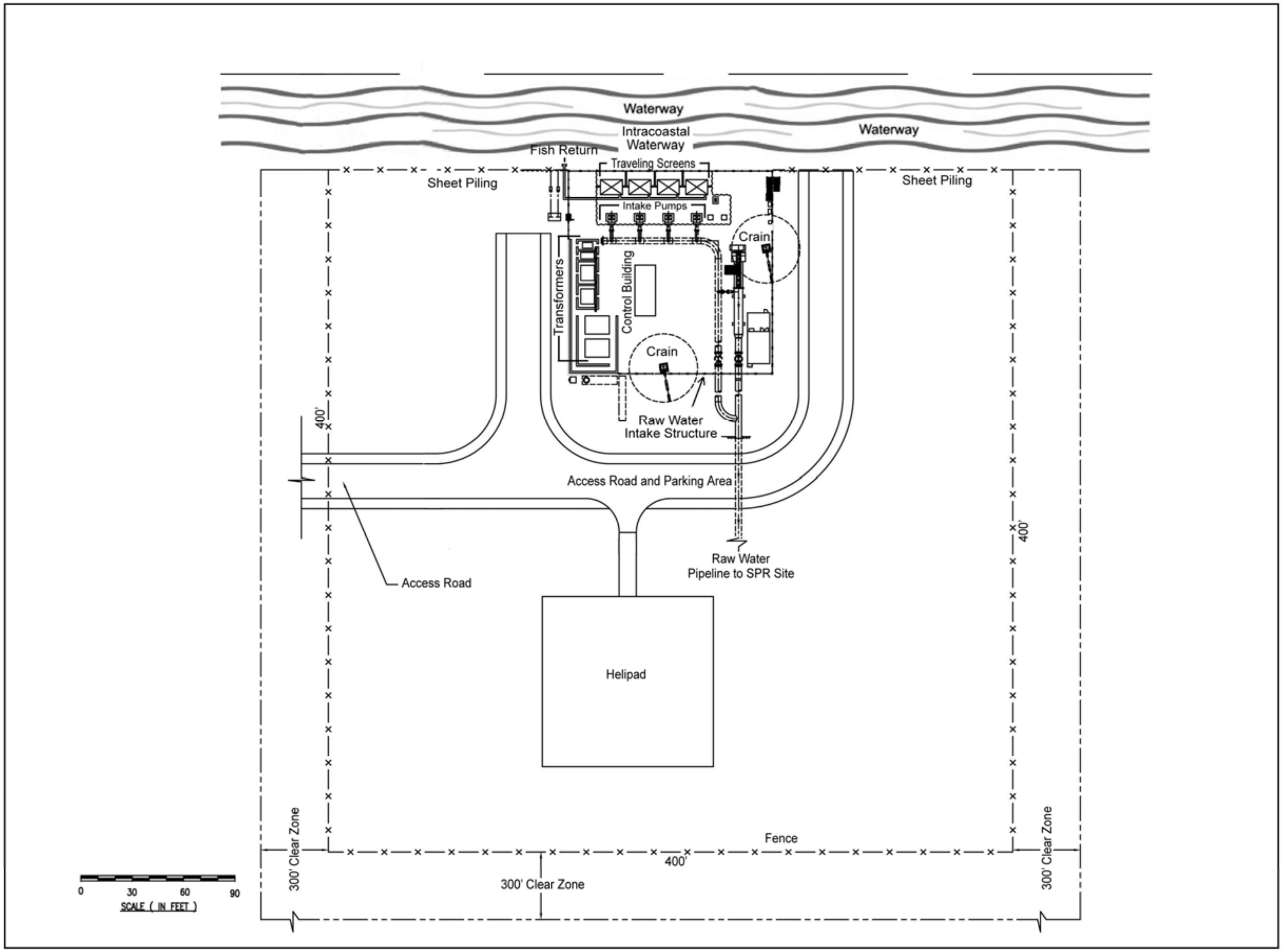
DOE would use two methods of disposing of brine produced during cavern solution mining: ocean disposal or injection wells. At Big Hill and each of the proposed new sites except Bruinsburg, the brine would be directly discharged into the Gulf of Mexico through a brine **diffuser** system. Brine would be displaced from caverns into a **brine pond** with a high-density polyethylene liner, where **anhydrites** would be separated from the brine by gravity settling. From this pond, the brine would flow into a different area of the pond or into a second pond or area, where any residual oil floating on the surface of the brine would be skimmed off. Oil collected by the **skimmer** boom would be stored temporarily in a waste oil tank, and after evaluation, it would be returned to inventory. Any oil failing evaluation would be disposed of offsite as waste (see section 2.3.10).

Finally, the brine would be pumped into the brine disposal pipeline. The brine would be treated with ammonium bisulfite, which scavenges dissolved oxygen, thereby reducing corrosion in the brine disposal pipeline. Vertical, centrifugal pumps would pump at a rate of up to 1.2 MMBD to the disposal point.

For ocean disposal, the brine disposal pipeline would be buried below the bottom of the Gulf of Mexico and extend until the water is at least 30 feet (9 meters) deep. After the brine reaches that point, it would be discharged underwater vertically through a diffuser with 3-inch (7.6-centimeter) nozzles mounted vertically and spaced 60 feet (19 meters) apart. The diffuser would extend over 4,000 feet (1,200 meters) beyond the pipeline. The diffuser would have up to 75 exit ports that can be opened or closed in order to maintain a minimum brine exit velocity of 30 feet (9.1 meters) per second. Each nozzle on the diffuser would be equipped with a flexible rubber hose that would extend 4 feet (1.2 meters) above the Gulf floor and with a diffuser guard designed to prevent interference with shrimping and other fishing activities. Discharged brine would have a salinity of about 263 parts per thousand, whereas the seawater in the gulf has an average salinity of 35 parts per thousand.

Under the proposed expansion at the Bayou Choctaw and West Hackberry sites, brine would be disposed of using existing and proposed new brine injection wells. Brine disposal at West Hackberry would use the existing brine disposal wells, while brine disposal at Bayou Choctaw would use the existing and up to six new brine injection wells. At the West Hackberry site, existing caverns would be purchased, and brine would only be disposed of during the oil fill. An underground injection system also would be used to dispose of brine from the proposed Bruinsburg site. The process for moving the brine to underground

Figure 2.3.2-1: RWI Typical Structure (Chacahoula and Stratton Ridge)



injection wells would be similar to that of the Gulf of Mexico disposal method—first to separating ponds before being pumped into disposal pipelines—except for the final disposal point. In this method, the brine would be injected into wells specifically designed and permitted to inject brine into deep non-potable groundwater aquifer systems.

2.3.4 Crude Oil Distribution System

SPR storage sites would be connected to a crude oil distribution system as a means of filling caverns for storage and distributing oil during drawdown. The crude oil distribution system would consist of a series of onsite and offsite pipelines and pumps connecting to an existing oil distribution network. To accommodate some of the new sites being considered, the existing distribution network also may be expanded to include new **tank farms**, terminals, and other equipment. The existing SPR storage facilities are linked to three major Gulf Coast crude oil distribution complexes (see figure 2.2.2-1). The proposed new or expanded SPR storage facilities at Bruinsburg, Chacahoula, Richton, and Bayou Choctaw would be connected to the Capline Complex. The proposed new SPR storage facility at Stratton Ridge would be connected to the Seaway Complex. The existing and proposed SPR storage facilities at West Hackberry would be linked to the Texoma distribution complex. The existing and proposed SPR storage facilities at Big Hill would be linked to both the Seaway and Texoma complexes. Each of these complexes includes oil refineries, pipelines, and marine oil terminals on the Gulf Coast. During an emergency drawdown of the SPR, crude oil would be transported by pipeline, barge, or tanker.

2.3.5 Site Support Structure and Equipment

To support storage site operations, several types of structures and equipment would be constructed at the site as needed. The following buildings would be needed to support operations and maintenance:

- Office and control room;
- Maintenance shop and warehouse;
- Crude oil, raw water, and brine pump enclosures;
- Sample storage building;
- Laboratory; and
- Security buildings.

These buildings typically would occupy a 35,000-square-foot (3,250-square-meter) area. To facilitate construction and site operations, DOE would build roads at the site. The roads generally would have two 10-foot (3-meter) lanes with 6-foot (1.8-meter) shoulders. Total roadway length for a site would average 5.1 miles (8.2 kilometers). DOE also would need miscellaneous surface facilities such as pump pads, piping manifolds, maintenance yards, **laydown yards**, and parking lots. Total storage facility surface area for new sites would range from 170 to 270 acres (69 to 110 hectares). Expansion sites range from 250 to 570 acres (100 to 230 hectares), and areas that would be added by proposed expansion would range from 96 to 240 acres (39 to 97 hectares).

An SPR site also would need an electrical substation, sewage treatment facility, lightning-protection system, and fire-safety system. The fire-protection system would receive its water supply from either the RWI structure or an onsite tank. In a fire, the water would be distributed through underground piping. The system would include a foam (aqueous film-forming foam) spray system for controlling fires at the oil injection pump pads and oil loading center, an automatic sprinkler system inside buildings, and an onsite fire truck.

All SPR sites would be equipped with security systems and staffed by protective personnel. The sites would be completely fenced with 7-foot (2.1-meter) chain-link fence and equipped with site perimeter surveillance and detection systems. The sites would maintain a 300-foot (91-meter) visual clear zone with perimeter lighting. Personnel and vehicle entry would be restricted. Site entrances would be equipped with vehicle barriers and entry portals for personnel screening. Employee and visitor parking would be provided outside the controlled area.

Electrical power would be required for basic construction and operational activities, quarterly equipment testing, and annual testing of drawdown capabilities. The number of pumps used at any one time and their energy requirements would vary depending on the number of caverns being developed, the type of activity, and the conditions of each pipe **casing**. Cavern development would be the most energy-intensive activity, averaging approximately 12 million kilowatt-hours per month for a 16-cavern site. The RWI, brine disposal, and oil fill and distribution systems would be powered by electric pumps. During cavern development, pumps would usually run 24 hours each day. Oil-fill energy requirements would be about 6 million kilowatt-hours per month. During standby periods, energy requirements would be about 1 million kilowatt-hours per month for a 16-cavern site. During standby periods, energy requirements would be about 0.5 million kilowatt-hours per month. During drawdown periods, energy requirements would be greater than for oil fill and less than for cavern development, depending on the rate of drawdown.

High-voltage 115-kilovolt, 138-kilovolt, or 230-kilovolt power lines would be built to supply the substation at a new SPR storage site. Two lines would be constructed for each site, generally using new ROWs or along ROWs shared with pipelines or roads. The ROW for a single 115-kilovolt or 138-kilovolt power line would be 100 feet (30 meters) and the ROW for parallel 115-kilovolt or 138-kilovolt power lines would be 150 feet (46 meters). The ROW for a single 230-kilovolt power line would be 100 feet (30 meters) and the ROW for a parallel 230-kilovolt power line would be 200 feet (60 meters). A three-line single circuit would be supported on self-weathering 75-foot (23-meter) steel monopoles spaced at 600 to 900-foot (183- to 274-meter) intervals.

2.3.6 Storm Protection Measures

DOE has established emergency response plans at all existing SPR storage facilities to address major storm events such as hurricanes. SPR staff would monitor weather and potential storms continually. If a hurricane were projected to hit an operational storage facility, the threat level would be assessed and the appropriate emergency response plan would be initiated. During threats, all loose materials onsite, including materials at the laydown areas, would be tied down or relocated to a secure area. Windows on buildings would be secured with energy efficient storm shutters or prefabricated plywood covers. Storage tanks would be checked to ensure that they are storing enough material to effectively weigh them down and prevent serious damage. If the storage tanks are found to be too light, water would be added to them. Finally, all nonessential personnel would be released from work, and site operations would be suspended.

Storm damage could potentially affect SPR storage facilities and support infrastructures, disrupt workforces, and result in communication interruptions. The effects of storm damage to a SPR storage facility can be best demonstrated by recent events. Storm protection measures—including activating back-up communication centers—were implemented when major Hurricanes Katrina (Category-4 landfall in Louisiana) and Rita (Category-3 landfall on the Louisiana/Texas border) devastated parts of the Gulf Coast region in August and September 2005. In addition to causing structural, economic, and social damage to a tri-state region in the Gulf Coast, these hurricanes shut down most crude oil and natural gas production and affected the ability of suppliers to get gasoline to national markets due to the closure of critical refineries in the region. Several SPR storage sites were directly affected, sustained some damage, and many employees were displaced from their homes. Notwithstanding, SPR operations were able to be restored almost immediately. The Oil Exchange Program providing crude oil to refiners in order to continue operations commenced in less than three days after Hurricane Rita and five days after Hurricane

Katrina at which time President Bush declared a SPR drawdown—an action that has occurred only twice in 30 years. This demonstrates the effectiveness of planned SPR storm protection measures and of the resilience of SPR infrastructure to sustain short-term damage from major storm events.

2.3.7 Construction in Uplands

> **Uplands** refer to generally dry land that is different from, marsh, swamp, and wetlands.

As described above, construction activities generally would include site preparation, development of RWI and brine disposal systems, cavern creation, development of any new oil pipelines needed to connect to existing distribution networks, and construction of support structures and equipment. The actual activities undertaken would depend on the sites selected and existing facilities at each site. The following sections describe required activities in developing a typical new SPR facility in **uplands**. Certain of these activities also pertain to expansion of existing facilities, particularly where new caverns would be developed.

Clearing and Grubbing

Construction of a new SPR facility would begin with clearing and **grubbing** the site. Clearing would consist of felling, trimming, and cutting trees into sections and removing surface vegetation, rubbish, and existing structures. Materials removed generally would be disposed of at an approved offsite facility. In most cases, onsite burning or disposal would not be permitted. Grubbing would include removing roots, stumps, brush, and general debris. As part of this work, topsoil also would be removed. Generally, uncontaminated native topsoil would be stockpiled on the site for use in restoring sloped areas, which then would be seeded with native vegetation to control erosion. Waste materials would be recycled or disposed of offsite.

All the land within a new site and RWI structure within the 300-foot (91-meter) security buffer would require clearing and grubbing for initial site construction activities. These operations generally would require two crews (an onshore construction crew is about 52 people). Depending on the density of trees and brush, the clearing and grubbing would be completed in approximately 100 working days.

Grading and Stabilization

Grading and general embankment, stabilization, and compaction operations would begin as soon as clearing and grubbing are completed. As adequate site areas are cleared, rough grading (i.e., moving dirt from high areas of the site to lower areas) would begin. For a typical 300-acre (120-hectare) site, estimated daily production of graded materials would be 3,000 cubic yards (2,300 cubic meters) for two 300-horsepower dozers (short haul) and 2,500 cubic yards (1,900 cubic meters) for two 14-cubic-yard (11-cubic-meter) scrapers (long haul). Rough grading would require 5 to 10 working days. As areas of the site are cut to subgrade levels, the soil would be stabilized with lime and then compacted. Two crews would stabilize approximately 1 acre (0.4 hectare) per day, requiring 130 working days for this operation. Placing and compacting embankment material would be done at a rate of 2,000 cubic yards (1,500 cubic meters) per day, requiring approximately 60 working days.

2.3.8 Construction in Wetlands

At the proposed Chacahoula site, the majority of construction would occur in saturated or open-water wetlands. Construction would require dredging and filling of wetlands. Dredging is the removal of materials from the bottom of a body of water. At Chacahoula, fill areas would be created for gravel roadways, onsite pipelines, onsite buildings and structures, and drilling pads above each well. The pipelines and roadways would be co-located to minimize potential construction impacts. The foundations of buildings would be placed on concrete or wooden piles driven into the earth below the water.

2.3.9 Pipeline Construction

Offsite pipelines for brine disposal, raw water, and crude oil distribution would be buried. In preparation for pipeline construction, DOE would clear the ROW, which requires preparation similar to that required for construction. DOE would give all possible consideration to preserving trees in the ROW. DOE also would grade the ROW to facilitate laying the pipeline, and would build temporary facilities such as roads and bridges for use during pipeline construction.

Five basic modes of pipeline construction would be used in uplands and wetlands through which a pipeline from any proposed site could pass. The method chosen for a particular pipeline would depend on terrain, pipe size, and presence of ground and surface water. The five modes are described below:

- **Conventional Land Lay:** This method generally would be used for pipe installation at higher elevations where groundwater or surface water conditions would not prevent the use of heavy equipment. The pipe would be installed in ditches excavated by backhoes and ditching machines. The pipeline would be assembled and lowered into the ditch using side-boom tractors and other equipment. The ditch then would be backfilled, returning the terrain to its original contour.

- **Conventional Push Ditch:** This method would be used in marshland areas where water depths are reasonably predictable. Timber mats support the heavy equipment used to create ditches of sufficient depth for pipeline installation. The pipeline would be assembled at the push site, on high ground, on a barge, or on a temporary platform, and then pushed into the ditch. Floats would be used to push the pipe into position. When these floats are removed, the concrete-coated pipe would sink to the bottom of the ditch. Returning the ROW to its original contour depends on the success of the backfilling and the ditch slope.

- **Flotation Canal:** For this method, which requires a minimum of 6 feet (1.8 meters) of water, a canal would be created to accommodate barges and floating equipment. The pipe would be installed in the canal through a sequential assembly operation on a barge deck. The canal would not be backfilled.

- **Modified Push Ditch:** This method would be most applicable in areas with predictable water levels such as coastal **marshes**. Shallow-draft barges would excavate a canal. A larger push barge would be used as a platform to assemble the pipe, and then, with flotation buoys, the pipe would be floated into the canal. The pipe is allowed to sink to the bottom of the canal when the flotation buoys are removed. Finally, the canal would be backfilled.

- **Directional Drilling:** This method is used for laying in a pipeline beneath major road and water crossings. The main advantage is that during construction, the method avoids disruption to traffic and sensitive environmental features. Using a slanted drill, construction workers would drill a pilot hole on one side of the crossing and then repeat this process on the other side. After drilling the pilot holes, workers would expand them to create sufficient space for the crude oil pipeline.

Pipeline construction in the Gulf of Mexico generally would require a trench about 20 feet (6.1 meters) below the ocean floor and 12 and 6 feet (3.7 and 1.8 meters) wide at its top and bottom, respectively. Pipeline construction would differ for coastal waters (i.e., within water depths of 12 to 15 feet [3.7 to 4.6 meters]) and offshore waters (i.e., beyond water depths of 12 to 15 feet [3.7 to 4.6 meters]). In coastal water, a mechanical dredge (e.g., clam bucket or dragline dredge) would excavate the pipeline route. Afterward, the pipeline would be assembled sequentially on a pipelay barge and then pushed off the pipe ramp. Flotation buoys would keep the pipeline suspended in the water until the pipeline was allowed to descend into the ROW.

In offshore water, excavation of the pipeline ROW would occur after the pipeline was laid. First, the pipeline would be assembled sequentially on a pipelay barge with a conveyor system, and then it would be pushed into the Gulf where it would be allowed to descend to the sea floor. A dredging sled, mounted on the stern of the trenching barge, then would be lowered to the ocean floor and positioned over the pipe. Hydraulic jets on the sled would displace the material around the pipe. The pipeline would then lie in the trench previously occupied by the displaced bottom material. Depending on the area's environmental sensitivity, the resulting suspended bottom material would dissipate in the Gulf water or be collected and disposed of in **spoils** areas.

Pipeline construction would require both construction **easements** and permanent easements. The width of the easements would vary with the type of terrain the pipeline crosses and other site characteristics. Table 2.3.9-1 lists the typical easement width requirements for pipelines. Figure 2.3.9-1 shows the typical layout of a pipeline easement in both uplands and wetlands. Chapter 3 uses these easement assumptions to calculate the acreages affected by pipeline construction.

An **easement** is a right held by one party to make specific, limited use of land owned by another party. An easement is granted by the owner of the property for the convenience or ease of the party using the property. Common easements include the right to pass across the property or the right to construct a pipeline under the land or a power line over the land.

Table 2.3.9-1: Typical Widths of Pipeline Easements

Land Type	Construction Easement	Permanent Easement	Total Easement
Single Pipeline			
Uplands	50 feet (15 meters)	50 feet (15 meters)	100 feet (30 meters)
Wetlands	100 feet (30 meters)	50 feet (15 meters)	150 feet (46 meters)
Water	100 feet (30 meters)	50 feet (15 meters)	150 feet (46 meters)
Multiple Pipelines			
Uplands	120 feet (37 meters)	50 feet (15 meters)	170 feet (52 meters)
Wetlands	150 feet (46 meters)	100 feet (30 meters)	250 feet (76 meters)
Water	150 feet (46 meters)	100 feet (30 meters)	250 feet (76 meters)

2.3.10 Operations and Maintenance

This section discusses typical operation and maintenance activities for SPR sites and pipeline systems.

Site Operations and Maintenance

The main activities at an SPR site would include oil drawdown and fill and routine daily operations such as inspecting equipment, preparing log sheets, documenting data for equipment performance evaluation, reporting safety hazards, making environmental checks, performing laboratory work, and conducting maintenance activities. As necessary, a site would be sprayed with herbicides (e.g., around the fenceline) and pesticides (e.g., for fire ants and mosquitoes). Section 3.2 identifies these and other chemicals commonly used at an SPR site. An SPR facility would employ approximately 75 to 120 people onsite, depending on the site's final storage capacity. Operations and security personnel would be onsite 24 hours a day.

Figure 2.3.9-1: Uplands and Wetlands Pipeline ROW Requirements for a Single Pipeline

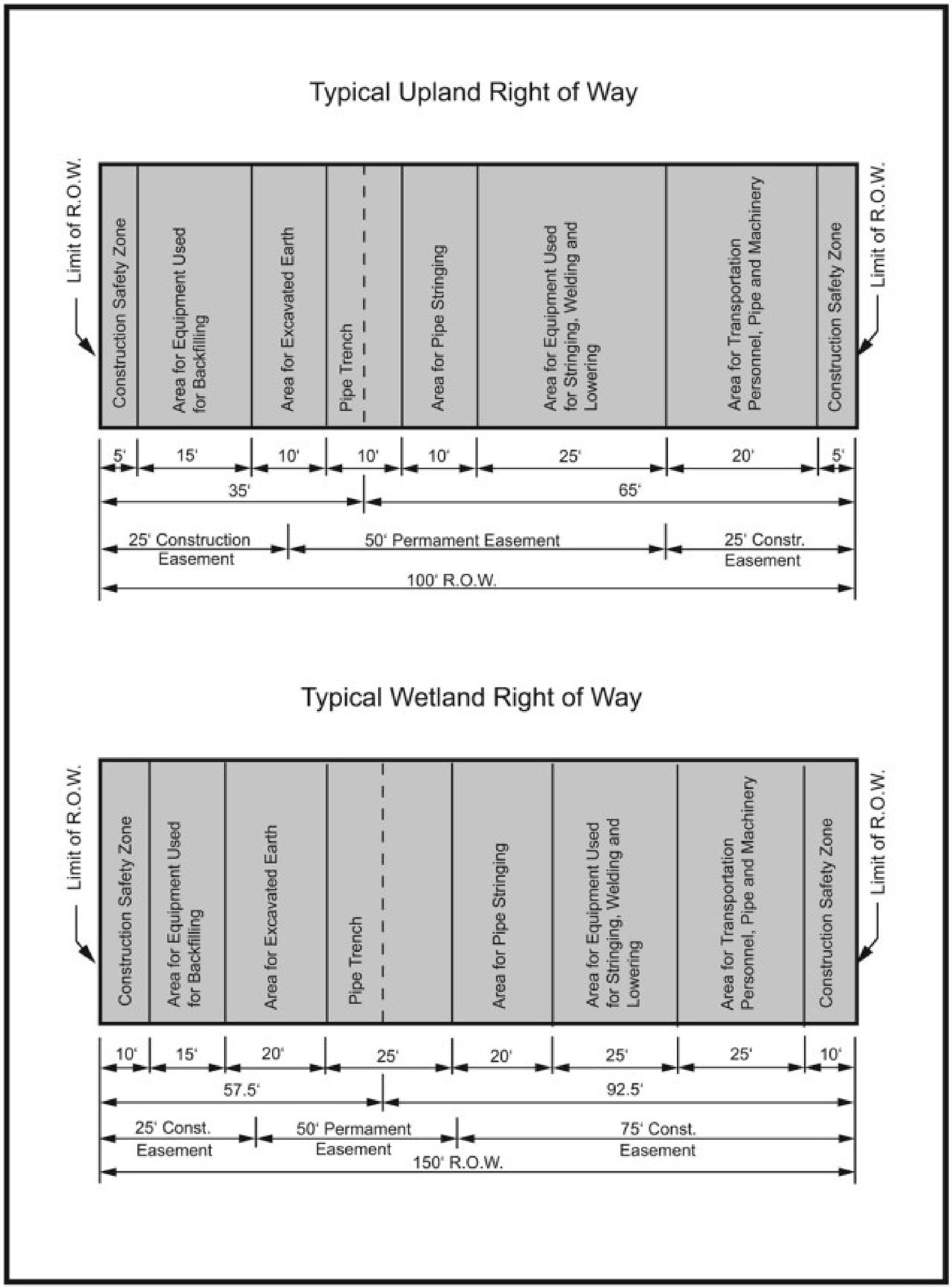


Figure 2-6 v2
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DOE would monitor cavern structural integrity daily by measuring pressure trends. DOE would test completed caverns for structural stability at least once every 5 years by using nitrogen well-leak tests as prescribed by methods acceptable to respective state regulators.

The central control room at an SPR site would remotely monitor many onsite activities and operations. Valves and other operating mechanisms along the oil pipeline would be adjusted from the control room. The control room operator also would detect any leaks in the brine pipeline and deviations in cavern pressure. An onsite data logger would collect data continuously about the condition of the facility. During oil movement, flow and pressure would be monitored hourly by manually checking the conditions at the valves. The control room would be staffed 24 hours a day, 7 days a week by at least one shift leader. The shift leader would direct staff to monitor situations at distant locations as needed.

Maintenance activities at an SPR site typically would include the preventive and corrective maintenance of solution mining equipment including pumps, motors, valves, instruments, piping, and “workovers” (work programs performed on existing cavern wells) to reposition cavern strings.

Hazardous materials are used in the operation and maintenance of existing SPR sites and would be used at proposed new and expansion sites. Table 2.3.10-1 itemizes the types and quantities of hazardous materials typically stored at existing SPR sites.

Table 2.3.10-1: Typical Quantities of Hazardous Materials Stored at Existing SPR Sites

Material (Use)	Typical Location	Maximum Daily Amount Stored Onsite (pounds)
Ammonium bisulfite solution (water treatment chemical)	Brine pad, raw water injection pad, equipment pad	10,000–99,999
Bromotrifluoromethane (refrigerant)	Various	1,000–9,999
Diesel fuel #2 (emergency power generation, motor fuel)	Emergency generator fuel tanks, property tank	10,000–99,999
FC–203CE Lightwater Brand AFFF (fire protection chemical)	Foam storage building	10,000–99,999
FC–203CF Lightwater Brand AFFF (fire protection chemical)	Foam deluge building	10,000–99,000
FC–600 Lightwater Brand ATC/AFFF (fire protection chemical)	Foam storage building	10,000–99,999
Ansulite 3% AFFF AFC–3A (fire protection chemical)	Firetrucks, foam storage building	10,000–99,999
Flogard POT805 (water treatment chemical)	Potable water building	100–999
Gasoline (motor fuel)	Property tank	10,000–99,999
Herbicides, such as Monsanto Rodeo and Red River 90 Spray Adjuvant (grounds maintenance)	Flammable storage building	1,000–9,999
Motor oil (motor lubricant)	Flammable storage building, equipment areas	1,000–9,999
Oil Base Sweep EZ Floor Sweep (property maintenance)	Maintenance building	100–999

Table 2.3.10-1: Typical Quantities of Hazardous Materials Stored at Existing SPR Sites

Material (Use)	Typical Location	Maximum Daily Amount Stored Onsite (pounds)
Paints (property maintenance)	Flammable storage building	1,000–9,999
Silica, crystalline quartz	Maintenance building	10,000–99,999
Simple Green (cleaner, degreaser, deodorizer)	Maintenance building	100–999
Sodium hypochlorite solution (water treatment)	Potable water building	100–999

To convert pounds to kilograms, multiply by 0.4536

Source: *Site Environmental Report for Calendar Year 2003*. DOE 2004f. Tables 2-2 through 2-7.

Spills of hazardous materials from SPR sites are required to be reported under several Federal and state laws and regulations and SPR site operating procedures. Emergency response procedures for each SPR site address the requirements for reporting spills of hazardous materials to the SPR operations and maintenance contractor, DOE, and appropriate Federal, state and/or local regulatory agencies.

Various local, state, and Federal requirements also govern the management of hazardous materials and responses to spills. For example, the Federal Clean Water Act (CWA) and related state statutes and regulations require sites to develop and maintain a Spill Prevention, Control, and Countermeasures Plan, and the Pollution Prevention Act of 1990 requires sites to develop and maintain pollution prevention plans and stormwater pollution prevention plans. Each proposed new SPR site would be required to develop and implement a Spill Prevention, Control, and Countermeasures Plan, and each expansion site would be required to update the site plan to incorporate the additional storage infrastructure and operations. Other site-specific plans that would be part of each SPR site's environmental program include Emergency Response Procedures with spill reporting procedures and a Site Environmental Monitoring Plan.

Each SPR site would also implement an environmental training program to ensure that applicable personnel are aware of the SPR Environmental Management System and environmental laws and regulations, and are trained in oil and hazardous material spill prevention and the safe handling of hazardous waste. In the event of a hazardous material release, trained emergency response personnel at the SPR site would respond to control and minimize potential spill impact.

Local, state, and Federal fire protection standards and guidelines applicable to existing SPR sites are identified in the *2003 Site Environmental Report Appendix A: Strategic Petroleum Reserve - DM Environmental Standards* (DOE 2004f). These standards and guidelines would also apply to proposed new SPR sites in Texas and Louisiana, and similar state and local standards and guidelines would apply to proposed new SPR sites in Mississippi.

Fire protection systems at existing SPR sites include firewater storage tanks and ponds, firewater pumps, and fire trucks. For example, firewater is supplied to the Bayou Choctaw and Big Hill sites through the RWI system and to the West Hackberry site through a deepwater well at a design rate of 375 gallons (1,400 liters) per minute. A secondary water supply is provided to the West Hackberry site from the Hackberry community water works at a rate of no more than 500 gallons (1,900 liters) per minute. All of these systems are equipped with a series of primary pumps, backup pumps, and firewater tanks. Each of the existing sites also has automatic and manually activated aqueous film forming foam systems for fire protection; sprinkler systems to protect control centers, maintenance buildings, foam buildings, and other buildings; a fire truck with pumps capable of using water or water/foam; and portable, trailer-mounted, foam-water pumps and portable fire extinguishers on wheels.

The SPR has adopted the National Interagency Incident Management System, the response management system required by the National Oil and Hazardous Substances Pollution Contingency Plan. Each existing SPR site has a group of well-trained Emergency Response Team personnel who can respond to emergencies such as spills and fires. These personnel and New Orleans response management personnel have been trained in the unified Incident Command System and a team of selected New Orleans response personnel is available to support extended site emergency operations when needed.

All of the fire protection systems at the existing SPR sites would be available for use if one of the alternatives is selected for expansion. Likewise, each of the proposed new sites would be equipped with fire protection systems that are functionally equivalent to those described above.

Pipeline Operations and Maintenance

DOE would inspect pipeline ROWs regularly for adjacent surface conditions, indications of leaks, and other factors affecting pipeline safety and operation. Weekly aerial patrols would monitor all general conditions affecting the ROW. Land and water patrols would investigate problems observed from the aerial patrols.

Nuisance vegetation along the pipeline ROW would be mowed regularly. In addition, defoliants would be used as needed to destroy additional vegetation that hinders pipeline operation and maintenance. Erosive conditions would be prevented and controlled by maintaining grass covers and constructing or maintaining terraces, **plugs**, and **bulkheads**.

> **Bulkheads** are retaining walls designed to hold or prevent the sliding of soil caused by erosion and wave action.

Other maintenance would include painting exposed portions of the pipeline and **pigging** the pipeline. Pigging monitors interior conditions of pipelines and ensures that efficient flow conditions are maintained. RWI pipelines would be cleaned periodically by scraper or brush **pig** operations. Use of “smart pigs” with ultrasonic detection and magnetometrics could be used as appropriate. **Caliper pigging** would be performed periodically to ensure pipeline integrity.

> In **pigging** operations, inspection and cleaning devices called “pigs” are sent through pipelines to check the condition of pipelines and clean them. Caliper pigging is used to determine the thickness of pipeline wells.

2.3.11 Decommissioning

Section 159(f) of the EPCA authorizes DOE to use, lease, maintain, sell or otherwise dispose of land or interests in land, or of storage and related facilities acquired under the SPR program. DOE may decommission and dispose of an SPR storage facility if it could no longer effectively continue its program mission. This could arise for a variety of reasons: if the SPR storage facility was no longer able to maintain critical physical systems, retain geological integrity, support the SPR program mission economically, or remain in compliance with state, Federal, and DOE environmental, safety, and health requirements. In addition, decommissioning could take place if the SPR storage program were to be terminated by Congress at some future date.

Decommissioning of an SPR storage facility has been undertaken twice in the past. During the early 1990s, DOE disposed of the Sulphur Mines SPR storage facility, an unneeded SPR site in Louisiana, with replacement capacity to be developed by the then on-going enlargement of the caverns at Bayou Choctaw and Big Hill storage facilities. The Sulphur Mines SPR storage facility was sold to an outside commercial user. Pursuant to NEPA, DOE prepared an Environmental Assessment to assess the potential environmental consequences of decommissioning the Sulphur Mines storage facility (DOE 1990b) which resulted in the issuance of a Finding of No Significant Impact. In late 1999, the Weeks Island SPR site, Iberia Parish, Louisiana storage facility was successfully decommissioned by DOE. The Weeks Island Mine had served as an SPR storage facility from its conversion from a commercial room and pillar salt mine in 1977. Following oil fill in 1980-1982, it stored about 73 MMB of crude oil until late 1995, at which time DOE submitted a plan for decommissioning and initiated oil drawdown procedures. DOE recognized that groundwater was leaking into the stored oil chambers by means of a rapidly growing sinkhole that had developed over the southern periphery of the mine and that the integrity of the mine could no longer be assured and it was unsuited for continued crude oil storage. Pursuant to NEPA, DOE prepared an Environmental Assessment to assess the potential environmental consequences of decommission of the Weeks Island SPR site (DOE 1995a) which resulted in the issuance of a Finding of No Significant Impact.

Decommissioning activities at an SPR facility and associated potential environmental impacts would depend on the future use of the facility. If the site were destined for continued use as an oil storage facility, activities might consist of little more than a change in ownership. Oil in storage could be included in the sale or withdrawn and moved to another SPR site. If, however, DOE were to close the facility entirely, extensive closure activities could be necessary. Under this scenario, crude oil would be removed from the caverns by displacement with water, which eventually would form brine in the caverns. Cavern wells would be plugged with concrete to prevent brine leakage through the casing. All above ground facilities, such as buildings, pumps, site electrical substations, and RWI structures would be demolished or removed from the site. Brine ponds would be closed. Crude oil pipelines would be emptied, cleaned, and capped. Underground pipelines likely would be left in place. Pipeline water crossings would be abandoned, but pipelines crossing waterways would be modified to minimize the chance that they could become future hazards to navigation. Such actions might include filling the pipelines with cement or filling them with a substance to encourage oxidation and decomposition. Electric power lines would be removed. Finally, the site would be revegetated with native species.

At this time DOE has no known or planned timetable for such post-operational decommission activities at existing expansion sites or proposed new sites, and future decommission remains distant. Unlike the Weeks Island SPR storage facility, which was a converted salt pillar mine, only solution mined caverns specially constructed for crude oil storage are currently used at SPR facilities, and these caverns have intrinsic geological stability. Hence future decommissioning would likely occur as a currently unforecastable economic or strategic decision. Also, DOE has designed storage cavern construction to sustain a minimum of five cycles of drawdown and fill. DOE has determined, however, that 10 or more cycles generally can be sustained under the current design standards. Also, in the four decades of SPR experience, relatively few complete cycles have occurred. Thus, in the reasonably foreseeable future, proposed new caverns are unlikely to be decommissioned due to completion of their useful life.

Because the range of possible decommissioning activities and associated environmental impacts are so broad, and these activities remain remote in time, no further discussion is included in this EIS. If any future decommissioning of a SPR storage facility did become warranted, site-specific Environmental Assessments or EISs would then be undertaken as required under NEPA, and the potential environmental, socioeconomic, and other potential impacts to the SPR site would be evaluated.

2.4 POTENTIAL NEW SITES AND ASSOCIATED INFRASTRUCTURE

This section describes the proposed action at each of the proposed sites. It describes the proposed new sites and associated infrastructure in alphabetical order and then the proposed expansion sites in alphabetical order. Table 2.4-1 presents key information for each of the proposed alternatives.

Following are some important notes about the data shown in table 2.4-1:

- The number of acres listed for each storage site represents the area of the site plus the area of a 300-foot (91-meter) buffer zone around the site.
- Lengths of individual crude oil pipelines, electric power lines, and roads are shown separated by a + sign. The totals shown are an aggregate of these individual lengths.
- Values shown for new ROWs represent the total lengths of new ROWs that would be created for oil or brine pipelines, electric power lines, and roads. These ROWs often would be shared.
- Values shown for expanded or existing ROWs represent the total lengths of existing ROWs and existing ROWs that would be expanded, used for oil or brine pipelines, electric power lines, and roads. These ROWs often would be shared.
- Because they are included collectively in several of the alternatives, values for the expansion sites Bayou Choctaw, Big Hill, and West Hackberry are first listed separately and subsequently as a single aggregated total with the heading “3 Expansion Sites.”
- Similarly, when being included together in an alternative, values for the expansion sites Bayou Choctaw and Big Hill are first shown separately and subsequently as a single aggregated total with the heading “2 Expansion Sites.”

2.4.1 Bruinsburg Storage Site

The Bruinsburg salt dome is located in Claiborne County, MS, 10 miles (16 kilometers) west of the town of Port Gibson (see figure 2.4.1-1) and 40 miles (64 kilometers) southwest of the city of Vicksburg. The site encompasses a cypress swamp, cotton fields, and an overlooking bluff. The maximum drawdown rate would be 1.0 MMBD.

DOE recently conducted seismic surveys of the Bruinsburg salt dome to measure the size of the dome to confirm its capability to provide 160 million barrels of oil storage capacity. Analysis of the surveys indicates that the salt dome is smaller than initially thought and would likely be capable of accommodating only 70 MMB, instead of the planned 16 caverns of 10-MMB each in the salt strata above 5,000 feet (1,500 meters) below the surface that would be required under current SPR operating criteria (Rautman et al. 2006). Surveys of salt dome characteristics at depths below 5,000 feet (1,500 meters) indicate that there may be an ability to develop oil storage caverns below 5,000 feet (1,500 meters), but doing so would be more difficult technically and would involve uncertain operational risks. This EIS retains the Bruinsburg site as presented in the draft EIS.

The Bruinsburg site would encompass approximately 266 acres (108 hectares) that includes an active cotton farm and forested areas. Developing this new SPR facility would require constructing 16 new, 10-MMB-capacity caverns, as illustrated in figure 2.4.1-2. The hill where the facilities would be located would be cut to an elevation of 110 feet, which is 10 feet above the 100 year flood elevation. This would involve placing about 30 feet of fill in the cavern area to bring the 80 foot elevation up to 110 feet and

Table 2.4-1: Key Details of the Alternatives

Alternative	Increased Storage Capacity MMB	No. of Caverns	Storage Site and Buffer	Pipelines (Miles per Pipeline)			Power Lines	Roads	New ROWs[e]	Expanded Existing ROWs[e]	Other Facilities	
			Acres	Crude Oil	Water	Brine	Miles	Miles	Miles	Miles	Types	Acres
Bruinsburg	160	16	365	39 and 109	4	14	11, 1, 4, 7, and 6	1 and 11	131	58	IW, T, RWI	215
3 Expansion sites	115	10 and 3[a]	287	23	0	2	0	2	2	24	IW pads	96
Bayou Choctaw	*20*	*2*	*0*	*0*	*0*	*1*	*0*	*1*	*1*	*0*	*IW pads*	*96*
Big Hill	*80*	*8*	*206*	*23*	*0*	*1*	*0*	*0*	*0*	*24*	*None*	*0*
West Hackberry	*15*	*3[a]*	*81*	*0*	*0*	*0*	*0*	*1*	*1*	*0*	*None*	*0*
Total	275	29	652	171	4	16	29	15	133	82		311
Bruinsburg	160	16	365	39 and 109	4	14	11, 1, 4, 7, and 6	1 and 11	131	58	IW, T, RWI	215
2 Expansion sites	116	8 and 2	206	23	0	2	0	1	1	24	IW pads	96
Bayou Choctaw	*20*	*2*	*0*	*0*	*0*	*1*	*0*	*1*	*1*	*0*	*IW pads*	*96*
Big Hill	*96*	*8*	*206*	*23*	*0*	*1*	*0*	*0*	*0*	*24*	*None*	*0*
Total	276	26	571	171	4	16	29	13	132	82		311
Chacahoula	160	16	320	21 and 54	18	41 and 17[c]	10, 15, and 5	4 +0.5	64	86	RWI	1
3 Expansion sites	115	10 and 3[a]	287	23	0	2	0	2	2	24	IW, T, RWI	96
Total	275	29	607	98	18	60	30	6	66	110		97
Chacahoula	160	16	320	21 and 54	18	41 and 17[c]	10, 15, and 5	4 +0.5	64	86	RWI	1
2 Expansion sites	116	8 and 2	206	23	0	2	0	1	1	24	IW pads	96
Total	276	26	526	98	18	60	30	5	65	101		97
Richton	160	16	347	87[b] and 116	10	88[d] and 13[c]	11 and 2	2	144	72	T, RWI	127
3 Expansion sites	115	10 and 3[a]	287	23	0	2	0	2	2	24	IW pads	96
Total	275	29	634	227	10	102	13	4	146	96		223
Richton	160	16	347	88 and 116	10	87 and 13[c]	11 and 2	2	144	72	T, RWI	127
2 Expansion sites	116	8 and 2	206	23	0	2	0	1	1	24	IW pads	96
Total	276	26	553	227	10	102	11	3	145	96		227

Table 2.4-1: Key Details of the Alternatives

Alternative	Increased Storage Capacity MMB	No. of Caverns	Storage Site and Buffer Acres	Pipelines (Miles per Pipeline) Crude Oil	Water	Brine	Power Lines Miles	Roads Miles	New ROWs[e] Miles	Expanded Existing ROWs[e] Miles	Other Facilities Types	Acres
Stratton Ridge	160	16	371	37 and 3	6	7 and 4[c]	6	1	17	37	T, RWI	40
3 Expansion sites	115	10 and 3[a]	287	23	0	2	0	2	2	24	IW pads	96
Total	275	29	678	60	6	13	6	3	19	61		136
Stratton Ridge	160	16	371	37 and 3	6	7 and 4[c]	6	1	17	37	T, RWI	40
2 Expansion sites	116	8 and 2	206	23	0	2	0	1	1	24	IW pads	96
Total	276	26	577	60	6	13	6	2	18	61		136

1 mile = 1.61 kilometers; 1 acre = .0405 hectares

Notes:
[a] Acquired cavern
[b] Pipeline also would transport brine discharge
[c] Offshore
[d] Pipeline also would transport water and crude oil
[e] The sum of the mileage of individual pipelines, power lines, and roads for expanded existing ROWs and new ROWs may not add up to the total mileage of the individual pipelines for a site because some pipelines, roads, and power lines share the same corridor

IW = injection wells; T = terminal(s)

Figure 2.4.1-1: Location of Proposed Bruinsburg Storage Site

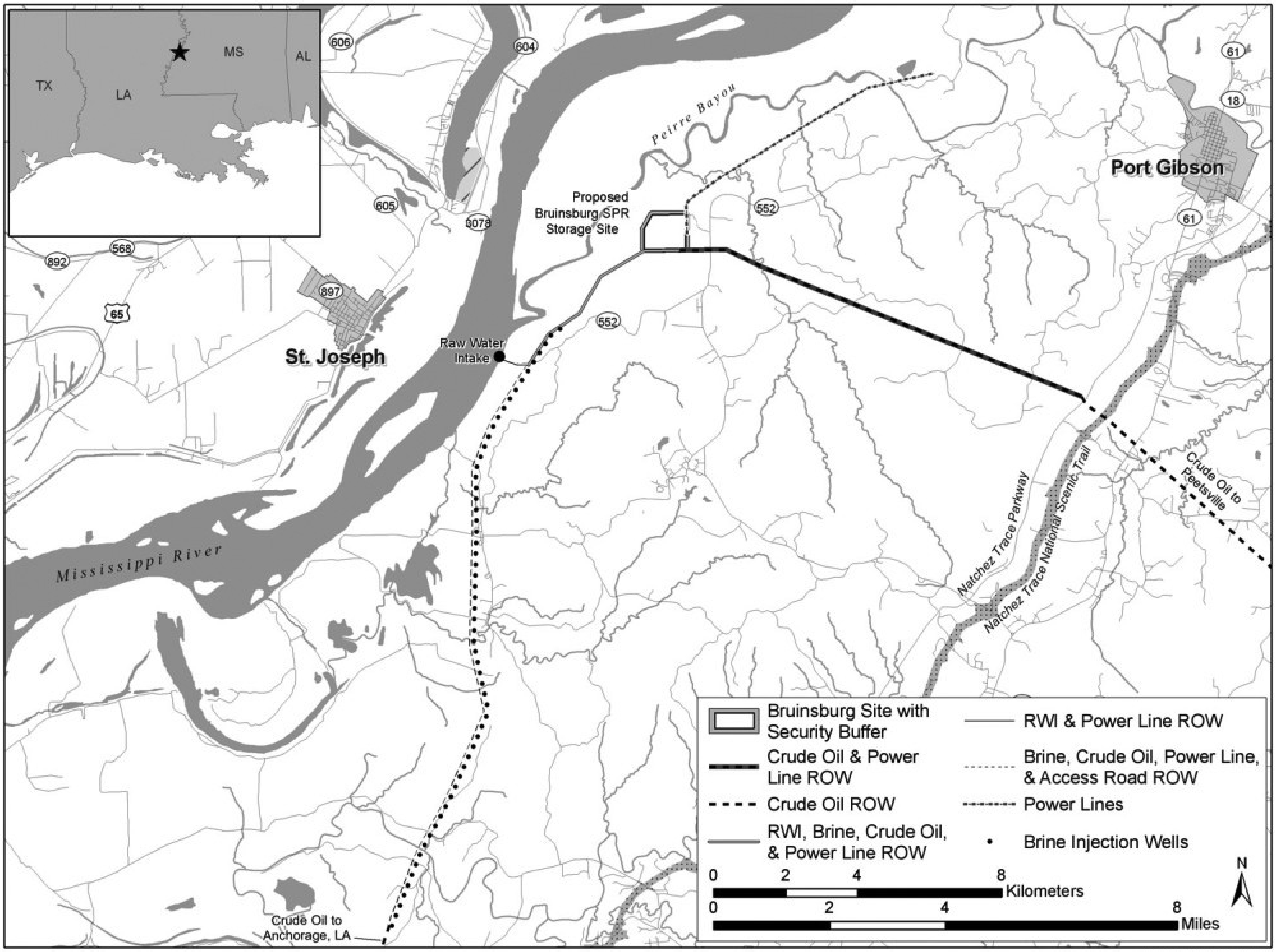

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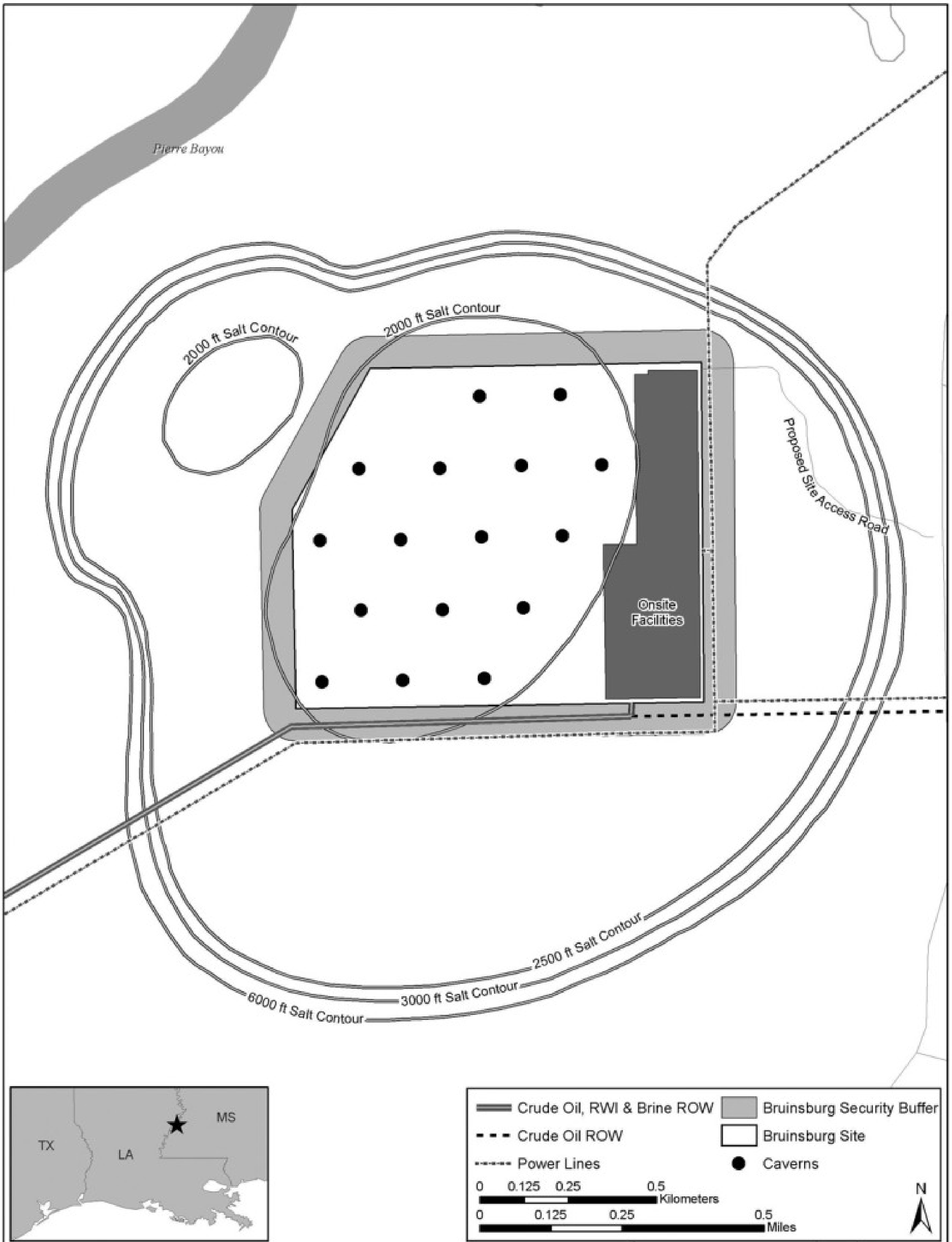
Figure 2.4.1-2: Proposed Layout of Bruinsburg Storage Site



cutting about 90 feet of elevation from the facility areas to bring the current 200 foot elevation to 110 feet. In addition, a water pumping system for cavern solution mining and oil drawdown; a brine settling and disposal system for cavern solution mining and oil fill; an oil pumping and measurement system for oil storage and distribution; administration, control, and maintenance buildings; and fire protection and physical security systems would be built. The location of the new caverns would be within the 100-year floodplain, whereas the facilities would be located outside of the 100-year floodplain on a bluff overlooking the caverns. A site access road from Route 552 would be built, of which 1,200 feet (366 meters) would be new, and the remainder would be a refurbished road.

A security buffer surrounding the site would be created by clearing 99 acres (40 hectares) 300 feet (91 meters) beyond a security fenceline for line-of-sight surveillance. The security buffer area would be cleared of undergrowth, scrub, shrub, and any trees, and would be managed as an open area. To do so, DOE may purchase additional land or easements from owners of abutting lands.

Raw water for solution mining at the Bruinsburg site would be drawn from the Mississippi River through a 42-inch (107-centimeter) pipeline that would run 4 miles (6.6 kilometers) south-southwest from the main site. The RWI pipeline is illustrated in figure 2.4.1-1. An RWI structure, which would be constructed at the point where the pipeline meets the Mississippi River, would house a set of 2,500-horsepower intake pumps. The Bruinsburg RWI structure would be similar to the Richton Leaf River RWI structure shown in figure 2.4.3-3. DOE would construct a rip-rap and concrete approach to the RWI structure consisting of a 210-foot (64 meters) wide rip-rap apron that tapers down to a 150-foot (46 meter) wide concrete apron that feeds into a 70-foot (21 meter) wide concrete channel into the RWI structure. The rip-rap and concrete approach to the RWI is designed to provide a constant water supply during fluxuating river levels, and to protect the structure during floods. Another set of 2,500-horsepower RWI pumps with a system capacity of 1.2 MMBD would be installed at the Bruinsburg site. An existing road would be refurbished to provide access to the RWI.

Of the new proposed sites, Bruinsburg would be the only site to use injection wells as its method of brine disposal. A 48- to 16-inch (122- to 41-centimeter), 14-mile (22-kilometer), brine disposal pipeline would transport the brine into underground injection wells located along the proposed Baton Rouge crude oil pipeline ROW. Sixty brine disposal wells would be spaced at 1,000-foot (300-meter) intervals along the ROW, but only 40 wells would operate at any one time. Twenty wells would be on standby or down for routine maintenance. An area of 230 feet by 230 feet (70 meters by 70 meters) would be cleared and fenced for each brine disposal well. The brine settling and disposal system would have a maximum capacity of 1.2 MMBD. An 11-mile (18-kilometer) road also would be constructed along the proposed brine pipeline to facilitate brine well construction and maintenance activities.

Crude oil would be transported to and from the storage site through two pipelines, as illustrated in figure 2.4.1-3. The first is a 30-inch (76-centimeter), 39-mile (62-kilometer) pipeline to the Capline Pipeline pump station at Peetsville, MS and a new 1.6 MMB storage terminal/tank farm that would be built on a 65-acre (26-hectare) site there. The Peetsville 65-acre (26-hectare) site would contain four 0.4 MMB oil storage tanks, support facilities, and an electrical substation (see figure 2.4.1-4). Electrical power to the substation would be provided from the abutting Peetsville pump station. Figure 2.4.1-4 illustrates the proposed facilities at Peetsville. The oil pumping and measurement system for oil storage and distribution would have a drawdown capacity of 0.5 MMBD from the caverns to the tank farm and 1.0 MMBD to the Capline system. The second pipeline is a 36-inch (91-centimeter), 109-mile (176-kilometer) pipeline to a terminal/tank farm that would be built on a 75-acre (30-hectare) site at Anchorage, LA. A tank farm similar to the Peetsville tank farm would be built connected by a 0.2-mile (0.3-kilometer) pipeline to the Placid refinery and a 0.8-mile (1.3-kilometer) pipeline to the nearby Exxon Mobil facility (see figure 2.4.1-5). The pipeline to the Placid refinery would provide DOE access to the

Figure 2.4.1-3: Proposed Pipelines for Bruinsburg Storage Site

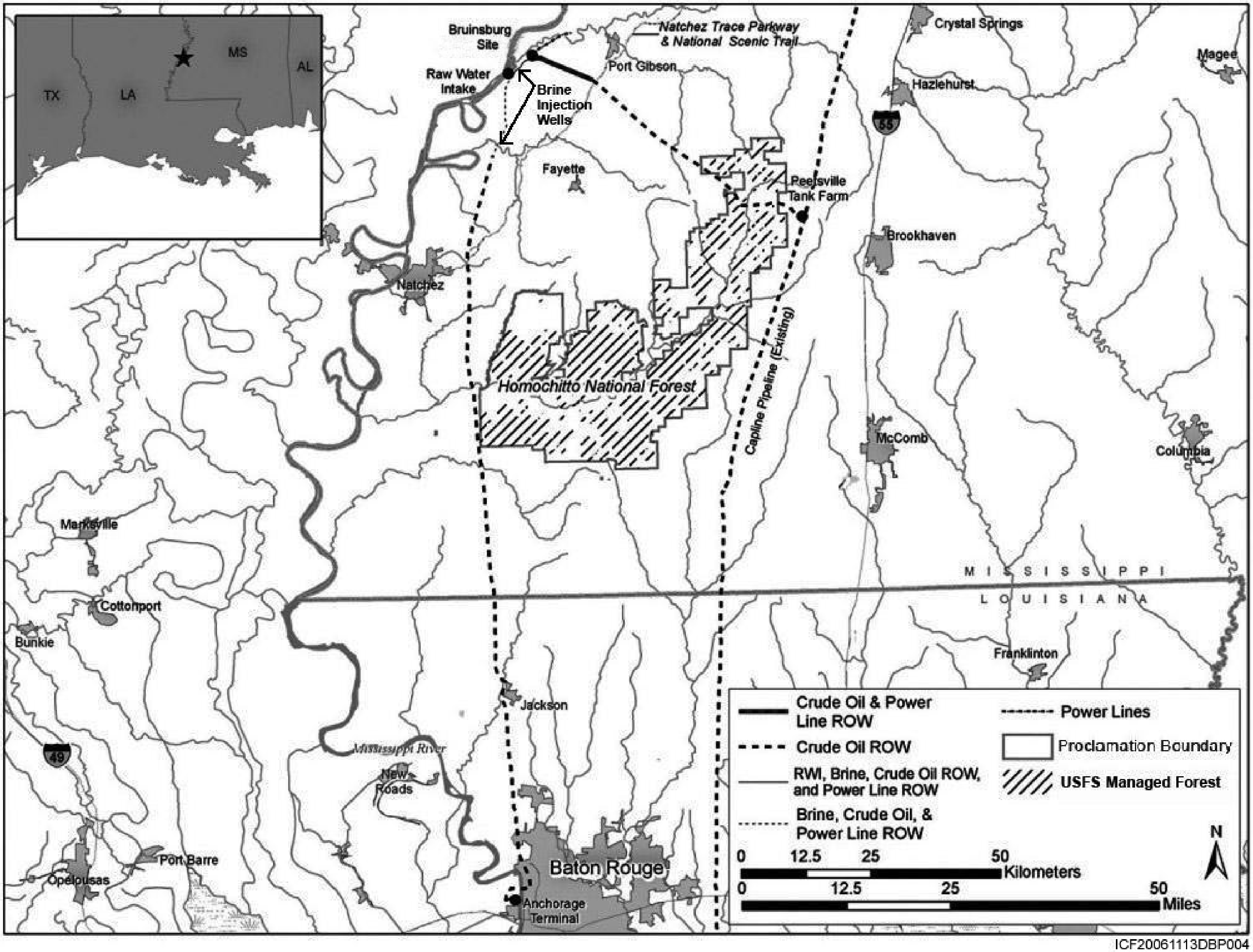


Figure 2.4.1-4: Proposed Layout of Peetsville Tank Farm

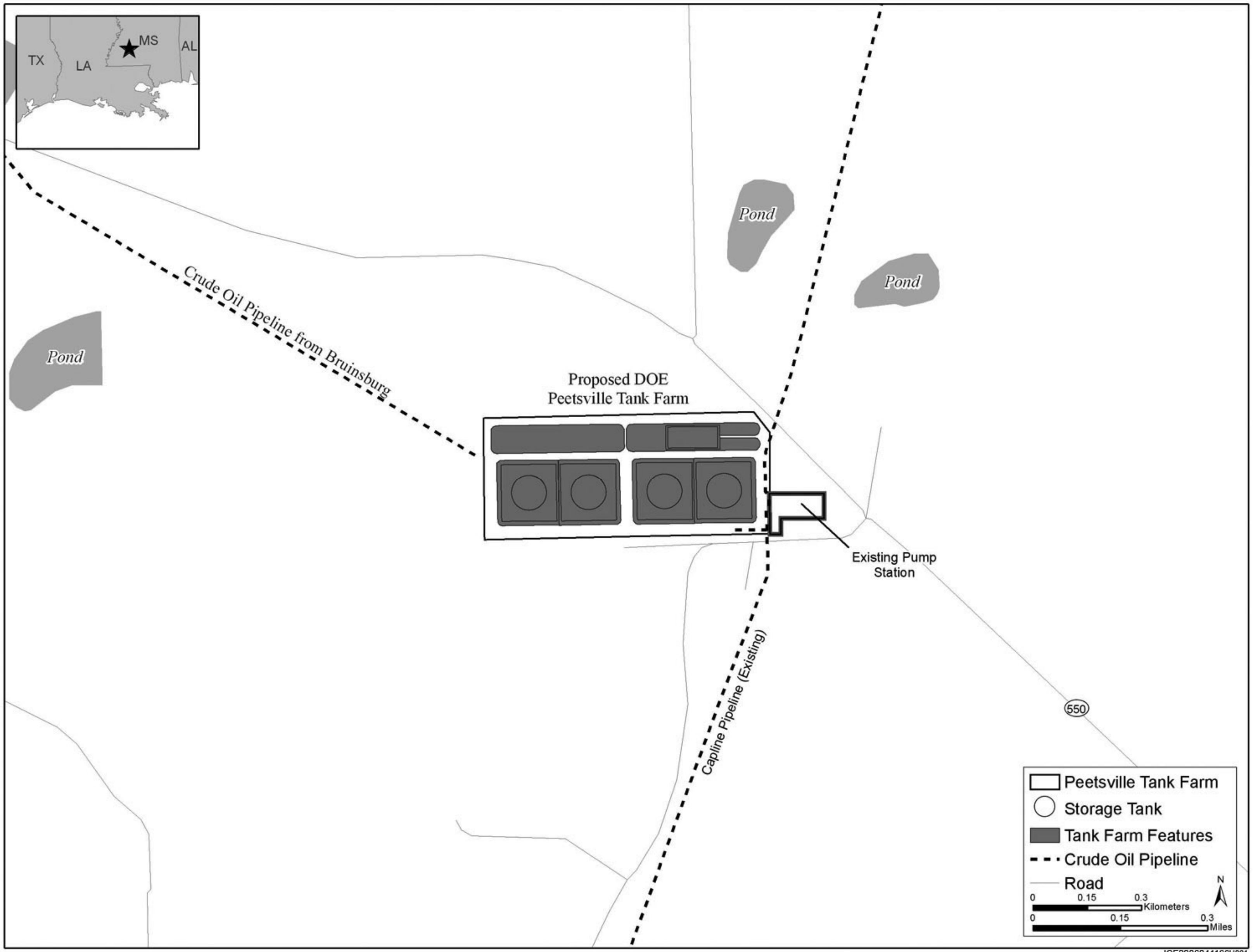


Figure 2.4.1-5: Proposed Layout of Anchorage Tank Farm

Placid refinery marine terminal on the Mississippi River. Figure 2.4.1-5 illustrates the proposed facilities at Anchorage.

Two 138-kilovolt power lines would be built to a substation at the site, a 5-mile (9-kilometer) line to Vicksburg Entergy's Grand Gulf substation, and a 7-mile (12-kilometer) line to the Port Gibson west side substation, as illustrated in figure 2.4.1-1. Each power line would require a 100-foot (30-meter) ROW. Two parallel 34.5-kilovolt power lines from the site substation to the RWI would be constructed along the 4-mile (6.5-kilometer) corridor of the raw water pipeline, as illustrated in figure 2.4.1-1. The ROW would be 60 feet (18 meters) wide. Two parallel 7.5 kilovolt power lines would be constructed from the RWI to run 0.6 miles (1.0 kilometers) east to the brine disposal pipeline and then along the 11 miles (18 kilometers) of the brine disposal pipeline to power the injection wells.

2.4.2 Chacahoula Storage Site

The Chacahoula salt dome site is located 40 miles (64 kilometers) north of the Gulf of Mexico, in northwest Lafourche Parish, southwest of Thibodaux, LA (see figure 2.4.2-1). This proposed new site would consist of 16 new caverns with a total capacity of 160 MMB. The maximum drawdown rate would be 1.2 MMBD.

The Chacahoula site, which would encompass approximately 227 acres (92 hectares), lies largely under water in wetlands. A security fence and road would be built 45 feet (14 meters) inside the property line on top of a **berm**. A security buffer zone would be cleared extending 300 feet (91 meters) from the fence and would comprise an area of approximately 93 acres (38 hectares). The land within the property line would be fully cleared in order to improve visibility and line-of-sight. The security buffer area would be cleared of any undergrowth, scrub, and any trees, and would be managed as an open area.

The area is largely undeveloped except for three brine caverns that have been developed by the Texas Brine Company in the south-central part of the 1,700-acre (690-hectare) Chacahoula salt dome and gas drillings on the south and northeast sides of the dome. The SPR storage site also would require constructing 16 new, 10-MMB capacity caverns, 8 raw water injection pumps, 4 brine pumps, 3 oil injection pumps, and numerous onsite buildings. Within the Chacahoula site, approximately 120 acres (49 hectares) would be filled in for the onsite facilities, cavern pads, and security fence and roads. The remaining area would be managed as an open water or emergent wetland. The wetlands between well pads would not be filled. Wetland areas within the site would remain interconnected with those outside the site via culverts. Infrastructure such as buildings and disposal ponds would require clearing and filling. As illustrated in figure 2.4.2-2, the caverns would be arranged in four rows of four caverns each in the western portion of the salt dome. At the storage site, DOE would construct a pig launcher and receiver for the pipeline, cavern oil distribution piping, and three 1,750-horsepower oil injection pumps. In addition, a crude oil storage tank may be built to store oil for use during cavern solution mining and maintenance operations. A 1.5 mile (2.4 kilometer) access road would be constructed from the site to Route 309. A secondary access road would be constructed south from the site across Bubbling Bayou, to an existing road, a distance of approximately 0.5 mile (0.84 kilometers). Construction on the site also would include buildings, security systems, and other surface features that are described in section 2.3.5.

The raw water used for cavern solution mining and drawdown would be obtained using four 2,500-horsepower pumps from a new RWI system on the ICW approximately 10 miles (16 kilometers) south of the project site. The new RWI structure would be connected to the storage site through a 42-inch (107-centimeter), 10-mile (16-kilometer) raw water pipeline. The majority of the RWI pipeline would parallel the proposed brine disposal pipeline. A 2.4 mile (4 kilometer) access road would be constructed from the RWI to highway 90. A map of the pipeline routes appear in figure 2.4.2-3. An onsite water distribution system would carry the water to eight 3,500-horsepower raw water injection pumps.

Figure 2.4.2-1: Location of Proposed Chacahoula Storage Site

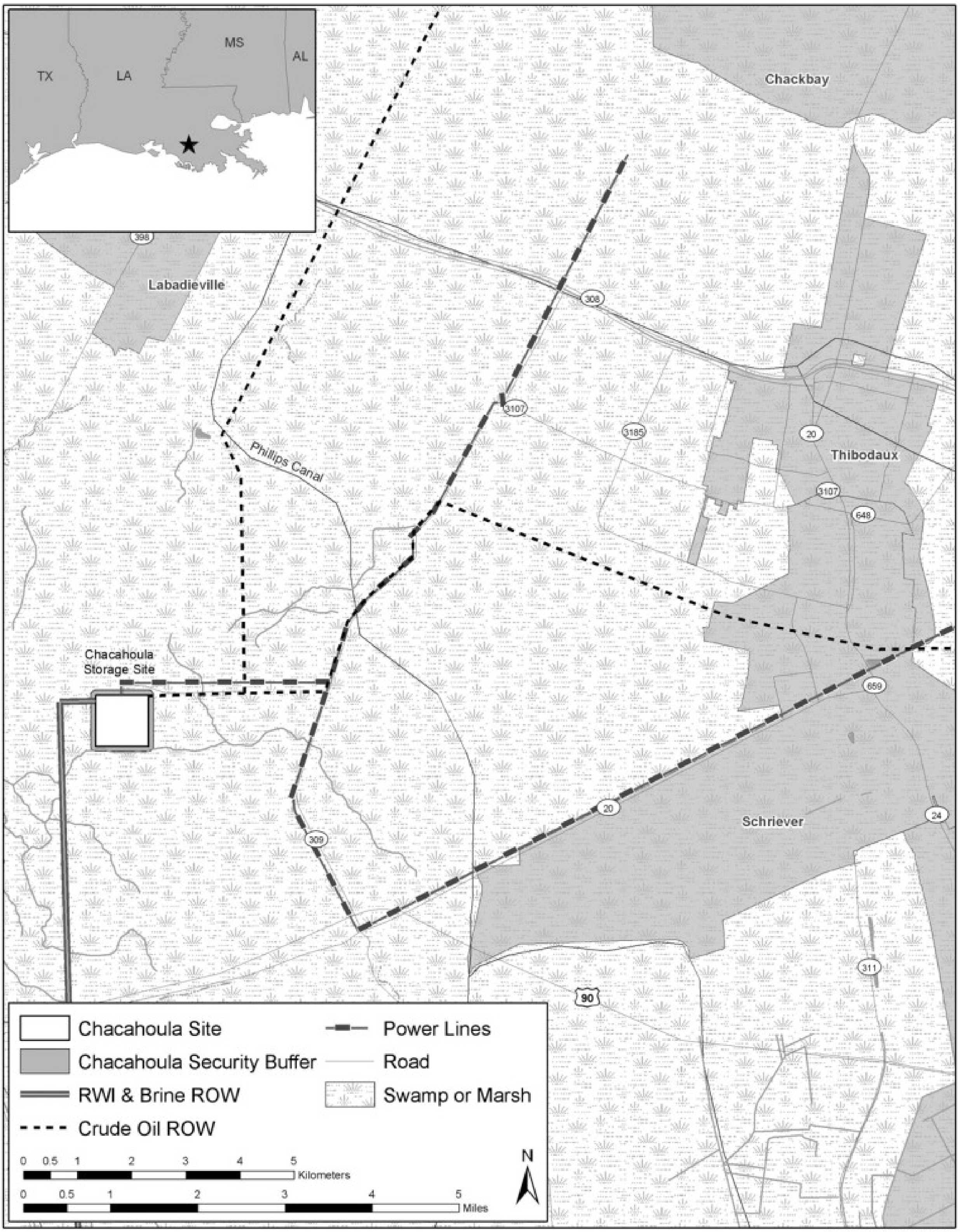


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Figure 2.4.2-2: Proposed Layout of Chacahoula Storage Site

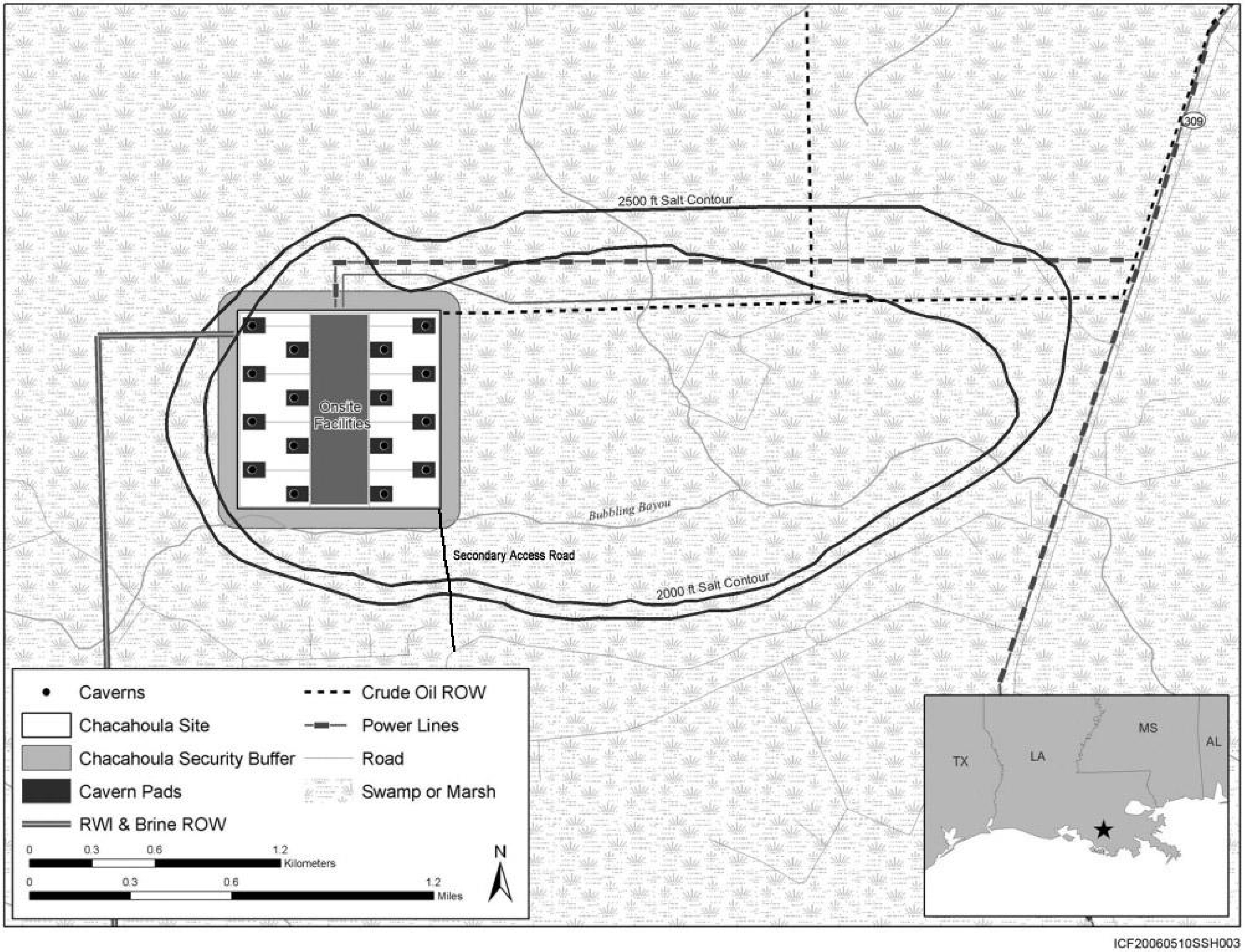
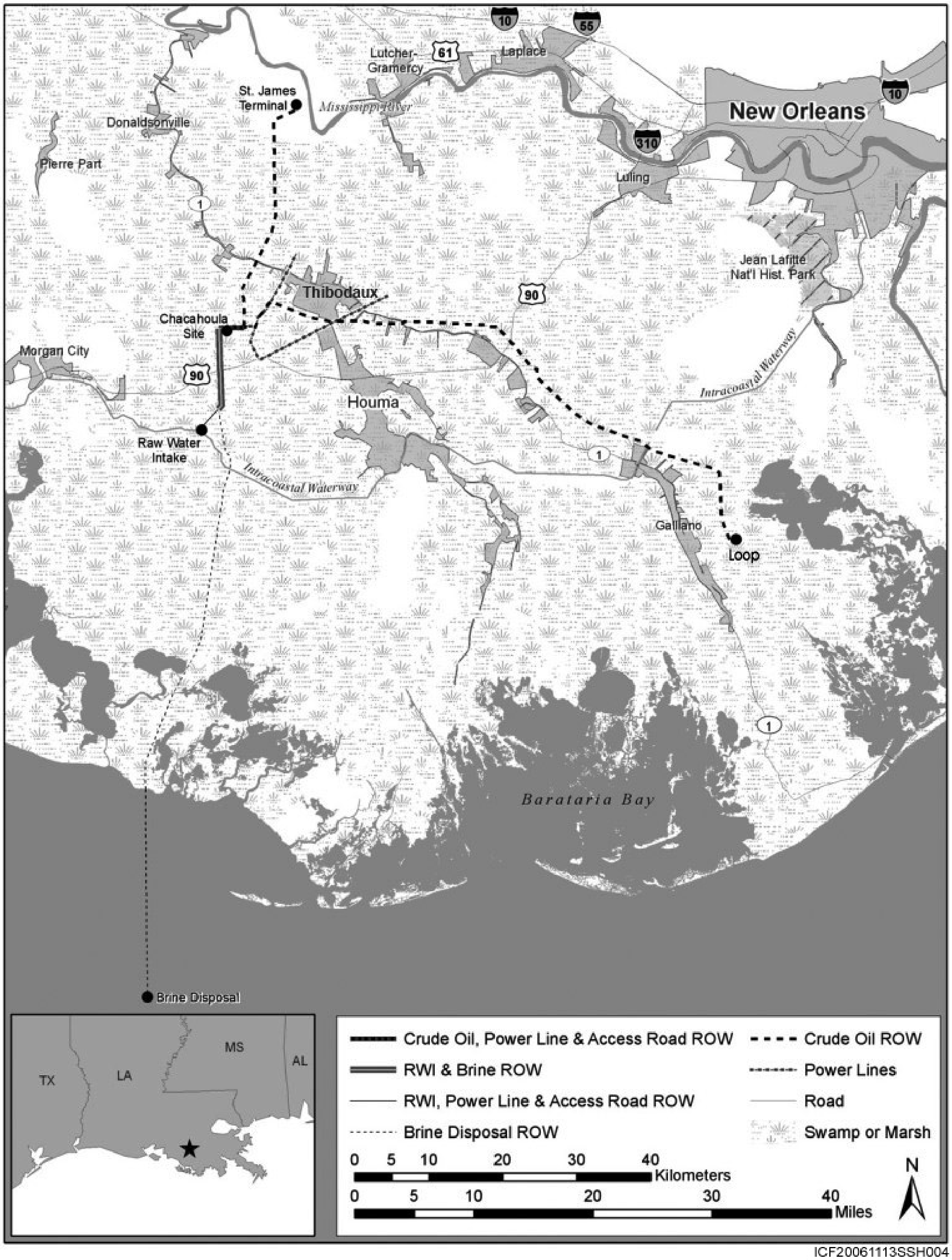


Figure 2.4.2-3: Proposed Pipelines of Chacahoula Storage Site



The **Louisiana Offshore Oil Port (LOOP)** is a private deepwater port operating off the coast of Louisiana. It is run by Louisiana Offshore Oil Port, Inc., a consortium of oil and gas producers. The onshore Clovelly dome storage system is a component of LOOP; it is not part of the existing SPR.

A new brine disposal system also would be constructed. Solution mining of the storage caverns would generate brine at a maximum rate of 1.2 MMBD. Brine would be disposed of through a 58-mile (93-kilometer), 48-inch (122-centimeter), pipeline to a diffuser offshore in the Gulf of Mexico (see figure 2.4.2-3), coordinates 28°56’1”N and 91°4’56”W. During oil fill, brine would be generated at a maximum rate of 225 MBD. The proposed pipeline would run approximately 17 miles (28 kilometers) offshore to a depth of 30 feet (9 meters). The ROW would consist of a 150-foot (46-meter) wide construction and a 50-foot (15-meter) wide permanent easement. Brine collection piping from each cavern, a brine pond system to remove any anhydrites and residual oil, and five new 1,000-horsepower brine booster pumps would be constructed onsite to complete the brine disposal system. Seven new 2,500-horsepower injection pumps also would be used to pump raw water into the caverns during oil drawdown. Crude oil would be transported to and from the storage site through a 21-mile (34-kilometer), 48-inch (122-centimeter) pipeline to the St. James terminal on the Mississippi River and a 54-mile (87-kilometer), 42-inch (107-centimeter) pipeline to the LOOP terminal at Clovelly. The pipeline to the terminal would parallel the existing crude oil pipeline that runs to the Capline terminal, and it would share the ROW with the RWI pipeline. The pipeline to LOOP would follow the existing Shell-Texaco pipeline ROW (see figure 2.4.2-3).

Two 230-kilovolt power lines would be built to a substation at the site, one 10-mile (15-kilometer) power line from the Thibodaux substation on the Entergy 230-kilovolt power line and an 18-mile (26-kilometer) power line from the Terrebonne substation on the Entergy 230-kilovolt power line, as illustrated in figure 2.4.2-1. Each power line would require a 100-foot (30-meter) ROW, except for the last 3 miles (4 kilometers) where the two lines would run west in parallel to the site substation and require a 200-foot (60-meter) ROW. Two parallel 115-kilovolt power lines from a connecting point on Entergy’s 115-kilovolt, 5-mile (7-kilometer) power line approximately 5 miles (7 kilometers) north of the RWI would be constructed along the corridor of the raw water pipeline to the RWI. The ROW requirement would be 150 feet (46 meters).

2.4.3 Richton Storage Site

The Richton salt dome is located in northeastern Perry County, MS, 18 miles (29 kilometers) east of Hattiesburg and 3 miles (4.8 kilometers) northwest of the town of Richton. This proposed new site would consist of 16 new caverns with a combined capacity of up to 160 MMB. The maximum oil drawdown rate would be 1.0 MMBD.

The Richton site would encompass approximately 238 acres (96 hectares) and would include a new 0.2 mile (0.3 kilometer) access road from Route 42. In addition, a surrounding security buffer would be created by clearing an area of 109 acres (44 hectares) 300 feet (91 meters) beyond an outer security fenceline for line-of-sight surveillance (see figure 2.4.3-1). The area would be cleared of undergrowth, scrub, shrub, and any trees, and would be managed as an open field. To do this, DOE might purchase additional land or make agreements with owners of abutting lands. DOE would construct 16 new, 10-MMB caverns, 7 raw water injection pumps, 4 brine pumps, 2 brine ponds, 5 oil injection pumps, and numerous onsite buildings. The caverns would be arranged in three rows (two rows of five and one row of six), extending south to north. This proposed layout appears in figure 2.4.3-2.

Figure 2.4.3-1: Location of Proposed Richton Storage Site

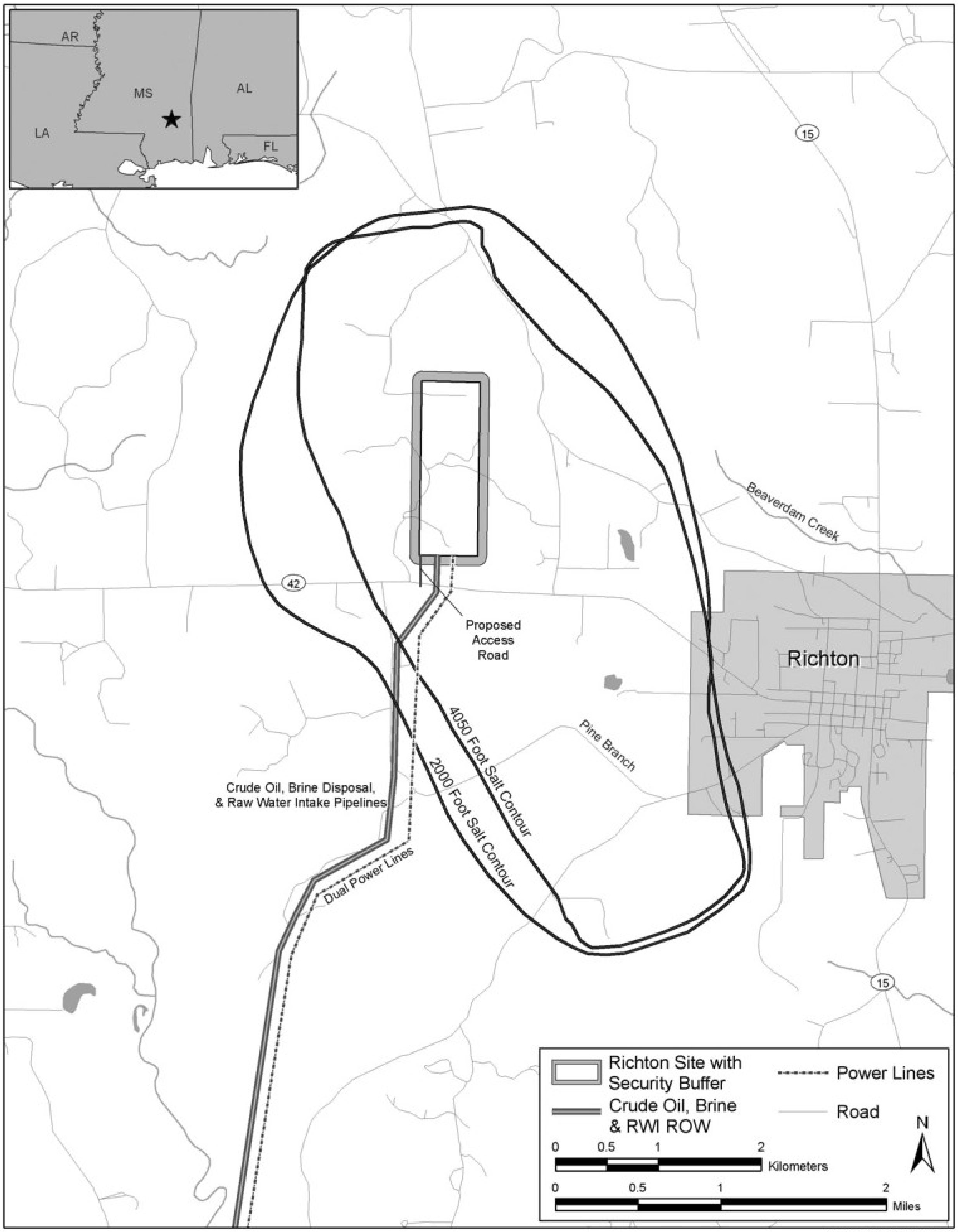


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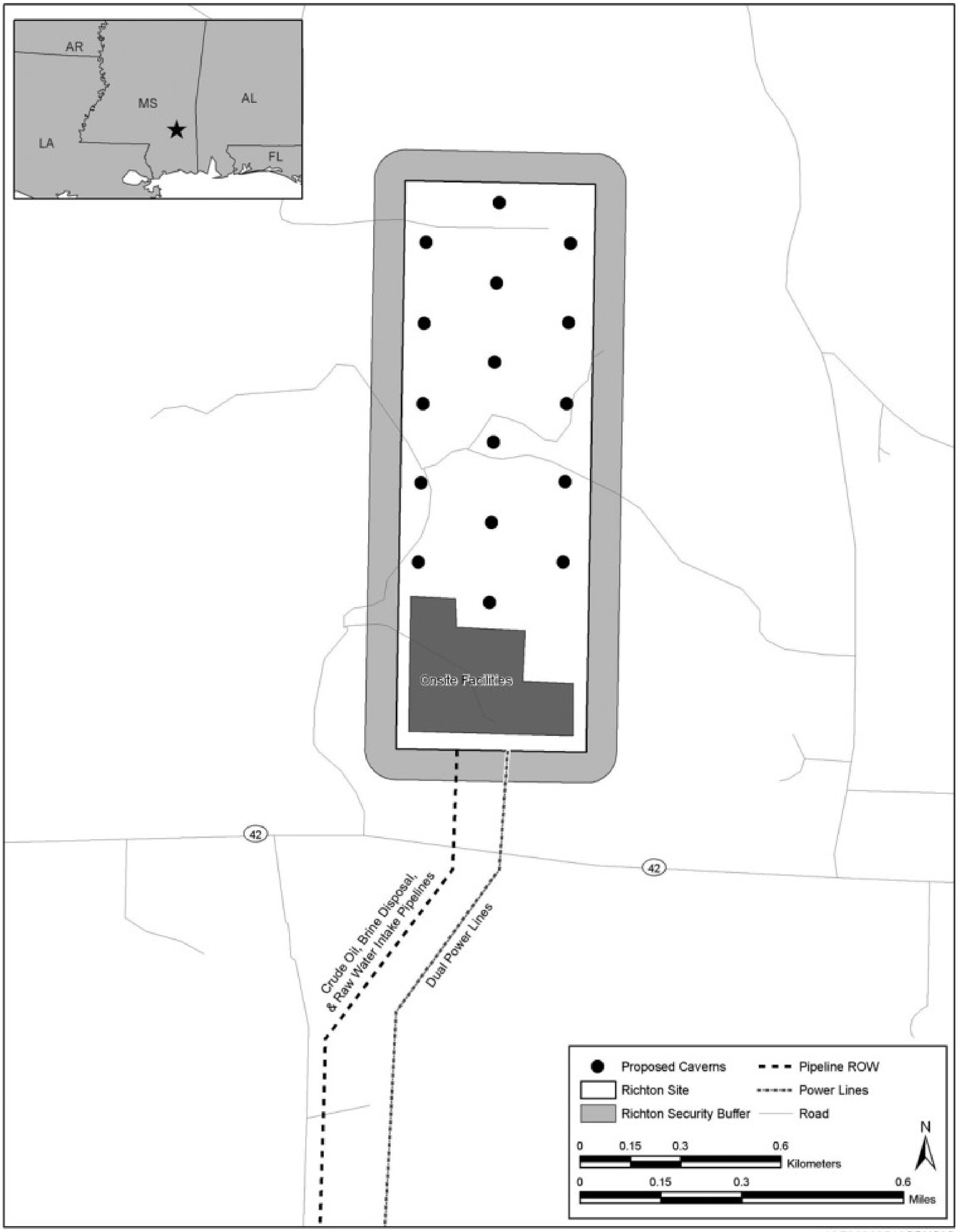
Figure 2.4.3-2: Proposed Layout of Richton Storage Site



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The proposed Richton storage site would be supplied by primary and secondary RWI structures (see figures 2.4.3-3 and 2.4.3-4, respectively). For the primary RWI structure, raw water would be drawn from the Leaf River through a 42-inch (107-centimeter) pipeline that would traverse approximately 10 miles (16 kilometers). The pipeline would run due south from the proposed site, across the Plantation Pipeline ROW, to a point on the river. The primary RWI would be constructed on a 16-acre (6.5-hectare) site and would house four 2,500-horsepower raw water injection pumps and auxiliary structures. The RWI facility would include four intake screens (T-strainers) located near the bottom of the river channel that would feed into an 84-inch concrete pipe that feeds into a sump located approximately 100 feet (30 meters) inland from the shoreline. Approximately 200 feet (60 meters) along the shoreline between the sump and the river would be graded and covered with a welded-wire fabric covered in shotcrete. In addition, a 20-foot (6 meter) wide concrete boat launch would be constructed from the sump into the river. Another seven 2,500-horsepower RWI pumps would be installed at the Richton storage site. The raw water pipeline would be co-located for about 6 miles (9 kilometers) of the ROW with the brine disposal pipeline and the crude oil fill pipeline. A 2.3 mile (3.7 kilometer) access road would be constructed from Old Augusta Road to the RWI structure. The RWI pipeline is illustrated in figure 2.4.3-3.

DOE modified the conceptual design for the Leaf River (and Bruinsburg) RWIs since the draft EIS. The modified primary RWI would reduce potential effects on aquatic resources by using a series of cylindrical screens located in the stream channel that would be oriented parallel to the river flow. This approach is typically recommended for river intakes because it takes advantage of the river flow to create a **sweeping velocity** across the screen surface to minimize the likelihood of impingement and entrainment of organisms. The screens would be fitted with air back flow systems to reduce clogging and reduce the likelihood of impingement of organisms. In addition, the intake system would be constructed within a cofferdam to minimize the potential for water quality impacts during construction. To further reduce the potential impacts of the Leaf River RWI, DOE also modified the conceptual design to use a relatively low intake velocity of 0.5 feet/second and relatively small screen size of 0.5 inches to further reduce the likelihood of impingement and entrainment.

The secondary RWI system, which was not included in the draft EIS, would withdraw water from the Gulf of Mexico at Pascagoula and transport it to the Richton storage site for cavern development, maintenance, or drawdown. This water source would provide 0.5 MMBD of supplemental water, rather than the full 1.2 MMBD for two reasons. First, expanding the RWI system capacity would involve substantial construction and operational costs, even though this extra capacity may never be needed during cavern development and drawdown. The costs would be higher, for example, because of a large diameter pipeline, high pumping capacity, and the electricity needed to pump water 88 miles. Second, due to its salinity, water from the Gulf of Mexico is less efficient in solution mining than fresh water from the Leaf River and its use would take more time than using freshwater, thereby increasing operational costs. The secondary RWI structure would be constructed on a 0.15-acre (0.06-hectare) site and would house four 3,250-horsepower raw water injection pumps and auxiliary structures. See figure 2.4.3-4. The secondary RWI structure would be co-located with the Pascagoula terminal/tank farm on and adjacent to the existing terminal approximately 200 feet (61 meters) east of the existing pier that extends into the Gulf of Mexico.

DOE would build two multi-purpose pipelines from Richton to Pascagoula (see figure 2.4.3-5). Each pipeline would be used in different ways for specific periods of construction and operation and maintenance.

Figure 2.4.3-3: RWI Structure on the Leaf River (Richton Alternatives)

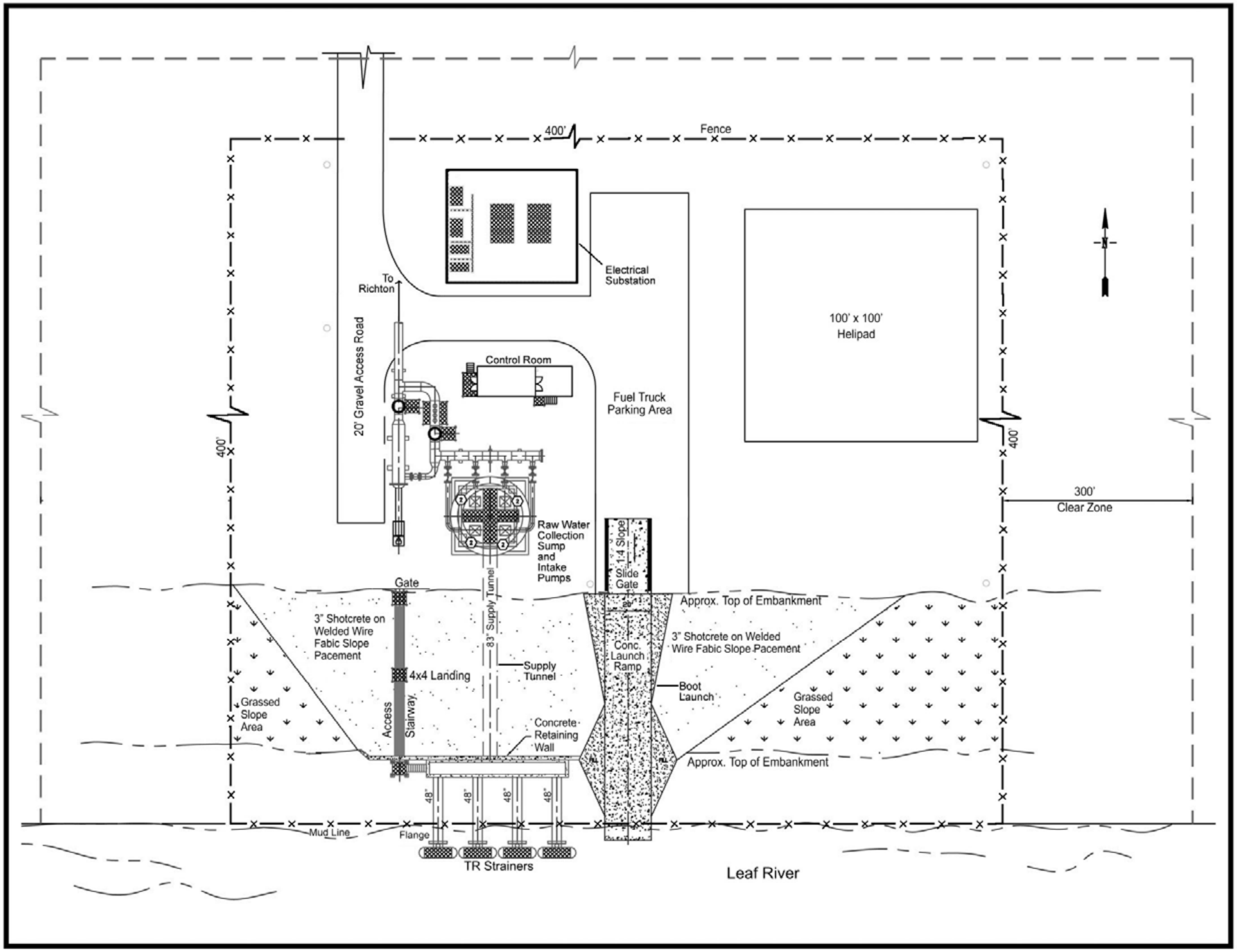


Figure 2.4.3-4: RWI Structure at Pascagoula (Richton Alternatives)

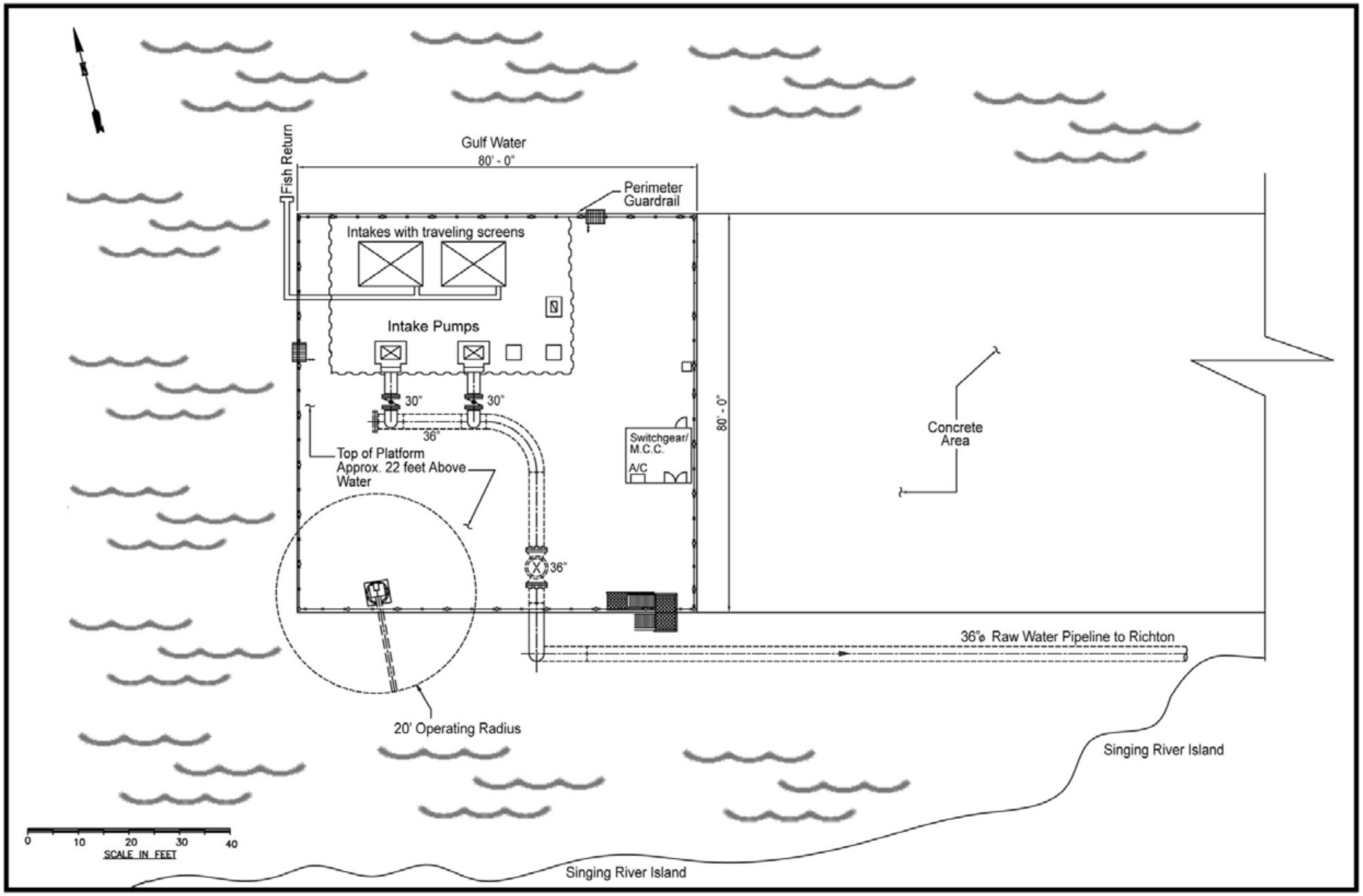
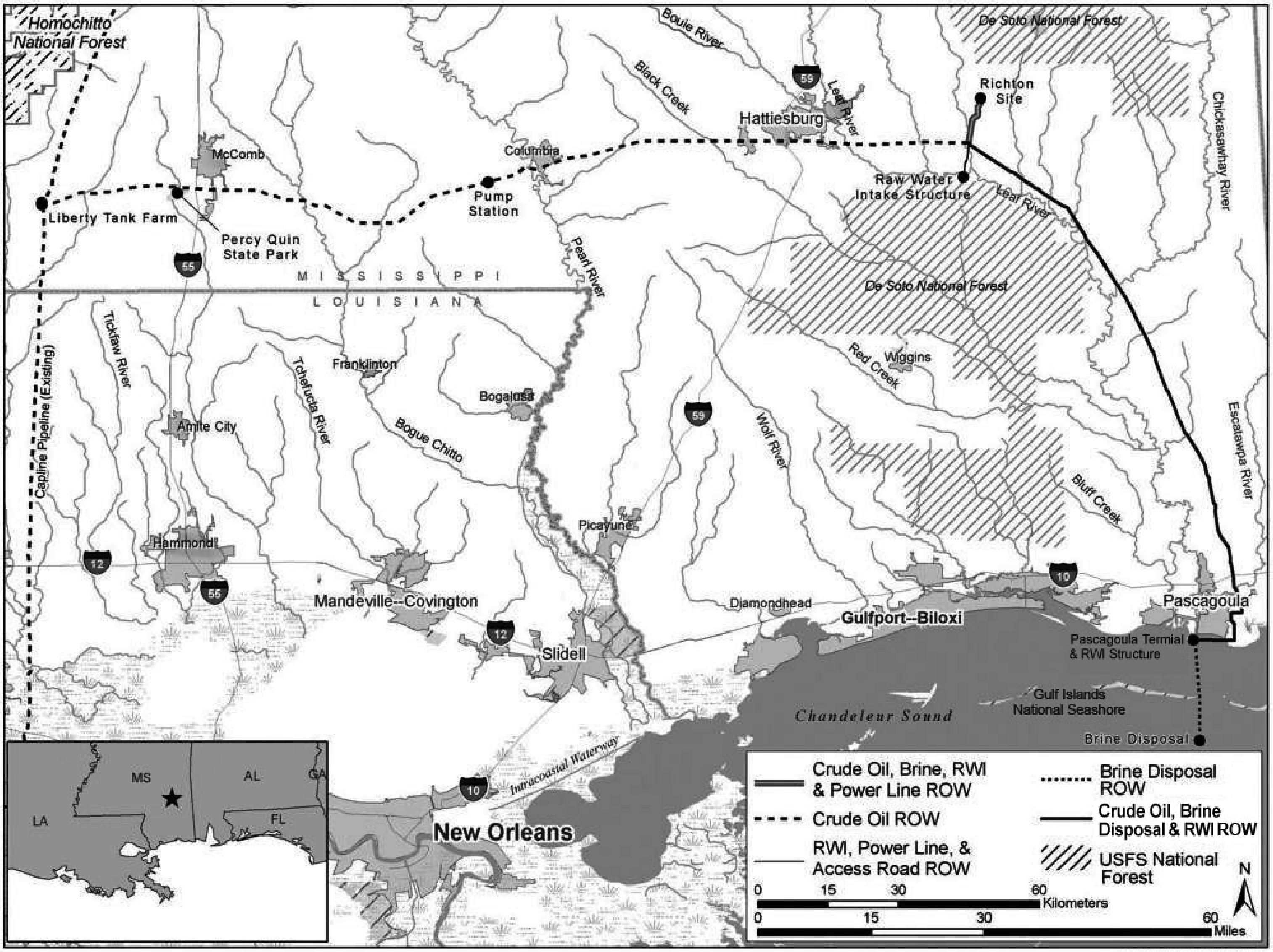


Figure 2.4.3-5: Proposed Pipelines for Richton Storage Site



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A 36-inch (91-centimeter) 88-mile (142-kilometer) pipeline would be used to transport crude oil from the Pascagoula terminal to the Richton site to provide blanket oil for cavern development. During operation, this pipeline would be used to transport discharge associated with cavern filling and maintenance to Pascagoula and then to the Gulf of Mexico along a 48-inch (112-centimeter) 13-mile (20-kilometer) offshore pipeline to the brine diffuser. (The coordinates of the offshore diffuser would be 30°09’06”N and 88°33’39”W.) DOE has changed the conceptual design as presented in the draft EIS from 16 inches (41 centimeters) to 36 inches (91 centimeters) so that the pipeline would also be available to transport seawater from the Gulf of Mexico to Richton during periods of low flow in the Leaf River both for cavern development and for drawdown operations.

The 87-mile (140-kilometer) 48-inch (122-centimeter) pipeline would be used during cavern creation to transport brine from the Richton site to Pascagoula and to the brine diffuser. Once construction of all the caverns had been completed, this pipeline would supply oil from the Pascagoula terminal to the storage caverns. During drawdown, the pipeline would be used to distribute oil from the storage site to Pascagoula.

Crude oil also would be transported to and from the Richton SPR facility through a 36-inch (91-centimeter), 116-mile (186-kilometer) pipeline to the Capline Complex in Liberty, as illustrated in figure 2.4.3-6. Near this connection, DOE would construct four 0.4-MMB oil storage tanks, support facilities, and an electrical substation, which would require a site of approximately 66 acres (27 hectares). At the midpoint of the pipeline route, DOE would construct a midpoint pump station consisting of three, 2,000-horsepower, diesel-powered pumping units on a 1.7-acre (0.7-hectare) site.

A new DOE-owned and -operated terminal/tank farm and RWI structure would be built adjacent to an existing dock that DOE would acquire and operate. These facilities would be located on the Naval Station Pascagoula Base Realignment and Closure site located on the north side of man-made Singing River Island, which lies just south of the main port of Pascagoula. This 49 acres (20 hectares) site would contain four 0.4-MMB oil storage tanks, support facilities, and an electrical substation as well as the secondary RWI structure previously discussed. For the terminal, the dock would be refurbished and the only in-water construction would be the installation of pilings. Figure 2.4.3-7 illustrates the proposed facilities.

Two 138-kilovolt power lines would be built to a substation at the Richton storage site, from local utility lines at a point 11 miles (18 kilometers) south. The parallel power line would require a 150-foot (46-meter) ROW. These power lines would run approximately 1 mile (1.6 kilometers) north to pass directly adjacent to the Leaf River RWI, and then share the ROW with the primary RWI intake pipeline for the remaining 10 miles (16 kilometers) to the site. A short 0.05-mile (0.08-kilometer) connection would be made to the primary RWI substation from these power lines. For the secondary RWI structure at Pascagoula, two new 1.6-mile (2.6 kilometer) 115-kilovolt power lines would run north from Singing River Island along the Highway 90 bridge for about a mile and then east to mainland Pascagoula.

2.4.4 Stratton Ridge Storage Site

The Stratton Ridge salt dome is located in Brazoria County, TX, 3 miles (4.8 kilometers) east of Clute and Lake Jackson and 6 miles (9.7 kilometers) north of Freeport, as illustrated in figure 2.4.4-1. This proposed new site would consist of 16 new caverns with a combined capacity of up to 160 MMB. The drawdown rate would be up to 1.0 MMBD.

Figure 2.4.3-6: Proposed Layout of the Liberty Tank Farm

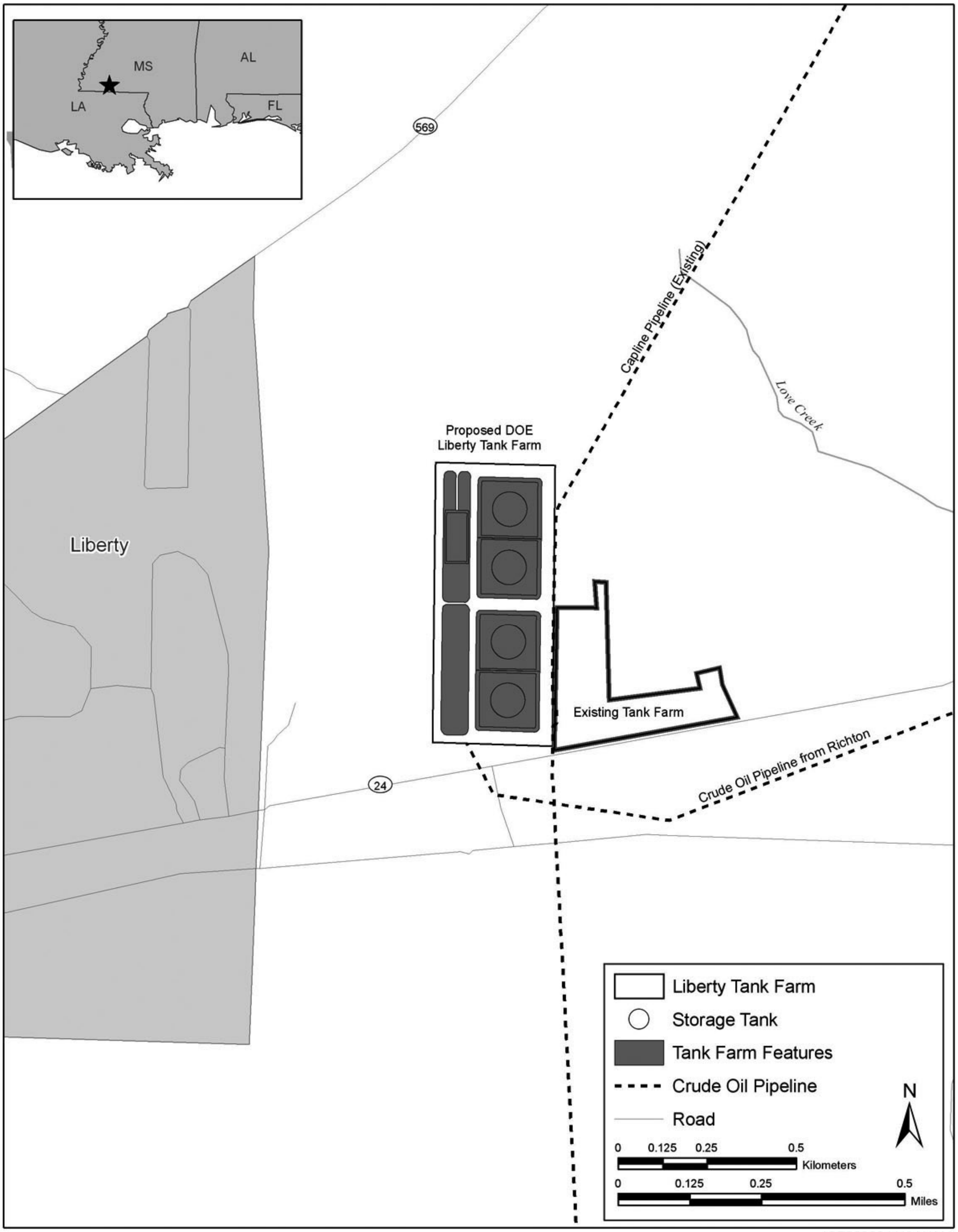

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Figure 2.4.3-7: Proposed Layout of the Pascagoula Terminal

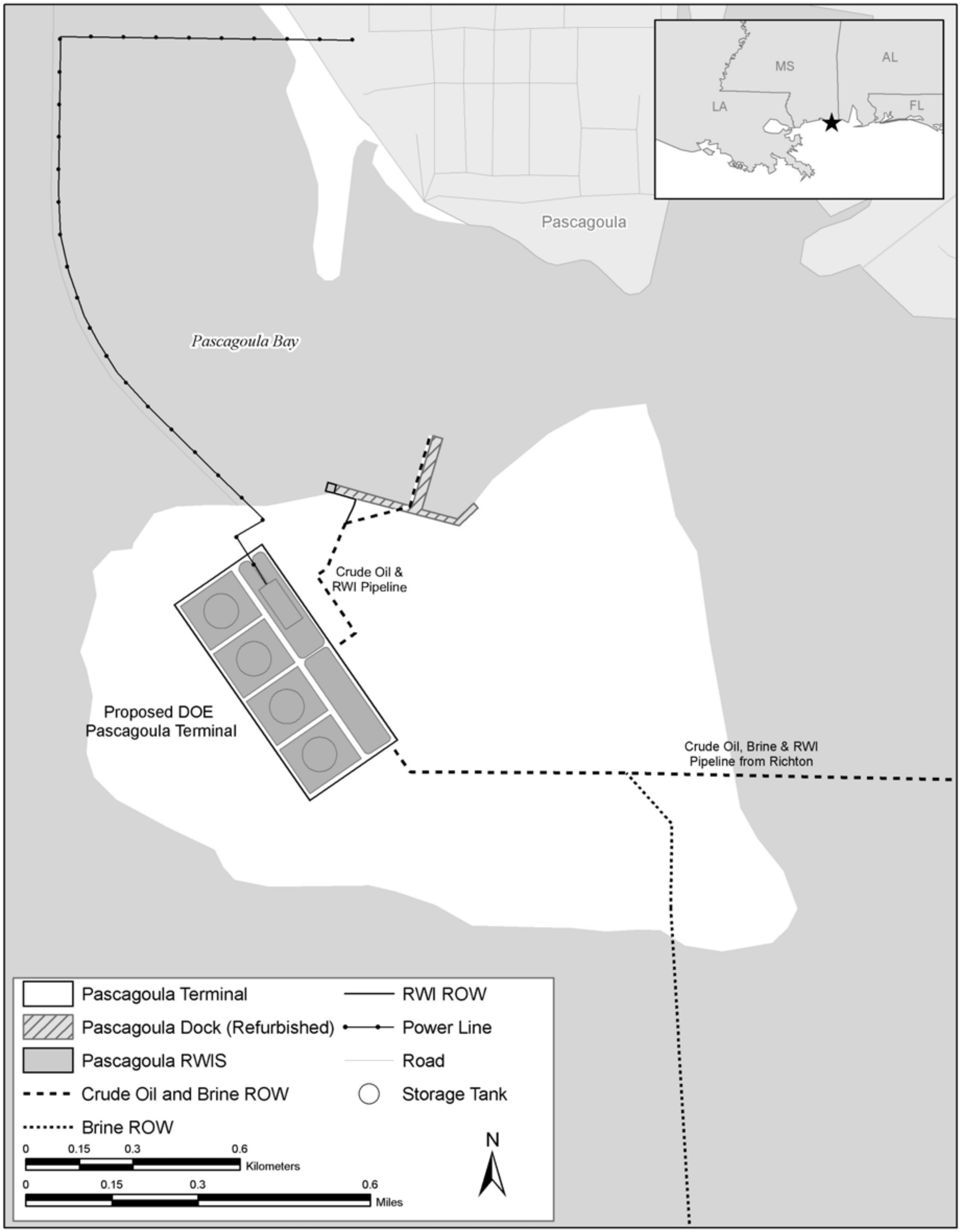

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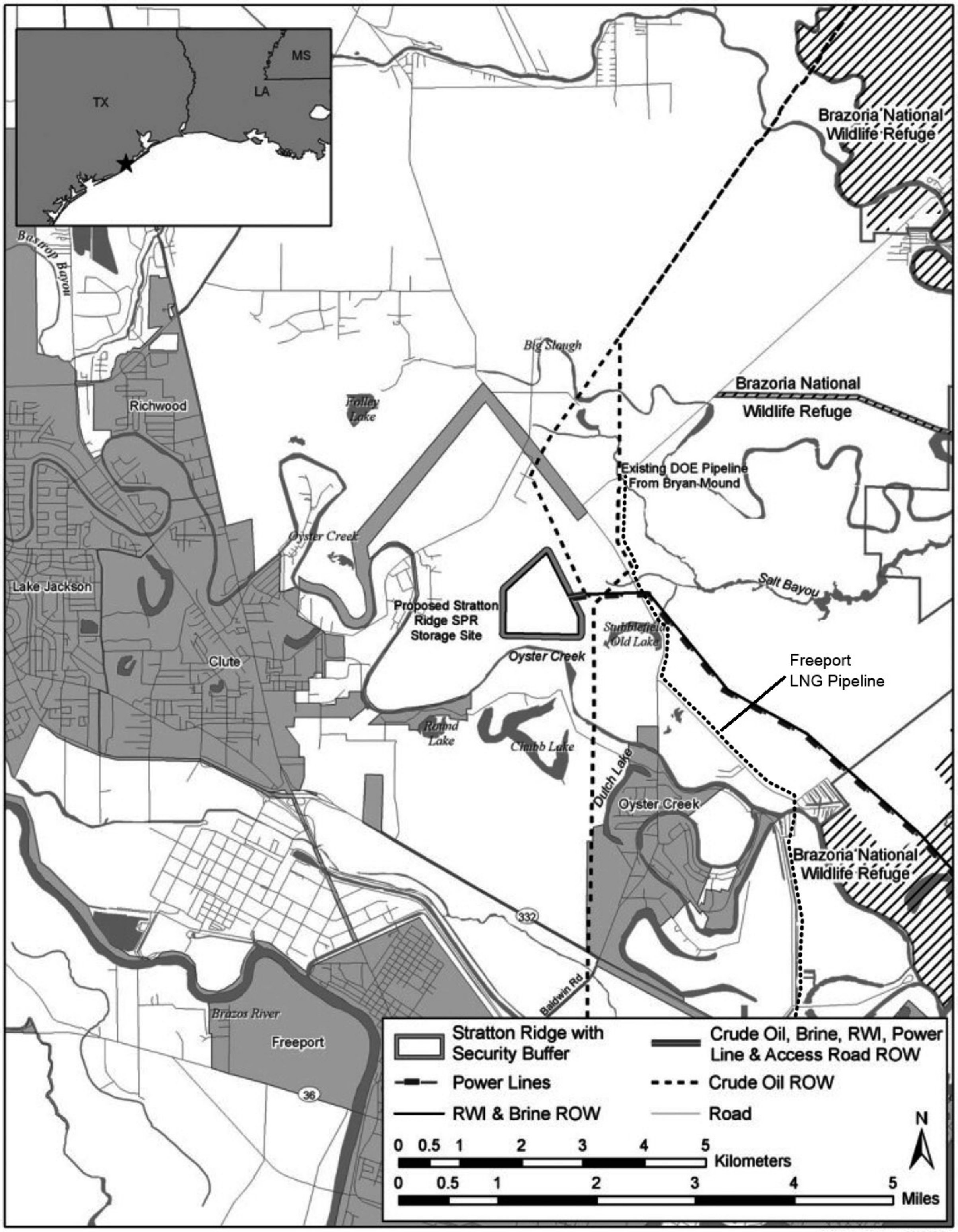
Figure 2.4.4-1: Location of Proposed Stratton Ridge Storage Site



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The proposed site encompasses approximately 269 acres (109 hectares) in the south-central portion of the salt dome. In addition, a surrounding security buffer would be created of 102 acres (41 hectares) by clearing an area 300 feet (91 meters) beyond an outer security fenceline for line-of-sight surveillance. The land would be cleared of undergrowth, scrub, shrub, and any trees, and be managed as an open field. To do this, DOE might purchase additional land or make agreements with owners of abutting lands. Although there is some cattle ranching in the vicinity of Stratton Ridge, the economy of the area centers on the petrochemical industry. Fifty-seven brine and crude oil storage caverns with an approximate total volume of about 150 MMB are currently operated at the Stratton Ridge salt dome by Dow, British Petroleum, Conoco, and Occidental.

DOE would construct 16 new, 10-MMB-capacity caverns, 7 raw water injection pumps, 4 brine pumps, 2 brine ponds, 5 oil injection pumps, and numerous onsite buildings. DOE would construct a 0.7 mile (1.1 kilometer) site access road from Route 523 to the site. Offsite construction would include an RWI structure encompassing 16 acres (6.5 hectares) on the ICW. The layout of the caverns appears in figure 2.4.4-2. A 0.7-mile (1-kilometer) access road would be built.

The RWI structure would be located 8 miles (13 kilometers) southwest of the site on the south side of the ICW, and it would contain four 2,500-horsepower raw water lift pumps. DOE would construct a 0.25 mile (0.4 kilometer) access road to the RWI structure. A 6-mile (10-kilometer) 42-inch (107-centimeter) raw water pipeline would be used to transport raw water from the ICW to the site for cavern solution mining and oil drawdown. The pipeline would have a throughput capacity sufficient to solution-mine caverns at a rate of 1.0 MMBD, and it would provide adequate water for drawdown.

A 10-mile (16-kilometer), 48-inch (122-centimeter) brine disposal pipeline would carry the brine to a depth of 30 feet (9 meters) into the Gulf of Mexico (see figure 2.4.4-3). Diffuser ports would be located on the final 4,000 feet (1,200 meters) of the pipeline. The 7-mile (11-kilometer) onshore portion of the pipeline would share the ROW with the RWI pipeline described earlier. The 3-mile (5-kilometer) offshore portion of the pipeline would lie perpendicular to the coast to take advantage of ocean currents for maximizing diffusion. Its terminus would be located at coordinates 28°56’36”N and 95°13’18”W.

A 42-inch (107-centimeter) 37-mile (60-kilometer) crude oil pipeline would be built to a proposed terminal/tank farm in Texas City adjacent to the existing Bryan Mound-Texas City pipeline (see figure 2.4.4-3). This tank farm would interconnect with an abutting BP facility via two proposed 30-inch (76-centimeters), 3-mile (4-kilometer) pipelines. It would contain four 0.4-MMB oil storage tanks, support facilities, and an electrical substation and would occupy a 39-acre (16-hectare) site. A cross-connection would also be made to the existing crude oil pipeline from Bryan Mound to Texas City. This configuration would allow oil fill and crude oil transfers between the Stratton Ridge and Bryan Mound sites. Figure 2.4.4-4 illustrates the proposed tank farm at Texas City.

An existing 138-kilovolt power lines run along the north eastern boundary of the site and would be directly connected to a site substation that would be built adjacent to these existing power lines. Dual 34.5-kilovolt power lines would be built from the site substation to the RWI adjacent to the RWI pipeline along a 6-mile (10-kilometer) 60-foot (18-meter) ROW. The portion of the dual 34.5 kilovolt power lines that pass through the Brazoria National Wildlife Refuge (NWR) would be constructed underground rather than along poles.

Figure 2.4.4-2: Proposed Layout for Stratton Ridge Storage Site

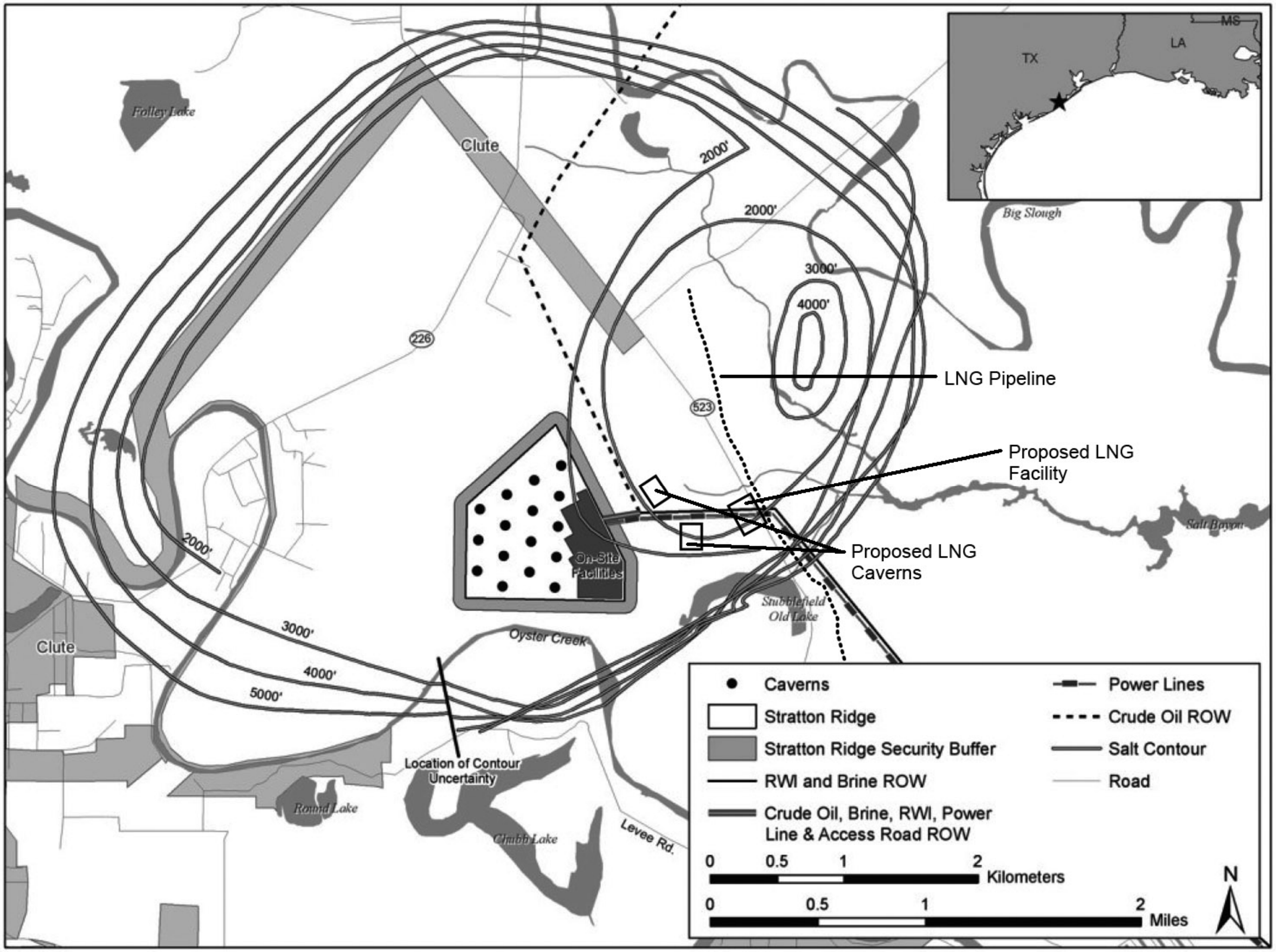

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Figure 2.4.4-3: Proposed Pipelines for Stratton Ridge Storage Site

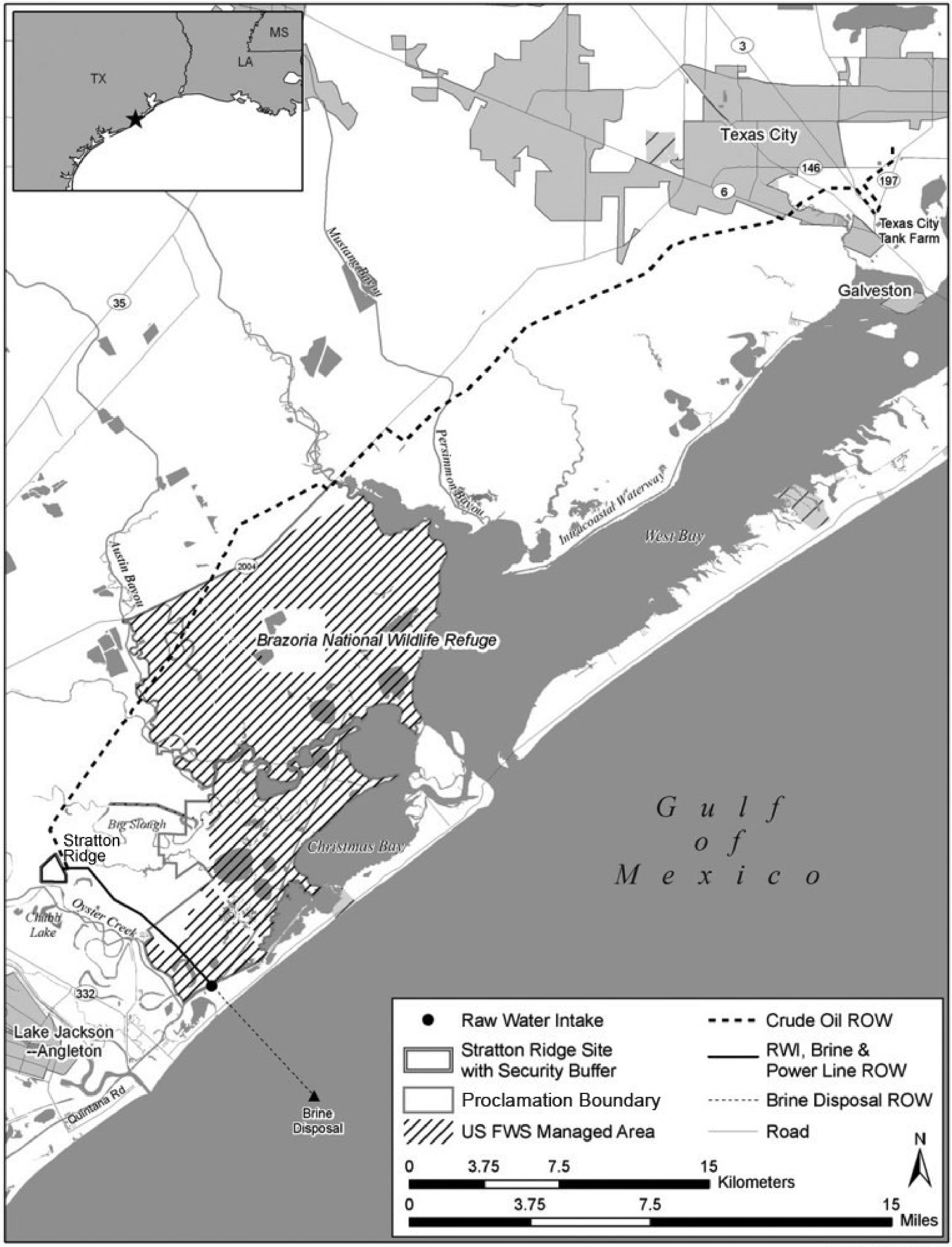

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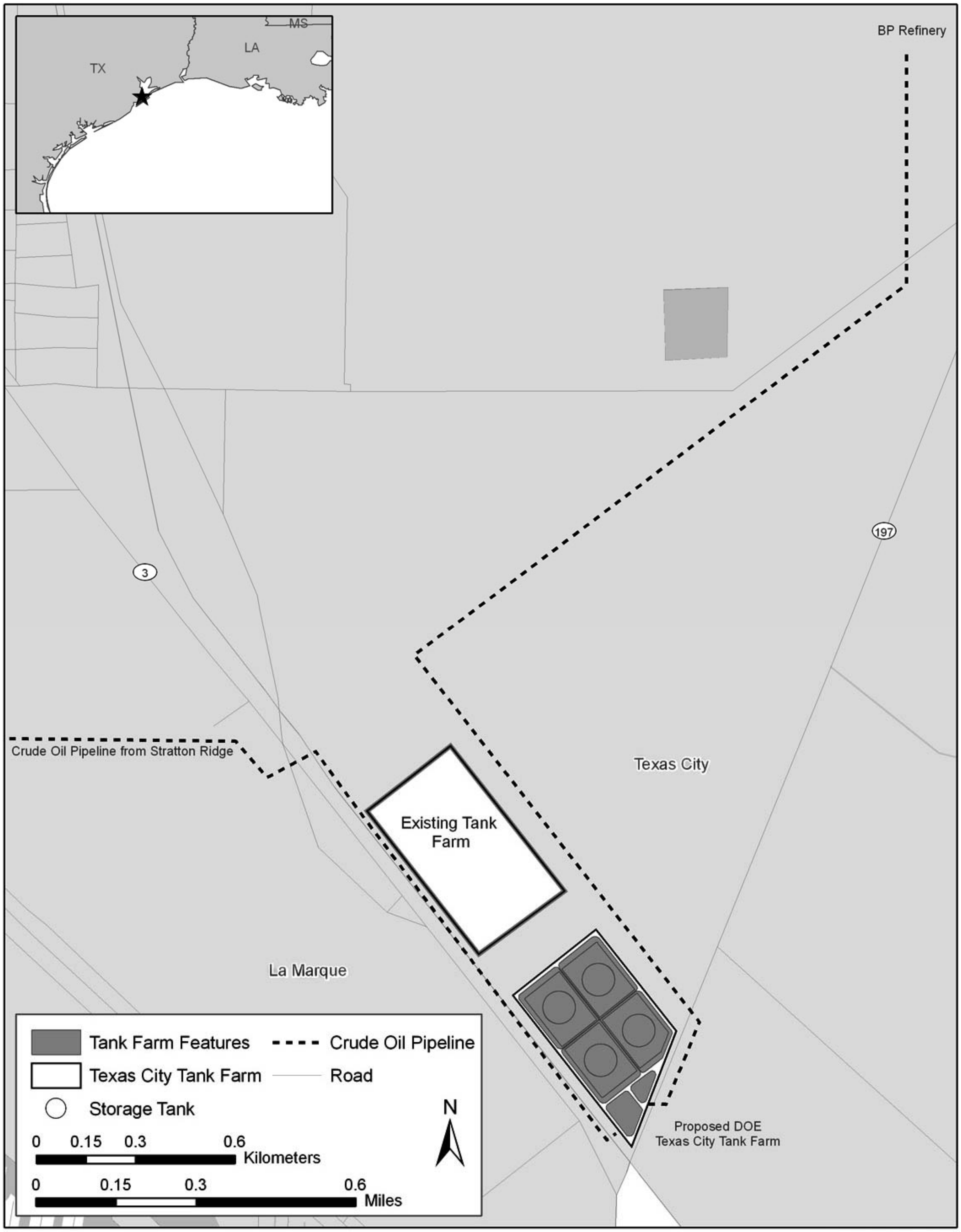
Figure 2.4.4-4: Proposed Layout of Texas City Tank Farm



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2.5 EXPANSION AT EXISTING SPR SITES

This EIS considers the expansion of three existing SPR storage sites, Bayou Choctaw, LA, Big Hill, TX and West Hackberry, LA. The location of each facility is illustrated in figure 2.5-1. Storage capacity at Big Hill would be expanded by 80 or 96 MMB; Bayou Choctaw would be expanded by 20 MMB; and West Hackberry would be expanded by 15 MMB or not at all. The specific amount of expansion would depend on the alternative that DOE selects. The draft EIS also evaluated expansion of the Big Hill site by up to 108 MMB and expansion of the Bayou Choctaw site by 30 MMB. These options were associated with the Clovelly site alternatives that are no longer under consideration.

2.5.1 Bayou Choctaw Expansion Site

Bayou Choctaw occupies a 356-acre (144-hectare) site in Iberville Parish, LA, about 12 miles (19 kilometers) southwest of Baton Rouge, as illustrated in figure 2.2.2-1. The Mississippi River is located about 4 miles (6.4 kilometers) east of the salt dome and the Port Allen Canal, an extension of the ICW, is about 0.25 miles (0.4 kilometers) to the west. The general area is swampy with an elevation ranging from less than 5 feet (1.5 meters) to more than 10 feet (3 meters) above mean sea level.

The existing storage facility consists of six caverns with approximately 12.5 MMB capacity each (see figure 2.5.1-2). Combined storage capacity is 76 MMB with a drawdown rate of 515 MMBD. Raw water is supplied from an intake facility on Cavern Lake to the north of the site. The lake has a surface area of approximately 12 acres (5 hectares) and it is connected by canal to the ICW. Brine is disposed of through underground injection wells south of the storage site. DOE would expand the storage capacity of the Bayou Choctaw facility by 20 MMB by developing two new 10-MMB caverns on the existing DOE property. The new caverns would be connected to the existing RWI, crude oil distribution, electrical, storage facility control and monitoring, and brine disposal systems. The current RWI system's capacity would be increased to 0.615 MMBD to accommodate increasing the oil drawdown rate to 0.590 MMBD. The impellers on the RWI pumps would be refitted and 750-horsepower drivers would be added to the system.

The brine disposal system also would be upgraded by installing 3,000 feet (900 meters) of brine pipeline to six new injection wells located 3,000 feet (900 meters) south of the existing brine injection well area on a 96-acre (39-hectare) site to meet the increased storage capacity at the site. The system upgrades are designed to meet the increased brine disposal requirements during cavern development, drawdowns, and filling events. The current brine disposal rate is limited by underground injection permits to 0.11 MMBD; therefore, increasing the storage capacity would not increase the brine disposal rate. A new brine disposal filtration system would be installed. The existing crude oil distribution system would meet all of the drawdown requirements for an expanded site. No offsite oil pipeline enhancements would be required. Onsite expansion would include installation of new 12-inch (30-centimeter) pipelines connecting the expansion caverns to the existing crude oil distribution system.

General construction on the site would include a new heat exchanger to accommodate the increased flow rate, new 12-inch (30-centimeter) brine headers, 16-inch (41-centimeter) crude oil headers, and 4-inch (10-centimeter) string flush piping with all necessary block and control valves. New 12-inch (30-centimeter) firewater pipelines with hydrants and monitors would be installed. A 0.5-mile (0.7-kilometer) access road would be built for the new caverns, an existing road would be upgraded, and a replacement bridge constructed.

Figure 2.5.1-1: Location of Proposed Bayou Choctaw Expansion Site

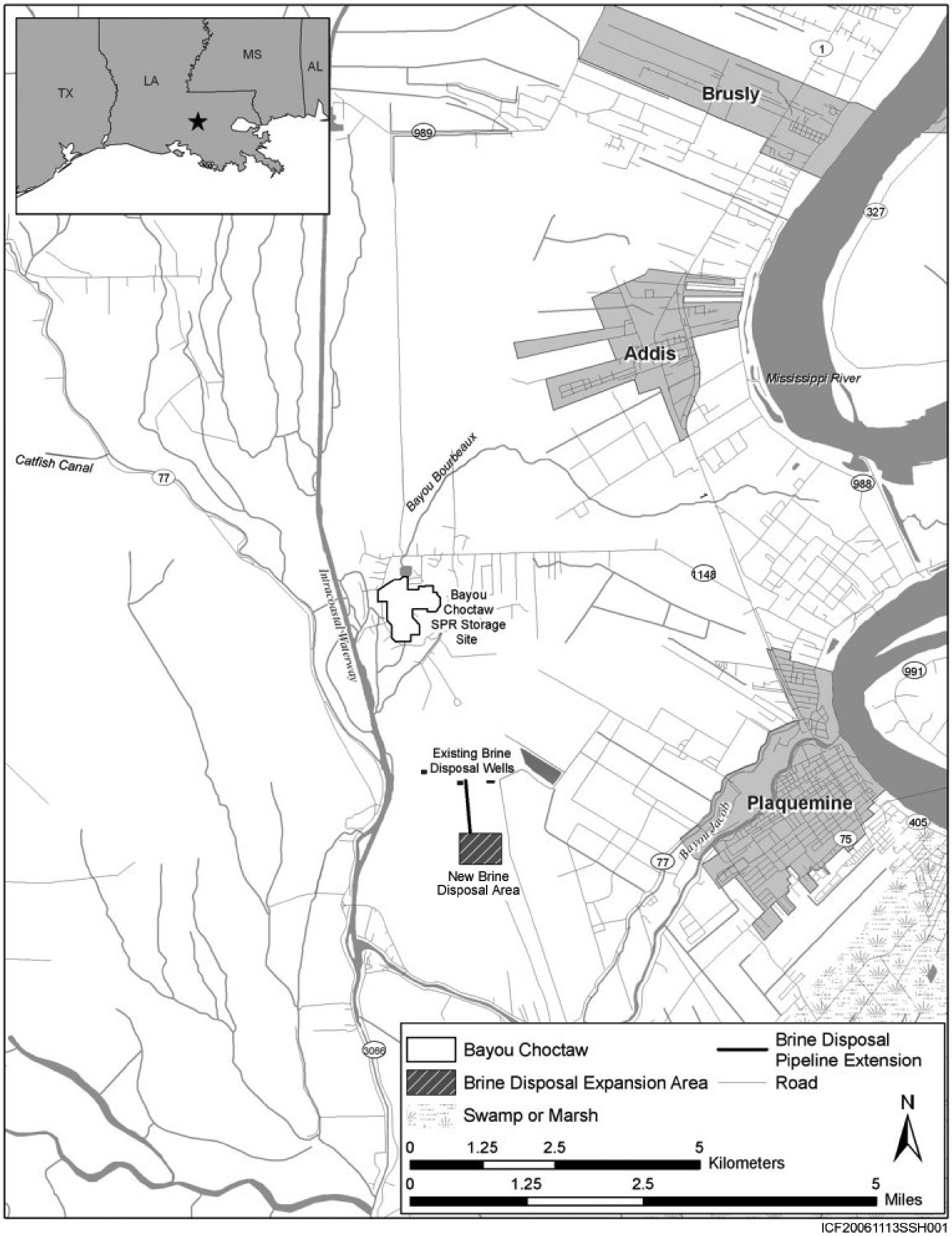
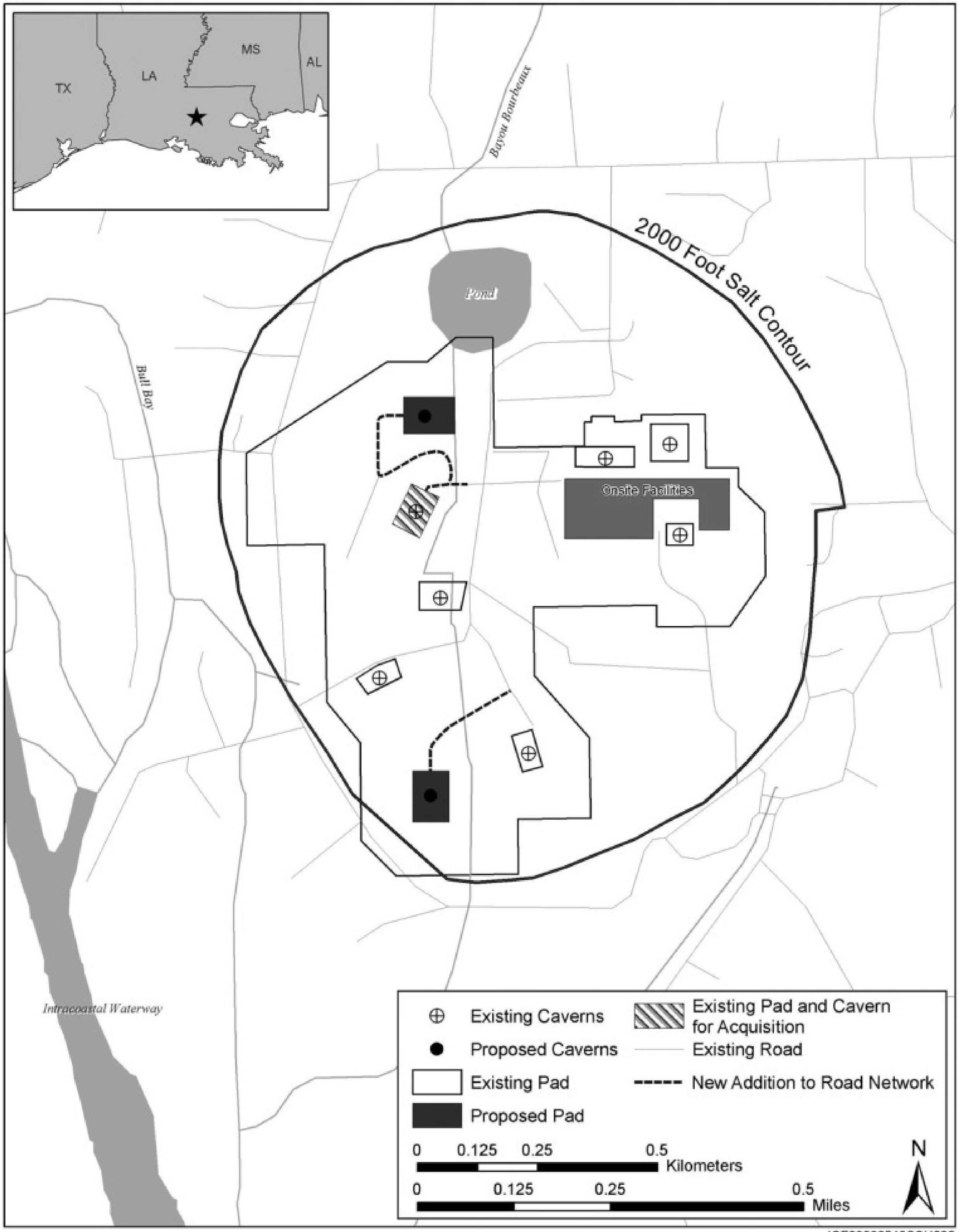


Figure 2.5.1-2: Layout and Proposed Expansion for Bayou Choctaw Storage Site



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2.5.2 Big Hill Expansion Site

Big Hill is located in Jefferson County, TX, 17 miles (27 kilometers) southwest of Port Arthur, as shown in figure 2.5.2-1. The existing site occupies approximately 250 acres (101 hectares). It is 70 miles (113 kilometers) east of Houston. The surrounding area is predominantly rural with agricultural production as the primary land use. Oil and gas production is the other major economic activity in Jefferson County.

The existing Big Hill facility, illustrated in figure 2.5.2-2, consists of 14 crude oil storage caverns with a combined capacity of 170 MMB and a drawdown rate of 1.1 MMBD, a brine disposal system, an RWI system, and a crude oil distribution system. The site also has various support facilities including a heliport; diesel oil storage; various laydown yards; maintenance yard; and control, service, and administration buildings. The caverns are located in the center portion of the salt dome and are arranged in two rows of five caverns and one row of four caverns. Each cavern is located at a depth of 2,200 to 4,200 feet (670 to 1,300 meters) and has a maximum width of about 200 feet (61 meters).

DOE proposes to expand the Big Hill facility by up to 96 MMB of new storage capacity and increase the drawdown rate to 1.5 MMBD. DOE may expand the existing Big Hill SPR facility by 80 or 96 MMB by constructing 8 new 10 or 12 MMB caverns. For each expansion scenario, DOE would acquire approximately 147 acres (60 hectares) of land directly north of the existing site. An overview of the 96 MMB expansion is shown in figure 2.5.2-2. A security buffer of 59 acres (24 hectares) would be created by clearing an area 300 feet (91 meters) beyond an outer security fence on this acquired land. This area would be cleared of undergrowth, scrub, shrub, and any trees, and would be managed as an open field. The area where the expansion would take place is currently owned by Sabine Pass Terminal, although British Petroleum retains mineral rights. Neither of these companies currently has any operations on the site. Unocal has developed two 0.5-MMB liquid petroleum gas storage caverns just north of the proposed storage area. There are no other operators on the Big Hill salt dome.

Because Big Hill is an SPR facility, any site expansion could take advantage of the existing infrastructure. Nevertheless, the increased storage capacity and drawdown rate would require that all of the major systems be expanded or upgraded. Construction necessary to expand the facility would include preparing the site, solution mining the new storage caverns, constructing a new crude oil distribution pipeline, upgrading the existing brine disposal pipeline, and upgrading the RWI pumps. The existing anhydrite-settling pond, which is 55 to 65 percent full of solids, could not handle the increased brine flow from the new caverns, and a new settling pond would be added. The replacement pond would be constructed adjacent to the existing pond. Because the new pond would be connected to the existing underground pipeline network, construction would be limited primarily to the pond itself.

The new caverns would tie into the existing RWI system, with only minor upgrades necessary. New RWI pumps and five additional raw water injection pumps would be installed to handle the increased demand for raw water.

The existing brine disposal pipeline would have adequate capacity to handle the increased flow, but approximately 7,000 feet (2,100 meters) of the existing line would need to be replaced because of corrosion from existing activities. To meet the new drawdown rate of 1.5 MMBD, DOE would construct a 30-inch (76-centimeter), 23-mile (40-kilometer) crude oil pipeline to the Sun terminal at Nederland, TX. This pipeline would parallel the existing pipeline ROW. Figure 2.5.2-1 shows the pipeline route. DOE would install two crude oil injection pumps and motors at Big Hill. Expansion also would require installing security measures, as outlined in section 2.3.5.

Figure 2.5.2-1: Location and Pipelines of Proposed Big Hill Expansion Site

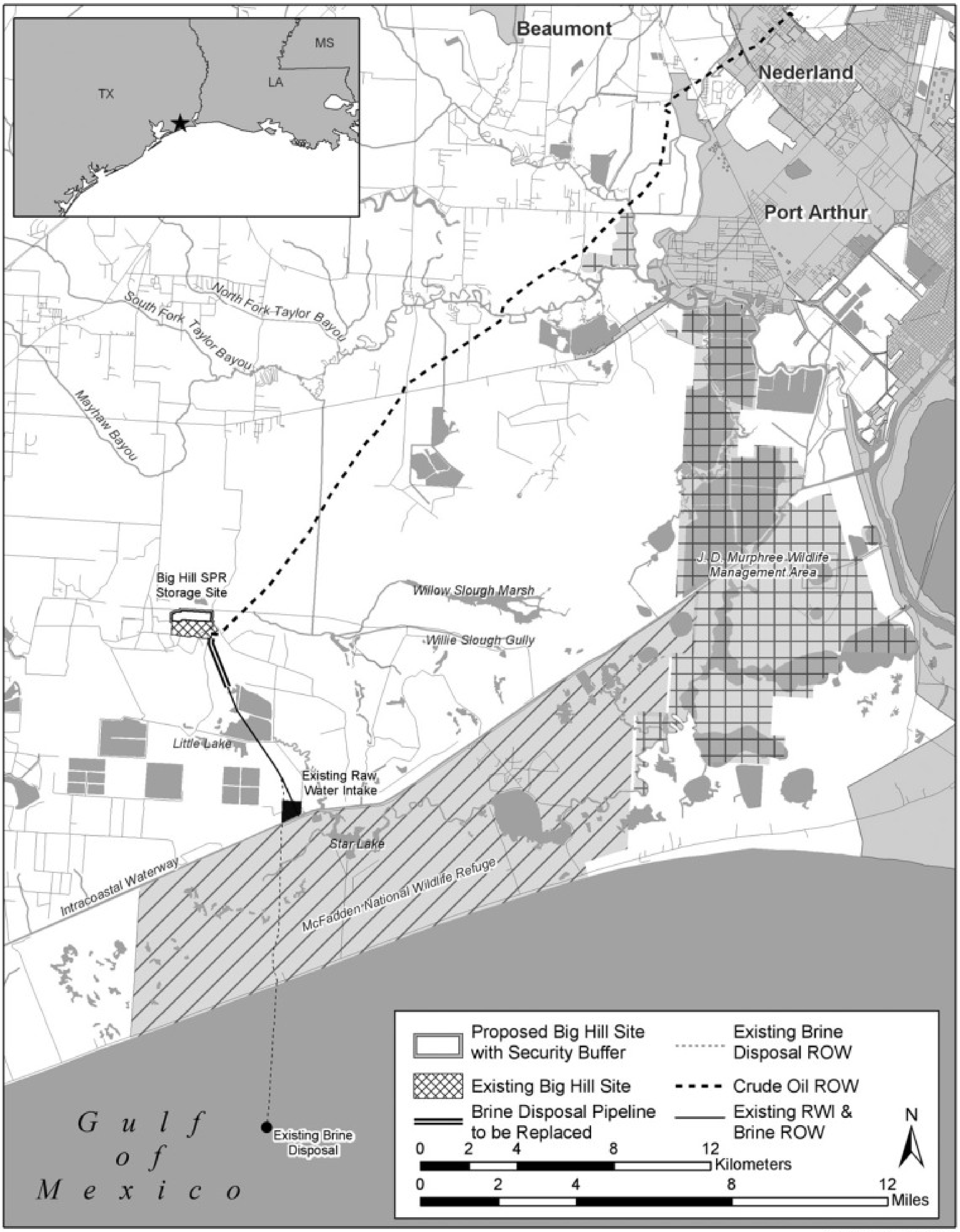

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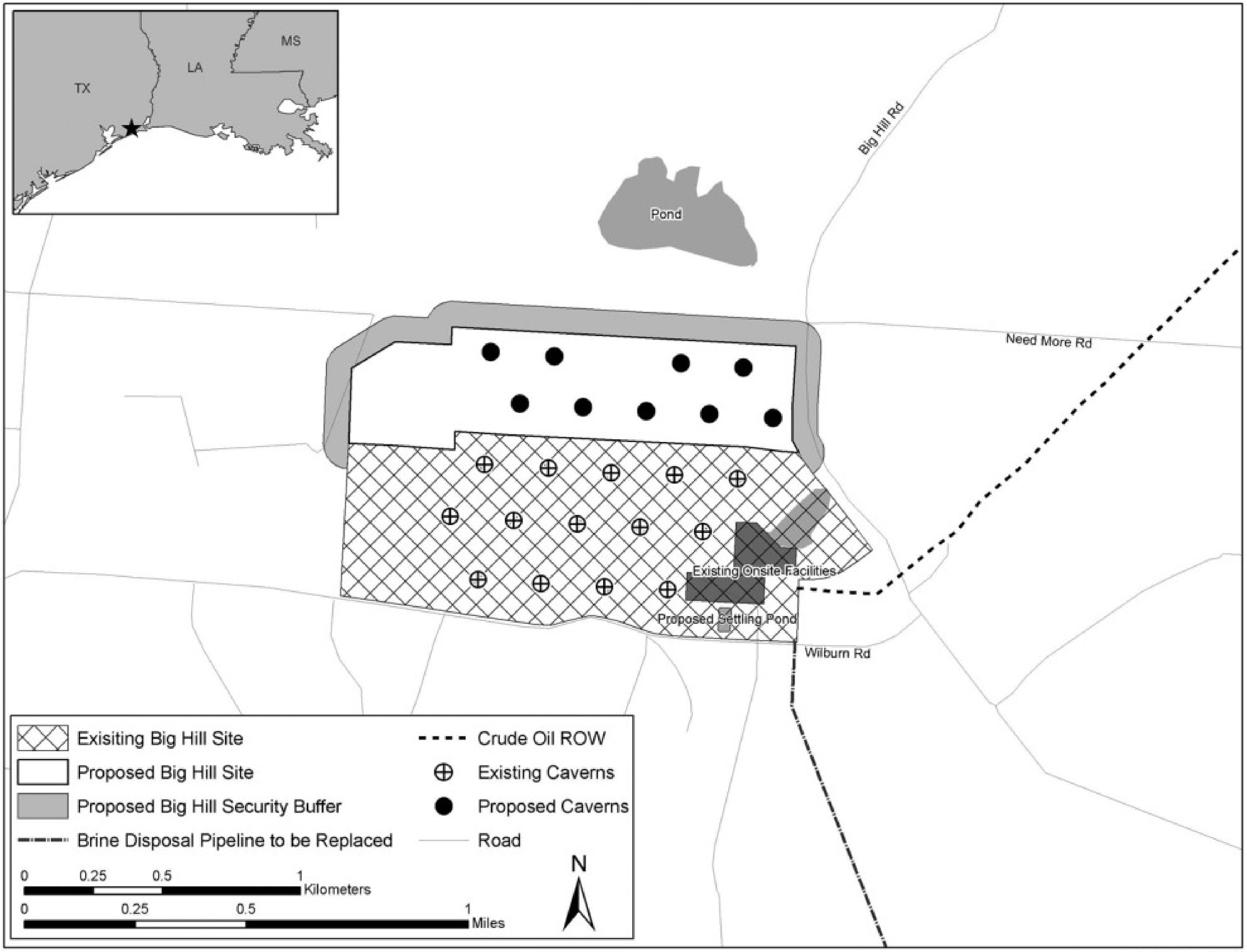
Figure 2.5.2-2: Layout and Proposed Expansion for Big Hill Storage Site



2.5.3 West Hackberry Expansion Site

West Hackberry occupies a 565-acre (228.6 hectares) site in Cameron and Calcasieu Parishes in southwestern LA, as shown in figure 2.5.3-1. The site is located approximately 20 miles (32 kilometers) southwest of the city of Lake Charles and 16 miles (26 kilometers) north of the Gulf of Mexico. Hackberry, a local unincorporated town of approximately 1,500 people, and the Calcasieu ship channel, are approximately 4 miles (6.4 kilometers) east of the site. The Sun terminal in Nederland, TX, which serves as the oil supply and distribution terminal, is about 40 miles (64 kilometers) west of the site.

The SPR storage facility consists of 22 caverns with a combined capacity of 227 MMB (see figure 2.5.3-2). Raw water is supplied from the ICW, approximately 4 miles (6.4 kilometers) north of the SPR storage site. The raw water pipeline crosses Black Lake en route from the RWI structure to the storage facility. The maximum drawdown rate is 1.3 MMB. The site is connected to the Sun terminal through a 43-mile (69-kilometer) crude oil pipeline and to the Lake Charles meter station through a 14-mile (23-kilometer) crude oil pipeline.

DOE would acquire three privately owned existing 5-MMB capacity caverns that are located adjacent to the existing site. These three existing caverns would add 15 MMB of storage capacity and 53 acres (21 hectares) to the existing SPR site. In addition, DOE would purchase 240-acres (97-hectares) of abutting land to the west, as illustrated in figure 2.5.3-1. The maximum drawdown rate would remain at its current rate of 1.3 MMBD. The caverns are privately owned and filled with brine. They are arranged in one row that runs roughly north-south on the west side of the existing facility. Expansion would not require significant upgrades to the RWI facility, crude oil distribution capabilities, or the brine disposal system. Only minor construction would take place to connect the acquired caverns to the SPR storage site. An overview of the site and the expansion area is shown in figure 2.5.3-2.

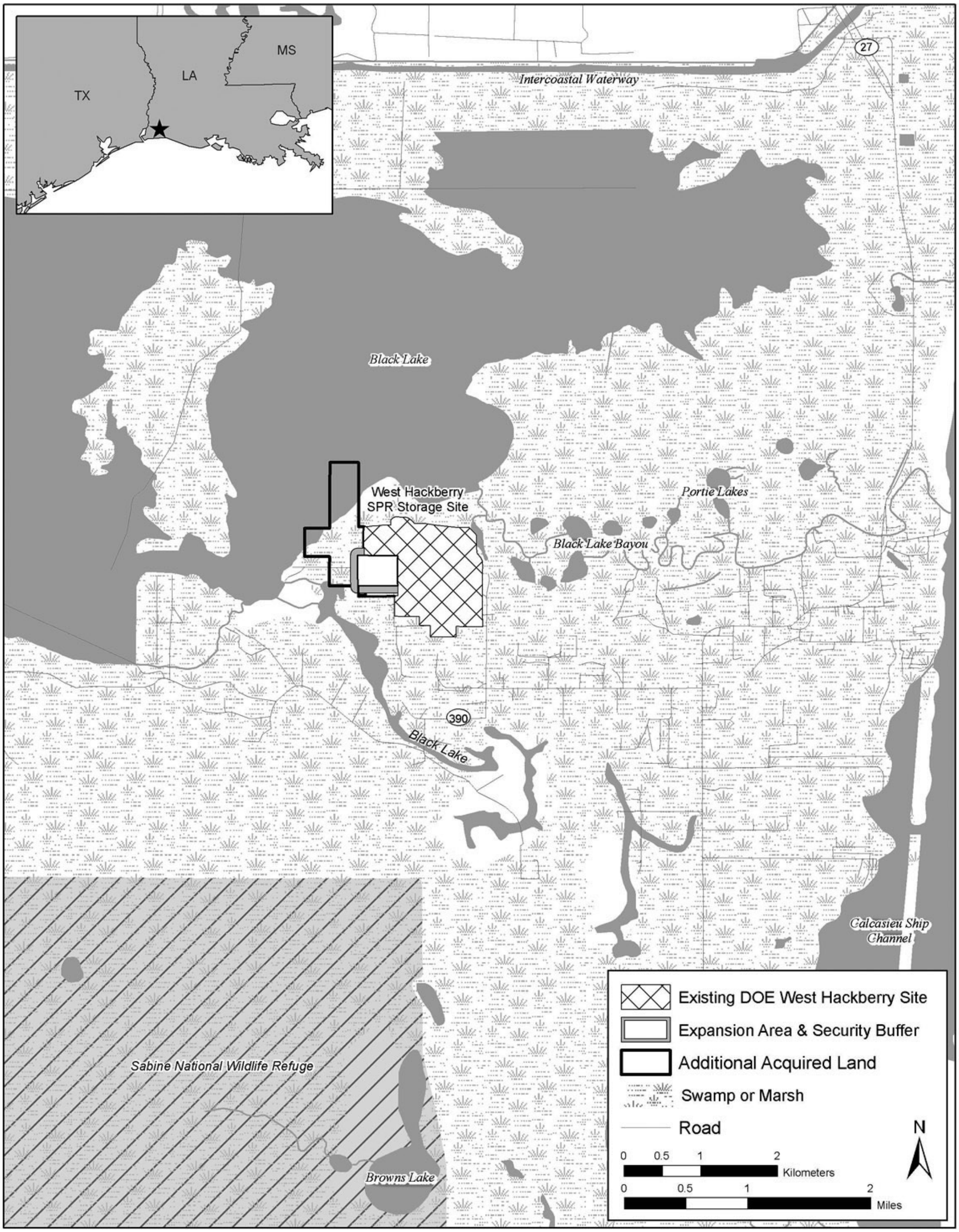
New onsite pipelines would connect the acquired caverns to the existing onsite water, brine, and crude-oil systems. The existing electrical system and the existing storage facility control and monitoring system would be adequate to handle the increased demand created by the expansion. Both systems would be connected to the expansion site. In addition DOE would construct a 0.5-mile (0.9-kilometer) access road to the acquired caverns. The expansion also would require the installation of security measures, as outlined in section 2.3.5, and would include a 27-acre (11-hectare) security buffer around the acquired caverns.

2.6 ALTERNATIVES ELIMINATED FROM DETAILED STUDY

As required by EPACT Section 303, DOE limited its review of potential new SPR sites and expansion sites to (1) sites that DOE addressed in the 1992 draft EIS and (2) sites proposed by a state where DOE had previously studied a site. DOE eliminated from consideration the alternative locations in Louisiana, Texas, New Mexico, and Virginia identified during public scoping because the sites were not technically feasible and would violate the mandate of EPACT Section 303.

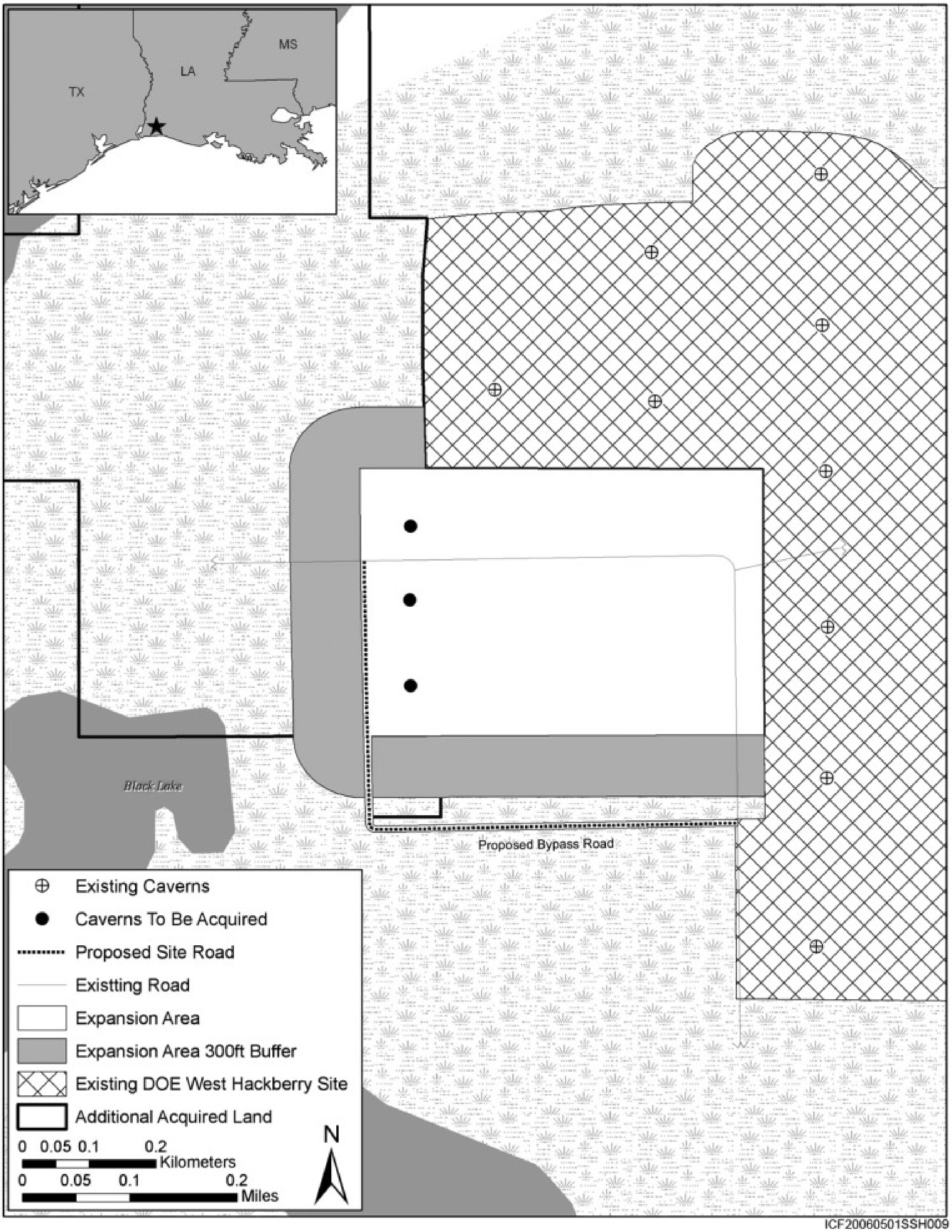
DOE eliminated the alternative of expanding capacity at Bryan Mound, TX, an existing SPR site, because the salt dome has no available capacity for additional storage. While the 1992 draft EIS addressed the potential new salt dome sites at Cote Blanche, LA, and Weeks Island, LA, DOE’s review of these sites for this EIS concluded that they are no longer viable due to the sale of the DOE’s Weeks Island crude oil pipeline and its subsequent conversion to natural gas transmission. The Cote Blanche site would have been connected by pipeline to the Weeks Island pipeline.

Figure 2.5.3-1: Location of Proposed West Hackberry Expansion Site



ICF20060411SSH010

Figure 2.5.3-2: Layout and Proposed Expansion of West Hackberry Storage Site



Subsequent to the publication of the draft EIS, DOE determined that the Clovelly 120-MMB alternative and the Clovelly 80- or 90-MMB and Bruinsburg 80-MMB alternatives are not feasible and therefore are not reasonable. After the draft EIS was published, DOE completed additional studies of the geotechnical suitability of the Clovelly salt dome for SPR development (Arguello et al. 2006; Rautman and Looff 2006). The dome's hourglass shape and its small size had required that DOE propose to place new SPR caverns for 120-MMB capacity below and in between Clovelly's existing caverns. This configuration has been found to present several risk factors to the integrity of the Clovelly caverns and infrastructure and overall operation of the proposed site.

Because of the potential mechanical interaction of the SPR caverns with the LOOP cavern field in the Clovelly dome formation, the maximum operating pressures for the SPR caverns would be greatly reduced to avoid severely damaging the bonding of the well casing within the salt formation. This reduction in maximum operating pressures would do the following:

- Substantially limit the maximum rate of filling and withdrawing oil from the caverns, and
- Reduce DOE’s ability to maintain the storage volume of the cavern. (Caverns at the depth DOE had proposed would incur high geological pressures that would cause the cavern volume to close or shrink, unless high pressures within the cavern are maintained.)

Because of these issues, development of the Clovelly 120 MMB alternative is no longer considered reasonable and feasible. DOE has removed the alternative from detailed consideration in the EIS.

In addition, DOE consulted with LOOP officials on whether an 80- or 90-MMB Clovelly facility, proposed in the draft EIS to be developed in conjunction with the Bruinsburg site, could be developed by constructing conventional SPR storage caverns entirely in the upper level of the unused portion of the salt dome around the existing LOOP caverns. LOOP indicated that it required space for three future caverns, which would leave space for only four to seven potential SPR caverns. That arrangement would provide only about 30 to 55 MMB of storage capacity. In addition, the arrangement would not meet DOE's minimum standoff distances from the edge of the dome and DOE's standard pillar-to-diameter ratio for the proposed caverns. Because of the small amount of overall capacity and the risk factors associated with cavern construction in the small salt dome, DOE does not consider this change in the conceptual plan for the Clovelly 80 MMB-Bruinsburg 80 MMB and the Clovelly 90 MMB-Bruinsburg 80 MMB alternatives to result in reasonable alternatives. Thus, DOE has removed these alternatives from detailed consideration in the EIS.

DOE analyzed the potential use of underground brine injection and brine discharge into the Gulf of Mexico for proposed new and expansion SPR sites. Brine injection wells are proposed only for Bruinsburg and expansion at Bayou Choctaw and West Hackberry. The other proposed sites would rely on brine discharge to the Gulf.

Underground injection presents technical, operational, and hydrogeological obstacles.

- Brine injection wells can be difficult and expensive to operate;
- The geology must be appropriate for wells to be drilled and the receiving aquifer must be hydrologically suitable; and
- Brine injection wells may pose risk to overlying drinking water sources, such as freshwater aquifers.

DOE has proposed using injection wells for brine disposal for the Bruinsburg site for the following reasons:

- The local geology would provide adequate protection of freshwater aquifers;
- The receiving aquifers are anticipated to have adequate capacity for the brine disposal; and
- The environmental impacts and costs would be much lower for building the brine injection pipeline than for building a lengthy brine discharge pipeline to the Gulf of Mexico.

Nonetheless, the development of the Bruinsburg site would require construction and operation of 60 injection wells to accommodate the brine volume. The other proposed new sites (Chacahoula, Richton, and Stratton Ridge) are closer than Bruinsburg to the Gulf of Mexico and therefore would have smaller construction and operation impacts and costs for brine discharge than for brine injection.

The existing Bayou Choctaw and West Hackberry SPR sites currently use underground injection for brine disposal. Only two new caverns would be constructed for the Bayou Choctaw expansion. The West Hackberry expansion would involve DOE acquiring three existing caverns, with no construction of new caverns. Therefore, the amount of brine that would be discharged from the expansion of these two existing sites would be considerably lower than that for the development of a new SPR site. These volumes would be well within the capacities of the receiving aquifers.

In addition, DOE considered several pipeline alignments for most storage sites to minimize potential impacts to wetlands. Other pipeline alignments that DOE eliminated from detailed consideration because they would affect more wetlands, these alignments are described in Appendix B Floodplains and Wetlands Assessment. DOE also considered, but dismissed from detailed analysis using water from the ICW for the Richton storage site because of the significant length of new pipeline (over 100 miles [161 kilometers]) that would be required.

2.7 COMPARISON OF ALTERNATIVES

CEQ NEPA regulations (40 CFR Part 1500.2(e)) direct Federal agencies to use the NEPA process to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment. Analyses of alternatives are the heart of an EIS. CEQ regulations (40 CFR 1502.14) state:

> *Based on the information and analysis presented in the sections on the Affected Environment (Sec. 1502.15) and the Environmental Consequences (Sec. 1502.16), it* [an EIS] *should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public.*

The following sections discuss the potential environmental impacts of the proposed seven alternatives, including the no-action alternative, across 10 resource areas:

- Environmental risks and public and occupational safety and health;
- Land use;
- Geology and soils;
- Air quality;
- Water resources;
- Biological resources;
- Socioeconomics;

- Cultural resources;
- Noise; and
- Environmental justice.

Section 2.7.11 at the end of the chapter compares the potential impacts across the alternatives.

2.7.1 Environmental Risks and Public and Occupational Safety and Health

The EIS evaluates and describes the potential environmental impacts of a release of oil, brine, and hazardous materials. For this analysis, DOE considered risk to be the likelihood (or chance) of occurrence and its potential consequences.

The risk of an oil spill from SPR activities generally is greatest during transfer activities. The initial filling of storage facilities represents the greatest chance of spills associated with imports into the United States because subsequent drawdowns and refills would only replace a transfer of oil from interrupted imports. Thus, the analysis focuses on the likelihood of an oil spill during initial-fill activities.

The risks from oil spills would be similar for all action alternatives because the risks are primarily a function of the amount of oil transferred into SPR caverns, which would be a similar for all action alternatives. Based on historical spill statistics, the predicted oil spills would likely be a low volume (less than 100 barrels) of oil. The predicted number of oil spills would be approximately 16 spills during initial fill of the storage caverns.

The potential consequences of such infrequent, low-volume, accidental releases of oil would be minor. The releases generally would result in localized soil contamination at the storage sites and terminal locations, which would be contained and cleaned up. Elevated concentrations of oil constituents occurring in the water column and on the water surface immediately after a spill would decrease over time because of dispersion, dilution, and degradation. The rate of concentration decline would depend on the size and flushing rate of the water body affected, as discussed below. Although there is a low probability of an accidental oil spill, the consequences of a release could be significant if the release was large and/or if it migrated into a sensitive aquatic system or plant community. A large release of oil could result in mortality of plants and animals through chemical toxicity, physical smothering, respiratory interference, food and habitat loss, and inhalation or ingestion. Impacted communities can take decades to recover from a large release. A release of oil could cause significant and sometimes fatal physiological trauma to plants and animals, especially bird eggs, fish eggs, and fish larvae. While the spills would result in the release of some air contaminants, the contaminants would be released so infrequently and in such small quantities that they would be readily dispersed in the atmosphere and would have little effect on ambient air quality along site boundaries.

The risk of brine spills would be low for all action alternatives. The risk is primarily a function of the amount of brine disposed, and this amount is similar for all alternatives, excluding the no-action alternative. The total number of brine spills predicted for each alternative would range from 91 to 98 (see table 3.2.2-2). Based on historical data, however, these spills would mostly be of low volume (less than 50 barrels). Higher-volume brine spills, while possible, are very unlikely based on SPR experience. Unless the spills were large or sustained, neither of which is predicted, the brine contaminants would be diluted and dispersed into the surrounding area and water bodies by rain; soils and vegetation affected by changes in the mineral concentrations would quickly recover; and any impacts of changes in mineral concentrations on shallow groundwater and air quality would be small. While unlikely, a large discharge of brine into a sensitive aquatic system or plant community could have significant effects.

In addition to the brine spills associated with each action alternative, the Richton alternatives could result in spills of salt water from the Gulf of Mexico. If the Leaf River is unable, because of low flow conditions, to supply the full amount of water needed for cavern development and drawdown, a pipeline between Pascagoula and Richton would supply salt water from the Gulf of Mexico. Any spills of this water would have lower salinity (and lower potential impacts) than would be associated with spills of brine.

The risk of chemical spills and fire would be low and similar for all action alternatives because risk is primarily a function of the types of activities conducted. Activities are nearly identical for all alternatives, except for the no-action alternative. The occupational injuries also would be small and similar across action alternatives. For example, the rate of lost workdays due to injuries at new and expanded sites would be similar to the rate at existing SPR sites, which is 0.83 workdays per 200,000 worker hours. This rate is much lower than the Bureau of Labor Statistics average of 5.3 workdays per 200,000 worker hours.

Release of oil, brine, salt water, or hazardous materials could result from an accidental or deliberate system failure, with deliberate failures arising from sabotage or terrorism and accidental ones from design or construction flaws, human errors, or natural events. The EIS considers both minor and major releases so that the potential impacts of a terrorist action are captured within the EIS. Although the range of potential consequences can be described, the likelihood of a terrorism or sabotage event cannot be predicted or evaluated to the same degree.

2.7.2 Land Use

The analysis of land use addresses land use conflicts, visual resources, prime farmland, and coastal zone management. Each of these four topics is addressed below.

Possible Land Use Conflicts

The regulations for implementing the National Environmental Policy Act require agencies to discuss possible conflicts between the proposed action and the objectives of Federal, state, and local land use plans, policies, and controls (40 CFR 1502.16(c)). Each of the proposed alternatives would require the commitment of land for the development and operation of new and expansion sites and their infrastructure. The total area would range from the high end of 4,495 acres (1,819 hectares) for the Richton alternative with 3 expansion sites to the low end of 2,206 acres (893 hectares) for the Stratton Ridge alternative with 3 expansions sites. With 2 expansion sites, each alternative would require 81 fewer acres. Tables 2.7.11-1 and 2.7.11-2 identify the area required for the other alternatives.

At the expansion sites, the new storage facilities would be similar to existing facilities and therefore land use would not change substantially. Differences in land use conflicts among the alternatives would result from land use conflicts at new storage, pipeline, and other infrastructure sites. No substantial land use conflicts would arise for the Chacahoula site. For the other new sites, the following conflicts would arise for their infrastructure development.

- For the Bruinsburg site and associated infrastructure, the crude oil pipeline to Peetsville, MS, would cross the Natchez Trace National Scenic Trail and the Natchez Trace Parkway along an existing power line ROW. (All proposed pipelines would be underground except where they cross levees.) The expansion of the ROW would require clearing vegetation and would slightly expand the existing land use of the ROW. The same pipeline would travel through private property contained within the

proclamation boundary of the Homochitto National Forest for 6.8 miles (11 kilometers). (The proclamation boundary defines an area where the U.S. Forest Service may purchase land from willing sellers to expand the forest without further Congressional authorization.) About 5.6 miles (9 kilometers) would parallel an existing highway in a new corridor. While this would be a new land use, other land uses in the new ROW are unlikely to be substantively affected. The remainder of the pipeline through the proclamation area would be in an existing ROW.

- For the Richton site and associated infrastructure, the crude oil pipeline to Liberty, MS, would cross the Percy Quin State Park for about 0.5 miles (0.7 kilometers) in a new ROW. If one of the Richton alternatives is selected, DOE would work with the State of Mississippi to realign the pipeline to cross the park in an existing ROW where feasible. In addition, the brine disposal pipeline would pass through GUIS, between two islands that are also partially designated as a Federal wilderness area and in an area of the Mississippi Sound that is managed by the GUIS. The Pascagoula terminal, tank farm, refurbished docks, and RWI would be located at the Naval Station Pascagoula, a Base Realignment and Closure site for which the future uses have not been determined.

- For the Stratton Ridge site and associated infrastructure, approximately 3 miles (4.8 kilometers) of the RWI pipeline, brine disposal pipelines, and two power lines would cross the Brazoria National Wildlife Refuge and privately owned land in the refuge's proclamation area in the same new ROW. In addition, 4.7 miles (7.6 kilometers) of the crude oil pipeline would cross the refuge in an existing pipeline ROW. If one of the Stratton Ridge alternatives is selected, DOE would work with the USFWS to reduce these land use conflicts, such as by placing the power line underground. The Stratton Ridge site would conflict with Dow Chemical's desire to use the salt that DOE would solution mine to create SPR caverns. Dow has stated that loss of access to the salt would have a substantial adverse effect on Dow Chemical's long-term operations and the local economy.

Visual Resources

Construction activities at new SPR storage sites would result in temporary visual impacts and long-term changes in the existing landscape. These new facilities would appear industrial in nature and would conflict with surrounding natural vegetation. Any such impacts, however, would be minor because the new facilities would not be visible from residential or commercial areas and the sites would have limited public access. Expansion of the existing SPR facilities would not provide a large visual contrast with the existing landscape because of the existing industrial land use at these sites.

The construction of pipelines, power lines, and other infrastructure would have only minor visual impacts, with three exceptions:

- The development of the Bruinsburg site would have a visual impact on the historic Civil War landscape, as described in section 2.7.8.

- As described under land use conflicts above, the ROWs for several sites would cross a national parkway, national scenic trail, national forest proclamation area, state forest, or national wildlife refuge. These ROWs would affect the views in these corridors. DOE would attempt to preserve the natural landscapes in these settings by using existing ROWs where feasible, placing pipelines underground, and otherwise working with other agencies to minimize the impacts.

- For the Stratton Ridge site and associated infrastructure, the RWI would be located along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. Recreational sightseers visiting the refuge might be sensitive to change in the visual quality, even though the RWI would be outside the refuge.

Farmland

SPR development activities would cause farmland conversion by shifting the use of land to nonfarm uses. Any prime or unique farmlands located on proposed SPR storage sites, RWI facilities, and oil distribution terminals would be permanently converted to nonfarm uses because the potential use of that land for agricultural purposes would be lost. The construction of pipelines and power lines would temporarily prohibit agricultural use of farmland within the construction easement during the construction period, which would be as long as up to 6 to 10 weeks at any specific location.

To assess these potential impacts, DOE, in consultation with the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), scored all of the individual sites and all of the alternatives using the farmland conversion impact rating. This scoring system is specified in the Farmland Protection Policy Act regulations (7 CFR Part 658). It considers a wide variety of factors related to potential farmland conversion impacts, including the amount of prime or unique farmland that would be converted, the amount of statewide and locally important farmland, the use of the land and nearby land, the distance to urban built-up areas and urban support services, on-farm investments, and compatibility with existing agricultural use. Under the regulations, "sites receiving a total score of less than 160 need not be given further consideration for protection and no additional sites need to be evaluated" (40 CFR 658.4(c)(2)). While all alternatives would affect farmlands, each alternative had a score below 160 out of 260 possible points and therefore needs not be given further consideration for protection.[2]

Coastal Zone Management

The Stratton Ridge storage site and associated infrastructure would be in the coastal zone. The Bruinsburg, Chacahoula, Richton, and Bayou Choctaw storage sites would be outside the coastal zone, but some of the associated infrastructure would be in the coastal zone. The expansion site and infrastructure of Big Hill and the expansion site of West Hackberry would be in the coastal zone. DOE consulted with the coastal zone management agencies for all three states regarding compliance with the Federal Coastal Zone Management Act (CZMA). The agencies prefer that DOE coordinate its consistency determination for the selected alternative through the USACE during the Clean Water Act Section 404 wetlands permitting process. USACE would then forward the determination to the coastal zone management agencies, which would conduct a consistency review and either object or concur with DOE's determination. This process satisfies the requirements of the CZMA.

2.7.3 Geology and Soils

Local subsidence, limited to the area above the proposed storage caverns, would range from about 2.6 to 6.1 feet (0.8 to 1.9 meters) over 30 years for the Bruinsburg, Richton, or Stratton Ridge storage sites and about 5 feet (1.5 meters) for the Chacahoula storage site. Local subsidence at expansion sites would be less than 3 inches (8 centimeters) per year. These depressions on dry land might cause minor ponding in the area overlying the caverns. Depressions in wetland areas would increase the zone of saturation closer to the surface or the depth of any standing water. The new caverns would be designed to not jeopardize the structure or integrity of existing caverns on the salt domes.

[2] The location of some of the proposed sites and their infrastructure changed slightly since DOE consulted with NRCS. These minor changes would not increase the score above 160 points for any site and its infrastructure.

2.7.4 Air Quality

The proposed action would generate low emissions of criteria pollutants. Emissions levels would be below levels of concern and below conformity determination thresholds in the ozone nonattainment areas at Bayou Choctaw, Big Hill, and Stratton Ridge. At the Stratton Ridge site, the conformity review conducted for this EIS estimates that the maximum emissions of VOCs would be slightly below the threshold that triggers a full conformity determination. Thus, if one of the Stratton Ridge alternatives is selected, DOE would conduct an additional conformity review using the final site design to determine whether thresholds would be exceeded and trigger a full conformity determination.

The largest source of greenhouse gas emissions for SPR expansion is carbon dioxide emitted from construction equipment and motor vehicles, and methane emitted from cavern leaching. During construction, the maximum annual average greenhouse gas emissions associated with any alternative would be less than 0.22 million tons of carbon dioxide equivalent. The emissions during SPR operations would be smaller, about one-third as much as during construction.

2.7.5 Water Resources

The analysis of water resources addresses potential impacts to surface water, groundwater, and floodplains. Each of these topics is discussed below.

Surface Water

The proposed new and expansion sites would withdraw water from nearby surface water bodies for use in cavern solution mining. Two of the proposed new sites (Chacahoula and Stratton Ridge) and two expansion sites (Big Hill and West Hackberry) would withdraw water from the ICW. The proposed new Bruinsburg site would withdraw water from the Mississippi River. One new site (Richton) and one expansion site (Bayou Choctaw) would withdraw water from other local surface water bodies, the Leaf River and Cavern Lake, respectively. The Richton site also would withdraw water from the Gulf of Mexico if the flow of the Leaf River is low. The water withdrawal from water bodies other than the Leaf River would represent a small amount of the average available water from the water body because the water bodies are large or tidal. For the proposed Richton site, the flow rate of the Leaf River is highly variable and withdrawal has the potential to be a significant fraction of the total river flow during drought periods. The amount needed for construction of the proposed site would come from the Leaf River and would be supplemented by water from the Gulf of Mexico during low flow conditions in the Leaf River. The withdrawal from the Leaf River would stop if flow reaches the Minimum Instream Flow established by the regulatory agencies. However, if a National Emergency is declared, which requires a drawdown of oil, DOE may have to withdraw from the Leaf River even when flow is below the Minimum Instream Flow, in order to meet DOE's proposed oil drawdown rate of 1.0 MMBD.

Brine from the solution mining of the salt caverns or from filling caverns with oil would be discharged into the Gulf of Mexico from the proposed SPR facilities, with the exception of Bruinsburg, Bayou Choctaw, and West Hackberry, where brine would be injected into deep subsurface aquifers via injection wells. All of the proposed brine diffuser locations in the Gulf of Mexico would be in waters of similar depths along the coastline (i.e., 30 feet [9 meters]) with placement at a depth that would not affect navigation. Small increases in salinity levels would occur from the discharge for all sites with brine discharge into the Gulf of Mexico. Modeling indicated a maximum of 4.7 parts per thousand extending 1.5 nautical miles (2.8 kilometers) out from the diffuser. This increase would be comparable to natural salinity variations in the Gulf of Mexico. However, for the Chacahoula site, brine discharged through the proposed diffuser may tend to pool at the sea bottom due to flow restrictions. The bottom of the Gulf of Mexico slopes gently seaward at all of the proposed diffuser locations except for Chacahoula, which is located in close proximity to a shoal area (Ship Shoal). Brine plume movement for the Chacahoula brine discharge could be restricted due to the **bathymetry** resulting from the presence of the shoal area. DOE would secure National Pollutant Discharge Elimination System (NPDES) discharge permits from the appropriate state agency for the brine discharge into the Gulf.

All alternatives would involve construction of multiple pipelines that would cross surface water bodies ranging from large rivers to small streams. Construction activities across these surface water bodies may cause temporary stream bed or stream bank erosion, suspension of sediments, and possibly siltation in the water channel. The proposed pipeline surface water crossings would require a Section 404/401 permit from the USACE and appropriate state agency. These permits would require engineering methods to reduce any erosion or sediment impacts, and may require compensation for the loss of aquatic resources.

Pipelines for the Bruinsburg, Richton, and Stratton Ridge sites would pass through and may cross surface water bodies in established wellhead protection areas. These areas are established around surface water or groundwater supply sources to guard against contaminants entering the drinking water supply. Given the required permitting process and other measures that would be taken to guard against pipeline leakage, the pipelines are unlikely to discharge contamination into the wellhead protection areas.

The brine or oil discharges into surface water described above are potential impacts under Environmental Risks and Public and Occupational Safety and Health and Biological Resources.

Groundwater

As previously mentioned, brine from Bruinsburg, Bayou Choctaw, and West Hackberry would be injected into deep saline aquifers via injection wells. West Hackberry would use an existing brine injection system, which would result in a very small increased risk to the underlying sole source aquifer. Bayou Choctaw would use existing and proposed new injection wells. At Bruinsburg, DOE would construct new injection wells.

The potential for brine to leak into shallow water source aquifers is very low for all sites. Brine injection wells would be sealed and pressure-tested to ensure that leakage would not occur. DOE also would implement a shallow groundwater-monitoring program at each site to ensure protection of groundwater quality. Additionally, each site has confined aquifers that are separated by impermeable strata, so impacts to groundwater associated with the disposal of brine by deep well injection would be minimal. At Bayou Choctaw, the proposed receiving formation for injection of brine is below any aquifers containing fresh or slightly saline water. The West Hackberry expansion would use the existing SPR brine disposal facilities, which have the capacity needed for expanding the site. At Bruinsburg, the total disposal capacity of the proposed injection formations and the pressure build-up likely to occur as a result of brine injection are currently unknown. If DOE were to select one of the Bruinsburg alternatives, the total disposal capacity and pressure build-up would be determined during the development of the detailed design and adjusted accordingly. If needed, brine would be injected in both the Sparta and Wilcox formations. Brine injected into these aquifers would travel further downgradient into increasingly saline portions of the aquifers, and away from the portions of the aquifers that constitute current or potential sources of fresh water.

Pipelines associated with the Bruinsburg, Richton, and Stratton Ridge sites would cross areas with state programs (e.g., wellhead protection areas) to protect against contamination of particular groundwater sources of drinking water. Given the required permitting process and other measures that would be taken to guard against pipeline leakage, the pipelines are unlikely to discharge contamination into the wellhead protection areas.

Floodplains

A substantial portion of the proposed storage sites and associated infrastructure of each alternative would be located in the 100-year and 500-year floodplains. Between 84 acres (34 hectares) under the Richton alternatives and 307 acres (124 hectares) under the Bruinsburg alternatives of the 100-year floodplain would be permanently affected. Between 27 acres (11 hectares) under the Chacahoula or Richton alternatives and 213 acres (86 hectares) under the Stratton Ridge alternatives of the 500-year floodplain would be permanently affected. The amount of onsite construction would vary by site, with the greatest amount of floodplain disturbance at the Stratton Ridge and Bruinsburg storage sites. Offsite pipeline construction would affect floodplains only during construction. Areas would be restored to grade following construction. Pipeline construction associated with the Chacahoula alternatives would cross the largest area of floodplains.

While some impacts to flood storage and flooding attenuation would occur, impacts generally would be limited because most of the infrastructure on the affected floodplains would be built below ground. The primary impacts would result from aboveground facility construction and placing fill for the new caverns at Bruinsburg, Chacahoula, Stratton Ridge, Bayou Choctaw, and Big Hill. These fill areas, however, would each constitute only a small proportion of the total area of the floodplain where they are located. The Chacahoula, Stratton Ridge, and Big Hill sites would be located in floodplains that extend over hundreds of acres in coastal basins. The Bruinsburg and Bayou Choctaw sites would be located in an extensive floodplain area associated with the Mississippi River. Thus, fill areas developed as part of the proposed action at these sites would not have significant impact on the flood storage capacity or hydraulic function of the related floodplains.

DOE would comply fully with applicable local and state guidelines, regulations, and permit requirements regarding floodplain construction. In general, DOE would be required to evaluate the impact of placing fill or structures in the 100-year floodplain and demonstrate that the proposed fill and structures would not increase the **base flood** elevation. Based on the factors discussed above and in detail in section 3.6 and appendix B, DOE expects that overall impacts to floodplain hydraulic function, lives, and property in the area, would not be significant.

2.7.6 Biological Resources

The analysis of biological resources addresses potential impacts to wetland, threatened and endangered species, special status areas such as parks, national wildlife refuges, and EFH. Each of these topics is addressed below.

Plants, Wetlands, and Wildlife

Each alternative would result in the clearing, grading, and filling of a variety of upland and wetland communities on the salt dome, at the ancillary facilities, security buffers, and in the ROWs. Filled wetlands would cause a permanent loss of all functions and values of the wetlands. For each alternative, the construction and operation of ROWs would cause temporary impacts to wetlands within the construction easement, such as by clearing and equipment use, and permanent impacts within the permanently maintained ROW, such as by converting forested or scrub-shrub wetland communities to emergent wetlands. The impacts to wetlands within the ROWs and security buffer would include the loss or impairment of some wetland functions and values, such as aesthetics, some wildlife habitat, water quality, and biological productivity. Other functions and values, such as flood attenuation, groundwater recharge, some wildlife habitat and food production, may not be affected.

DOE would complete a wetland delineation for the selected alternative and secure a jurisdictional determination or confirmation of the wetlands boundaries from the USACE. For all filling of wetlands, temporary construction disturbance, and permanent conversion of wetlands from one type to another, DOE would secure a Clean Water Act Section 404/401 permit from the USACE and appropriate state agency. The impact to wetlands for each alternative other than the no-action alternative would be a potential adverse effect. DOE would prepare a wetland compensation plan to mitigate the impacts to wetlands, as described in appendix B, section B.4 and appendix O.

Table 2.6.6-1 summarizes potential wetland acreage affected by each alternative with three expansion sites: Bayou Choctaw, Big Hill, and West Hackberry. In this table, the potentially affected wetland acreage is listed for forested, scrub-shrub, and emergent or other types of wetlands at the SPR storage sites, associated ancillary facilities, security buffers, and ROWs (such as for each site's associated utility lines, access roads, and pipelines for RWI, brine disposal, and crude oil). In table 2.6.6-1:

- **Permanently Lost (Filled) Wetlands** are wetlands that would be filled to support wellheads and other structures.

- **Permanently Converted and/or Periodically Disturbed Wetlands** are wetlands within a security buffer or permanently maintained ROW. Forested and scrub-shrub wetlands would be permanently converted to emergent wetlands by cutting trees and shrubs. Emergent wetlands would re-establish in these areas, but periodic clearing would prevent trees and shrubs from growing back. This category also includes emergent wetlands that would be cleared during construction and periodically disturbed by maintenance clearing activities.

- **Temporarily Affected Wetlands** are wetlands that would be temporarily affected by construction in a ROW, such as wetlands within a temporary construction easement. Forested, scrub-shrub, and emergent wetlands would be cleared, but would be allowed to re-establish. Wetlands could be disturbed by construction activities such as equipment and material storage, construction traffic, and some grading. DOE would restore original contours, replace the original hydric topsoil in the disturbed area where practical, and seed with native species. Re-establishment of scrub-shrub or forested wetlands may take 5 to 25 years depending on the type of wetland affected. Emergent and other wetland types would return to the pre-existing conditions shortly after restoring original contours, seeding, and implementation of best management practices.

Appendix B presents a detailed discussion of the wetland types and impacts associated with each site and alternative.

The Bruinsburg alternatives would potentially affect about 708 acres (287 hectares) of wetlands. This includes a permanent loss through filling of about 156 acres (63 hectares) and a permanent conversion of about 123 acres (50 hectares) of relatively rare and ecologically important forested wetlands. About 118 acres (48 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROWs.

The Chacahoula alternatives would potentially affect 2,502 acres (1,013 hectares) of wetlands. About 182 acres (74 hectares) of ecologically important forested wetlands would be filled and about 699 acres (283 hectares) of forested wetlands would be permanently converted to emergent wetland. About 503 acres (204 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROW.

Table 2.6.6-1: Potential Acreage of Wetlands Affected by Alternatives with Three Expansion Sites

Alternative[a]	Permanently Lost (Filled) Wetlands			Permanently Converted and/or Periodically Disturbed Wetlands			Temporarily Affected Wetlands			Total Potentially Affected Wetlands
	Forested	Scrub-Shrub	Emergent/ Other Wetlands[b]	Forested Converted to Emergent	Scrub-Shrub Converted to Emergent	Emergent/ Other Wetlands[b] Periodically Disturbed	Forested	Scrub-Shrub	Emergent/ Other Wetlands[b]	
Bruinsburg	156	9	7	123	26	81	118	28	160	708
Chacahoula	182	0	11	699	22	366	505	34	683	2502
Richton	59	0	54	295	79	163	506	114	287	1557
Stratton Ridge	227	16	49	70	8	183	9	4	275	841

[a] Under the alternatives with two expansion sites (Bayou Choctaw and Big Hill, but not West Hackberry), the amount of permanently converted scrub-shrub wetlands and the total acreage of potentially affected wetlands would be lower by 5 acres.

[b] Emergent/other wetlands include the following type of wetlands: Palustrine – emergent, Estuarine – emergent, Palustrine – aquatic bed, Lacustrine, Riverine, Marine, Palustrine – unconsolidated bottom, and Palustrine – open water.

The Richton alternatives would potentially affect 1,557 acres (630 hectares) of wetlands. The majority of the wetland areas affected (more than 1,400 acres [583 hectares]) in association with the Richton alternatives would be located in the long pipeline ROWs, which total over 200 miles and which pass through forested and emergent wetlands. The Richton alternatives would permanently fill about 59 acres (24 hectares) of forested wetlands and about 295 acres (119 hectares) of forested wetlands would be permanently converted to emergent wetlands. About 506 acres (205 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROWs.

The Stratton Ridge alternatives would potentially affect 841 acres (349 hectares) of wetlands. This includes a permanent loss through filling of 227 acres (92 hectares) of relatively rare and ecologically important forested wetlands. About 70 acres (28 hectares) of forested wetlands would be permanently converted to emergent wetlands. About 9 acres (4 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROWs.

The potential impacts of a brine or oil discharge into surface water was discussed above under Environmental Risks and Public and Occupational Safety and Health.

Threatened and Endangered Species

Each new site and associated infrastructure may affect one to five federally listed species. No federally listed endangered or **threatened species** would be affected at expansion sites. The following summarizes potential impacts for the proposed new sites.

<u>Bruinsburg Site and Associated Infrastructure</u>

- Fat pocketbook mussel, a federally endangered species, may be affected by the Bruinsburg ROW in-stream construction in Coles and Fairchild creeks.

- Pallid sturgeon, a federally endangered species, may be affected by the in-river construction and operation of the Bruinsburg RWI structure.

<u>Chacahoula Site and Associated Infrastructure</u>

- Bald eagle, a federally threatened species, may be affected by the development and operation of the Chacahoula site and construction along the Chacahoula ROWs. Potential foraging, roosting, and nesting habitat may be impacted.

- Brown pelican, a federally endangered species, may be affected by the construction along the Chacahoula ROW to LOOP. Roosting habitat may be affected.

<u>Richton Site and Associated Infrastructure</u>

- Gopher tortoise, a federally threatened species, may be affected by the construction along the Richton ROWs, which may result in a loss of habitat and tortoises.

- Black pine snake, a Federal candidate species, may be affected by the construction along the Richton ROWs, which may result in a loss of habitat and snakes.

- Yellow blotched map turtle, a federally listed species, may be adversely affected by the in-water construction and operation of the Richton RWI structure on the Leaf River. A loss of habitat, impingement and entrainment of juvenile turtles, and alteration of the hydrologic regime or water quality in the Leaf River may occur.

- Gulf sturgeon, a federally listed species, may be adversely affected by the in-water construction and operation of the Richton RWI structure at the Leaf River, and may be affected by the brine discharge pipeline in the Mississippi Sound and the operation of the RWI at Pascagoula. The RWI may adversely affect designated **critical habitat** and may adversely affect the population through impingement and entrainment of eggs and juvenile sturgeon and alteration of water quality and the hydrologic regime in the Leaf River.

- Pearl darter, a Federal candidate species, may be adversely affected by the in-water construction and operation of the Richton RWI structure. The RWI may result in a loss of habitat, impingement and entrainment of pearl darters, or alteration of the water quality and hydrologic regime in the Leaf River.

Stratton Ridge Site and Associated Infrastructure

- Bald eagle, a federally threatened species, may be affected by the development and operation of the Stratton Ridge site. Construction along the Stratton Ridge ROWs may affect potential foraging, roosting, and nesting habitat.

In accordance with Section 7 of the ESA, DOE has consulted with the USFWS and has identified the federally listed species that the proposed action would not affect and the federally listed species that the proposed action may affect. Upon the selection of an alternative, DOE would continue consultations with USFWS and NOAA Fisheries in accordance with Section 7 of the ESA.

Special Status Area

Expansion sites and the Chacahoula site and associated infrastructure would not affect any special status areas. The Bruinsburg site and associated infrastructure would involve a ROW crossing of the Natchez Trace Parkway. In addition, the crude oil ROW to Peetsville for the Bruinsburg site would pass through the proclamation area of the Homochitto National Forest. The Richton site and associated infrastructure would involve a ROW crossing of the Percy Quin State Park and the brine discharge pipeline would cross a managed area of the GUIS Seashore. The Stratton Ridge site would involve two ROWs that would pass through the Brazoria National Wildlife Refuge. The biological impacts on the special status areas would include temporary and permanent changes in the vegetative communities along the construction and permanent ROWs, respectively.

For issues involving the Natchez Trace Parkway, Homochitto National Forest, Brazoria National Wildlife Refuge, GUIS, and Percy Quin State Park, DOE would coordinate with the National Park Service (NPS), the U.S. Forest Service, the USFWS, NOAA Fisheries, and Mississippi to minimize the impacts to important natural resources.

Essential Fish Habitat

The Big Hill, Chacahoula, Richton, and Stratton Ridge sites would require developing new offshore brine disposal systems and pipelines and structures that could affect onshore and offshore EFH. The underwater construction of an offshore brine pipeline and diffuser for these sites would pass through EFH and would temporarily increase suspended sediments and cause marine species to leave the area. Construction of onshore pipelines and some RWI structures would temporarily affect **estuarine** and tidally influenced palustrine wetlands in a similar manner. Some EFH would be permanently destroyed with the construction of RWI structures on the ICW and a terminal and RWI structure at Pascagoula for the Richton alternatives.

The operation of the offshore diffusers would cause minor increases in the salinity concentrations under the Chacahoula, Stratton Ridge, and Richton alternatives around discharge points in the Gulf of Mexico. The estimated salinity concentrations would increase by up to 4.7 parts per thousand around the diffusers and would affect EFH. Some marine species may avoid the areas with increased salinity concentrations; however, the increase in the salinity concentration would typically be within the normal salinity concentration range of the Gulf of Mexico. Appendix C discusses the brine plume modeling that DOE completed and appendix E describes potential impacts associated with onshore and offshore construction and brine diffusion on EFH.

2.7.7 Socioeconomics

The proposed action would require a peak construction work force of approximately 230 to 550 employees at the new storage site and infrastructure, plus another 250 to 350 employees for the expansion sites and their infrastructure. The operations workforce would be about 75 to 100 employees at each site and about 25 additional employees at each expansion site. This employment would create positive local economic benefits under all alternatives.

While the proposed storage sites and infrastructure generally are located in or near rural communities, they are close (e.g., 20 to 45 miles [32 to 72 kilometers]) to more populated urban areas. Most workers would come from these relatively close areas. **In-migration** to the areas near the storage sites would be small relative to the regional population. Thus, the proposed action would create no noticeable increase in competition for labor, traffic, or demand for housing and public infrastructure and services.

The development of the Stratton Ridge site could cause a loss of jobs if Dow Chemical would be unable to access the salt that DOE would solution mine to create SPR caverns.

2.7.8 Cultural Resources

The proposed action would have the potential to damage or destroy archaeological sites, Native American cultural sites, or historic buildings or structures or to change the characteristics of a property that would diminish qualities that contribute to its historic significance or cultural importance. Native American archaeological sites have been recorded or may be present at all of the proposed new and expansion sites and associated pipelines and other infrastructure.

SPR development at the Bruinsburg site could result in potential adverse effects on the historic setting of the Civil War landing of the Union Army in Mississippi and an associated route of troop movements in an area that could become eligible for the National Register of Historic Places as a core study area. The floodplain where the Bruinsburg storage caverns would be developed is the site where the Union Army, under General Grant, disembarked after crossing the Mississippi River on April 30, 1863, to begin the invasion of Mississippi that culminated in the surrender of Vicksburg on July 4, 1863. A portion of the Bruinsburg site is likely to contain archaeological remains of troop presence. Remains of at least one of the ships that sank during the invasion are likely to lie northwest of the facility boundary. The historic Bruinsburg Road is reportedly still visible on the floodplain and along the route of the climb up to the escarpment.

Construction activities on the floodplain where the Bruinsburg storage caverns would be built might affect remains associated with the troop landing or prehistoric sites and would affect the setting and feeling of the troop-landing site. Construction activities on the escarpment where the rest of the storage site facilities would be built could affect remains associated with the historic line of the march of the Vicksburg campaign or prehistoric sites.

Under the terms of a programmatic agreement with the State Historic Preservation Officer (SHPO) in each state and the Advisory Council on Historic Preservation, DOE would identify and resolve adverse effects to historic properties in locations selected for expansion or new development. At those locations, DOE would conduct field reconnaissance and additional documentary research and consultations as appropriate to identify cultural resources including historic properties, that is, archaeological or historical sites, structures, districts, or landscapes that are eligible for listing in the National Register of Historic Places. For identified historic properties, DOE would assess potential project effects and resolve adverse effects in consultation with the SHPOs and the tribes that are concurring parties to the programmatic agreement.

Resolution of adverse effects may include measures such as rerouting a pipeline segment or shifting a surface facility footprint to avoid a **historic property**, thus no longer affecting it. Where avoidance is not possible, measures to mitigate disturbance or destruction of historic properties may include data recovery from an archaeological site or detailed documentation of a building or structure sufficient for the Historic American Buildings Survey or Historic Architectural and Engineering Records. These efforts might be followed with preparation of educational materials written to inform the public about the information gained from archaeological excavations or drawings and photographs of historic structures or other resources. Measures to address visual impacts or other alterations to the setting and feeling of an historic property might include use of vegetation or other methods to screen project facilities from visitors to the historic property. If screening is not possible, the preconstruction setting might be documented with photographs or video, with the resulting materials used to provide public access through interpretive displays or deposition in historical archives.

Specific to the Bruinsburg alternatives, several measures could mitigate the effects of altering the setting at the Union Army troop-landing site, which is already changed from the original site because the river channel moved westerly and the town of Bruinsburg was abandoned. The mitigation measures could include improved access for history students to the area by the access road to the new facility, possibly including construction of a viewpoint on the descent of the escarpment. In addition, another mitigation measure might be financial support to the NPS interpretive program. Currently, access is possible only by special permission from the private landowner; interpretive signs are posted only along public roads, not at the actual site. Damage or destruction of archaeological remains associated with the landing and troop movements would be mitigated through avoidance, if possible, or data would be recovered if damage or destruction of the remains were not avoidable. The current conceptual design for the site, with most buildings and other surface structures on the escarpment, would minimize the effect on the landing area.

2.7.9 Noise

Noise from constructing the proposed storage sites would be audible to the closest receptors for the proposed new and expansion storage sites. The estimated noise levels, however, would have minor impacts because the noise levels would be only slightly greater than the estimated ambient noise levels. The construction noise impacts along the pipelines and at other infrastructure locations also would be small. The level of noise from operations and maintenance activities would be lower than from construction activities. At several proposed storage sites, the noise levels would not be audible, that is, they would be lower than estimated ambient noise levels.

2.7.10 Environmental Justice

The potentially affected populations for each alternative include low-income, Black or African American, Native American or Alaska Native, Asian, and Hispanic or Latino populations. The Stratton Ridge site and associated infrastructure also includes Native Hawaiian or Other Pacific Islander populations. None of these populations would have impacts that appreciably exceed the impacts to the general population. Furthermore, none of the populations would be affected in different ways than the general population, such as by having unique exposure pathways, unique rates of exposure, or special sensitivities, or by using natural resources differently. Thus, there would be no disproportionately high and adverse impacts to minority or low-income populations.

2.7.11 Comparison of Alternatives

This section contains two tables that identify potential impacts in each resource area.

- Table 2.7.11-1 describes the potential impacts for each alternative with three expansion sites, which would be Bayou Choctaw, Big Hill, and West Hackberry, and for the no-action alternative.

- Table 2.7.11-2 addresses the difference between the alternatives in the first table (excluding the no action alternative), which have three expansion sites, and the remaining alternatives, which have just two expansion sites. In other words, the second table focuses on the differences associated with not expanding West Hackberry and increasing the expansion capacity at Big Hill. (It does not address Bayou Choctaw because the same expansion capacity would be developed at this site under both sets of alternatives.) As shown in the table, the differences between having three versus two expansion sites would be the same for each alternative.

Table 2.7.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Environmental Risks and Public and Occupational Safety and Health	Possible oil spills during initial fill. 16 oil spills predicted. Possible brine spills during the solution mining of caverns and fill. 91-98 brine spills predicted. Most oil, brine, or hazardous materials spills would be small and occur at storage sites where they would be controlled and kept from sensitive areas. Project lifetime risks would be low. Low likelihood of fire, based on historical operating data for existing SPR sites. There have been approximately 10 reportable fire incidents at SPR sites since 1992. None resulted in environmental impacts or long-term consequences to SPR operations. Number of occupational injuries (0.83 workdays per 200,000 worker hours) would be less than similar industries, based on SPR experience.	Same impacts as under Bruinsburg alternative.	Same impacts as under Bruinsburg alternative. In addition, additional possible brine spills if water from Leaf River is supplemented with water from Gulf of Mexico for cavern development or drawdown.	Same impacts as under Bruinsburg alternative.	No impact.
Land Use: Land Use Conflicts	3,485 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs. Potential minor conflict where pipeline would cross Natchez Trace National Scenic Trail and Natchez Parkway in an expanded existing ROW and where pipeline would cross 6.8 miles of proclamation area of Homochitto National Forest.	2,901 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs. No potential land use conflicts.	4,495 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs. The terminal, tank farm, refurbished docks, and RWI at Pascagoula would be at a the former Naval Station Pascagoula, a Base Realignment and Closure site for which the future uses have not been determined.	2,206 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs. Potential conflict with Dow Chemical's desire to use same salt. Potential conflict where the pipelines and power lines would cross 3 miles and pipeline would cross 4.7 miles of Brazoria National Wildlife Refuge in existing and new ROWs, respectively.	No impact.
Land Use: Visual Resources	Potential visual impacts due to changes in historic Civil War landscape. Potential changes in vegetation where Bruinsburg pipeline ROW would cross Natchez Trace National Scenic Trail, Natchez Trail Parkway, and proclamation area of Homochitto National Forest.	No substantial visual impacts because of limited changes in viewshed, limited access, and lack of proximity to areas with visual sensitivity.	Same visual impacts as Chacahoula. Brine discharge pipeline would cross GUIS Managed Area.	Potential visual impact due to changes in vegetation and new power lines from ROW across Brazoria National Wildlife Refuge. Potential visual impacts from RWI across ICW from the Refuge.	No impact.
Land Use: Farmland Conversion	Would not have a substantial impact in converting prime and unique farmland to non-agricultural use. Farmland impact score under Farmland Protection Act regulations (7 CFR Part 658) is below level where further consideration of farmland protection is required.	Same farmland conversion impact as under Bruinsburg alternative.	Same farmland conversion impact as under Bruinsburg alternative.	Same farmland conversion impact as under Bruinsburg alternative.	No impact.
Land Use: Coastal Zone Management	The Bruinsburg site and associated infrastructure would not be in the coastal zone. The Big Hill site and infrastructure and West Hackberry site and infrastructure would be in coastal zones. DOE and the state coastal zone agency would use the Clean Water Act Section 404 wetlands permitting process to reach a determination on coastal consistency.	Some of the Chacahoula infrastructure, Big Hill site and infrastructure, and West Hackberry site and infrastructure would be in coastal zones. Same coastal zone determination process as under Bruinsburg alternative.	Some of the Richton infrastructure, Big Hill site and infrastructure, and West Hackberry site and infrastructure would be in coastal zones. Same coastal zone determination process as under Bruinsburg alternative.	The Stratton Ridge site and infrastructure, Big Hill site and infrastructure, and West Hackberry site and infrastructure would be in coastal zones. Same coastal zone determination process as under Bruinsburg alternative.	No impact.
Geology and Soils	Potential minor surface subsidence (2.6 to 6.1 feet over 30 years) at the Bruinsburg site. Cavern construction and use would not interfere with use of other caverns on the salt dome. Local subsidence at expansion sites would be less than 3 inches per year.	Potential minor surface subsidence (approximately 5 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. Local subsidence at expansion sites would be less than 3 inches per year.	Potential minor surface subsidence (2.6 to 6.1 feet, over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. Local subsidence at expansion sites would be less than 3 inches per year.	Potential minor surface subsidence (2.6 to 6.1 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. Local subsidence at expansion sites would be less than 3 inches per year.	No potential subsidence, except at new and existing sites where natural geologic conditions or current or future infrastructure would contribute to local subsidence.

Table 2.7.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Air Quality	Low airborne emission levels from construction activities would not exceed National Ambient Air Quality Standards. Emissions levels would be below levels of concern, including below conformity determination thresholds in the ozone nonattainment areas at Bayou Choctaw and Big Hill. Low levels of emissions of greenhouse gases from construction equipment and motor vehicles.	Same air quality impacts as under Bruinsburg alternative.	Same air quality impacts as under Bruinsburg alternative.	Same as Bruinsburg, except that emission levels of volatile organic compounds would be just below the conformity determination threshold in the ozone nonattainment areas at Stratton Ridge. Because estimated levels are only slightly below the level that triggers a conformity determination process, DOE would conduct additional analysis based on the detailed design if one of the Stratton Ridge alternatives is selected.	No impact.
Water Resources: Surface Water	Construction activities would cause temporary and minor erosion and sedimentation. DOE would secure an Erosion and Sediment Control Permit and NPDES stormwater permit for construction activities.	Same erosion and sedimentation impacts as under Bruinsburg alternative.	Same erosion and sedimentation impacts as under Bruinsburg alternative.	Same erosion and sedimentation impacts as under Bruinsburg alternative.	No impact.
	DOE would also secure a Clean Water Act Section 404 permit and Section 401 Water Quality Certificate for construction activities in jurisdictional water bodies.	Same requirements as under Bruinsburg alternative for construction activities in jurisdictional water bodies.	Same requirements as under Bruinsburg alternative for construction activities in jurisdictional water bodies.	Same requirements as under Bruinsburg alternative for construction activities in jurisdictional water bodies.	
	Construction and operation would potentially affect 35 water bodies for the Bruinsburg site and infrastructure and 12, 4, and 3 water bodies for the expansions at Bayou Choctaw, Big Hill, and West Hackberry, respectively.	Chacahoula site and infrastructure would potentially affect 18 water bodies. Same water bodies for expansion sites as under Bruinsburg alternative.	Richton site and infrastructure would potentially affect 63 water bodies. Same water bodies for expansion sites as under Bruinsburg alternative.	Stratton Ridge site and infrastructure would potentially affect 17 water bodies. Same water bodies for expansion sites as under Bruinsburg alternative.	
	There would be a potential for significant adverse water quality impacts if a brine or oil release occurred and traveled into a water body. The risk of such a release is small based on the history of existing SPR facilities.	Same spill risk as under Bruinsburg alternative.	Same spill risk as under Bruinsburg alternative.	Same spill risk as under Bruinsburg alternative.	
	Bruinsburg RWI would withdraw from the Mississippi River 50 million gallons per day for 4 to 5 years, which is a small fraction of the river's flow.	Chacahoula RWI would withdraw 50 million gallons per day for 4 to 5 years from the ICW, a tidally influenced water body. Withdrawal would not significantly change the ICW water flow or volume, but may cause a slight upstream migration of the salinity gradient by less than 1 part per thousand.	Richton RWI would withdraw 46 million gallons per day from the Leaf River during normal and high flow conditions. During low flow conditions, DOE would supplement the Leaf River withdrawal with up to 23 million gallons per day from the Gulf of Mexico to withdraw a total of up to 46 million gallons per day. Regulatory agencies would establish a Minimum Instream Flow for the Leaf River. DOE also would secure a Beneficial Use of Public Waters Permit from Mississippi. DOE would terminate Leaf River withdrawals if the flows reach the Minimum Instream Flow, except during an oil drawdown that is required by a National Emergency. The Leaf River withdrawal during drawdown may have an adverse effect on water resources. If DOE is required to limit its withdrawals from the Leaf River during cavern construction, the construction period may extend beyond 4 to 5 years because the volume of water from the Gulf of Mexico may be smaller than the reduction in the volume from the Leaf River and a greater volume of saltwater than freshwater is needed in solution mining.	Stratton Ridge RWI would withdraw 42 million gallons per day for 4 to 5 years from the ICW, a tidally influenced water body. Withdrawal would not significantly change the ICW water flow or volume, but may cause a slight upstream migration of the salinity gradient by less than 1 part per thousand.	

Table 2.7.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Water Resources: Surface Water (continued)	Big Hill and West Hackberry expansions would use existing RWIs from the ICW, a tidally influenced water body, without changing existing water body conditions. Bayou Choctaw would withdraw 25 million gallons per day from Cavern Lake, which is fed by the ICW, for up to 3 years. Withdrawals would not significantly alter the flow or volume of water, but may cause a slight upstream migration of the salinity gradient by less than 1 part per thousand.	The impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be same as under Bruinsburg alternative.	Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be same as under Bruinsburg alternative.	Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be same as under Bruinsburg alternative.	
	Big Hill expansion would discharge brine into Gulf of Mexico using existing brine diffusers and within existing NPDES permitted limits. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge, but increase would be within natural salinity variation.	Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative.	Impact of Big Hill brine discharge would be the same as under Bruinsburg alternative.	Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative.	
Water Resources: Groundwater	Bruinsburg pipelines would cross multiple source water protection areas with programs protecting against contaminating groundwater that is used as a source of drinking water; however, risk of groundwater contamination from pipeline spills would be low.	Chacahoula pipelines would not cross source water protection areas.	Richton pipelines would be constructed through and adjacent to several source water protection areas; however, risk of groundwater contamination from pipeline spills would be low.	Stratton Ridge pipelines would be constructed through and adjacent to several areas serving public water systems or important to groundwater recharge; however, risk of groundwater contamination from pipeline spills would be low.	No impact.
	Bruinsburg, Bayou Choctaw, and West Hackberry would use deep-aquifer brine injection. These sites have confined aquifers separated by impermeable strata. The proposed brine injection wells would be permitted by U.S. EPA and/or appropriate state agency.	Bayou Choctaw and West Hackberry would use deep-aquifer brine injection. These sites have confined aquifers separated by impermeable strata. The proposed brine injection wells would be permitted by U.S. EPA and/or appropriate state agency.	Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative.	Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative.	
	At Bruinsburg, the total disposal capacity of the proposed injection formations and the pressure build-up likely to occur as a result of brine injection are currently unknown. If DOE were to select one of the Bruinsburg alternatives, the total disposal capacity and pressure build-up would be determined during the development of the detailed design, which would be adjusted accordingly.				
Water Resources: Floodplains	Construction of Bruinsburg storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 307 acres of 100-year floodplain and 49 acres of 500-year floodplain. Buildings at Bruinsburg would not be in floodplain. Wellheads, well pads, and roads would involve placing fill or infrastructure in a floodplain.	Construction of Chacahoula storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 185 acres of 100-year floodplain and 27 acres of 500-year floodplain, much of which would be filled. Some interior areas of the storage site would not be filled and would retain their flood storage capacity. The entire storage site at Chacahoula is located in a vast floodplain that extends to the Gulf of Mexico.	Construction of Richton storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 84 acres of 100-year floodplain and 27 acres of 500-year floodplain. Construction of tanks and other infrastructure at Pascagoula terminal would involve placing fill within a floodplain.	Construction of Stratton Ridge storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 165 acres of 100-year floodplain and 213 acres of 500-year floodplain. Wellheads, well pads, and roads would involve placing fill or infrastructure in a floodplain.	No impact.
	DOE would comply with floodplain protection requirements during design and construction so that the base flood elevation and downstream land uses would not be significantly affected.	Site floodplain requirements and impacts would be same as under Bruinsburg alternative.	Site floodplain requirements and impacts would be same as under Bruinsburg alternative.	Site floodplain requirements and impacts would be same as under Bruinsburg alternative.	
	ROWs for the Bruinsburg site and 3 expansion sites would temporarily affect 49 miles of 100-year floodplain and 7 miles of 500-year floodplain. Floodplain would not be permanently affected by the ROWs because no aboveground fill or structures would be placed in the floodplain after construction is complete.	ROWs for the Chacahoula site and 3 expansion sites would temporarily affect 110 miles of 100-year and 3 miles of 500-year floodplain.	ROWs for the Richton site and 3 expansion sites would temporarily affect 46 miles of 100-year floodplain and 6 miles of 500-year floodplain.	ROWs for the Stratton Ridge site and 3 expansion sites would temporarily affect 60 miles of 100-year and 11 miles of 500-year floodplain.	

Table 2.7.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Water Resources: Floodplains (continued)	The filling and loss of floodplain area would reduce the flood storage area in the immediate watershed, and cumulatively in the larger watersheds. Floodplain area loss also would result in loss of habitat for certain species as the filling would alter the existing habitat and ecosystem. Permits may require that any loss of floodplains be compensated for in another area within the watershed.	ROW floodplain impacts would be same as under Bruinsburg alternative.	ROW floodplain impacts would be same as under Bruinsburg alternative.	ROW floodplain impacts would be same as under Bruinsburg alternative.	
Biological Resources: Wetlands	Construction of Bruinsburg storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 172 acres of wetlands, including 91 acres of ecologically important palustrine forested wetland for the Bruinsburg storage site area. The type of palustrine forested wetland is bald cypress forest, which is relatively rare and ecologically and economically important.	Construction of Chacahoula site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 193 acres of wetlands, including 128 acres of relatively rare and ecologically important palustrine forested wetland for the Chacahoula storage site area. The type of palustrine forested wetland is bald cypress forest, which is relatively rare and ecologically and economically important.	Construction of Richton storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 113 acres of wetlands, including 43 acres of disturbed low value estuarine wetlands at the Pascagoula terminal site.	Construction of Stratton Ridge storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 292 acres of wetlands, including up to 192 acres of ecologically important palustrine forested wetland for the Stratton Ridge storage site area. The type of palustrine forested wetland is bottomland hardwood, which is relatively rare and ecologically important.	No impact.
	Security buffer at Bruinsburg, West Hackberry, and Big Hill storage sites would cause a permanent conversion of 19 acres of forested and scrub-shrub wetlands to emergent wetlands.	The clearing of an additional 213 acres of palustrine forested wetlands is necessary for the security buffer at Chacahoula. The security buffer at West Hackberry and Big Hill would cause permanent conversion of 7 acres to emergent wetlands or open water.	Security buffer at Richton, Big Hill, and West Hackberry storage sites would cause a permanent conversion of 9 acres of forested and scrub-shrub wetlands to emergent wetlands.	Security buffer at Stratton Ridge, West Hackberry, and Big Hill storage sites would cause a permanent conversion of 80 acres of forested and scrub-shrub wetlands to emergent wetlands.	
	Proposed ROWs for Bruinsburg and 3 expansion sites would affect 211 acres of wetlands within the permanently maintained easement and 306 acres within the temporary construction easement.	Proposed ROWs for Chacahoula and 3 expansion sites would affect 867 acres of wetlands within the permanently maintained easement and 1,222 acres within the temporary construction easement.	The proposed ROWs for Richton and the 3 expansion sites would affect 527 acres of wetlands within the permanently maintained easement and 907 acres within the temporary construction easement.	The proposed ROWs for Stratton Ridge and the 3 expansion sites would affect 181 acres of wetlands within the permanently maintained easement and 288 acres within the temporary construction easement.	
	Wetlands in the permanently maintained easement would be converted to emergent wetlands and would be periodically maintained to suppress woody species. Wetlands within the temporary construction easement would be cleared during construction, but would re-establish within 5-25 years depending on the type of wetland affected.	The general nature of the wetland impacts and re-establishment periods would be same as under Bruinsburg alternative.	The general nature of the wetland impacts and re-establishment periods would be same as under Bruinsburg alternative.	The general nature of the wetland impacts and re-establishment periods would be same as under Bruinsburg alternative.	
	Impact from permanent filling of wetlands and permanent conversion would be a potentially adverse effect because of the size and the regional importance of the forested wetlands, but would be mitigated. DOE would complete a wetland delineation, secure a jurisdictional determination, and secure Clean Water Act Section 404/401 permit for all impacts to wetlands. DOE would develop a comprehensive plan to further avoid and minimize wetland impacts and to mitigate for unavoidable impacts to wetlands by creating, restoring, or preserving wetlands, contributing a fee in lieu of creating, restoring, or preserving wetlands, or purchasing credits from a mitigation bank.	The impact from the permanent filling of wetlands and permanent conversion would be same as under Bruinsburg alternative.	The impact from ROWs is a potentially adverse effect because of the size of the area (over 600 acres) of palustrine forested and scrub-shrub wetlands. The impact would be mitigated. DOE would undertake the same wetland mitigation activities as under Bruinsburg alternative.	The impact from the permanent filling of wetlands and permanent conversion is a potentially adverse effect because of the size and the regional importance of the forested wetlands. Some of the forested wetlands at the Stratton Ridge site have relatively low ecological value because of invasion by exotic plants and animals. DOE would undertake the same wetland mitigation activities as under Bruinsburg alternative.	

Table 2.7.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Biological Resources: Threatened and Endangered Species	Proposed ROW for Bruinsburg may affect the fat pocketbook mussel, a federally endangered species, which may be present in Coles and Fairchild Creeks. Proposed RWI for the Bruinsburg site may affect the pallid sturgeon, a federally endangered species that lives in the Mississippi River, because of the potential for impingement and entrainment of juvenile sturgeon. DOE would initiate formal ESA Section 7 Consultations with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect these species or designated critical habitat.	Proposed site storage area for the Chacahoula site and all proposed ROWs may affect the bald eagle, a federally threatened species that is proposed for de-listing, by removing potential foraging, roosting, and nesting habitat. Proposed ROW for the crude oil pipeline to Clovelly may affect the brown pelican, which is a federally endangered species. The brown pelican has roosting habitat near the proposed ROW. DOE would initiate formal ESA Section 7 Consultations with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect these species or designated critical habitat.	The proposed storage site, ROWs, and RWI may affect the federally threatened gopher tortoise and the Federal candidate black pine snake. Potential impacts include loss of habitat or individuals from the construction. The proposed RWI at Pascagoula and brine discharge pipeline would be located in designated critical habitat for the Gulf sturgeon in the Mississippi Sound. Proposed RWI on Leaf River may adversely affect the federally listed yellow blotched map turtle and Gulf sturgeon, and the Federal candidate pearl darter. The adverse affect may occur because of the potential for impingement and entrainment of individuals and because the withdrawal could change the hydrological regime and water quality preferred by these species. RWI would be located within the segment of the Leaf River, which is designated as critical habitat for the Gulf sturgeon. DOE has modified the conceptual plan for the Leaf River RWI structure to reduce the potential for impingement and entrainment of aquatic species. To mitigate, regulatory agencies would establish a Minimum Instream Flow and DOE would develop a Water Conservation Plan in consultation with the regulatory agencies that protects the listed and candidate species. The withdrawal from the Leaf River would be supplemented by a withdrawal from the Gulf of Mexico at Pascagoula during low flow conditions in the Leaf River. The Pascagoula RWI may affect the federally listed Gulf Sturgeon. The withdrawal from the Leaf River would be terminated if the flows reach the Minimum Instream Flow, except during oil drawdown under a National Emergency. DOE would initiate formal ESA Section 7 consultations with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect a listed species or designated critical habitat.	The proposed site storage area for the Stratton Ridge site, ROWs, and RWI may affect the bald eagle, a federally threatened species that is proposed for de-listing, by removing potential foraging, roosting, and nesting habitat. The bald eagle has not been reported within the corridor. DOE would initiate formal ESA Section 7 consultations with USFWS and prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect these species or designated critical habitat.	No impact.
	Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.	Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.	Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.	Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.	
Biological Resources: Special Status Areas	The pipeline ROW to the Peetsville terminal would cross Natchez Trace Parkway, which is managed by the NPS. The proposed ROW follows existing utility and road corridors and is already disturbed. DOE would coordinate with the NPS to minimize the impacts to important natural resources.	No special status areas would be affected by this alternative.	Pipeline to Liberty terminal would pass through 0.5 miles of the Percy Quin State Park. DOE would coordinate with the State Park to select a route that would minimize the impacts to important natural and recreational resources. Brine disposal pipeline would cross managed area of the GUIS. The easement for the pipeline ROW would require a permit/consent from GUIS. DOE would coordinate with the NPS to minimize impacts to fish and wildlife resources and secure approval for the easement.	Crude oil pipeline ROW to Texas City and RWI, brine, and power line ROW would each pass through a portion of the Brazoria National Wildlife Refuge. RWI would be located across the ICW from the Refuge. RWI construction and operations may affect sensitive wildlife and migrating birds that inhabit or stop at the Refuge. DOE would coordinate with USFWS and negotiate a final route and construction approach that minimizes the impact to natural resources. DOE would bury the power line through the Refuge and use noise attenuation, down-shielded and low mast lighting at RWI to minimize impacts.	No impact.

Table 2.7.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Biological Resources: Special Status Areas (continued)	Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas.		Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas.	Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas.	
Biological Resources: Essential Fish Habitat	Big Hill expansion would cause minor salinity changes from the brine discharge to a small area of EFH in the Gulf of Mexico (modeling indicated a maximum increase of 4.7 parts per thousand). Impact to EFH would not be adverse because the increase in salinity would typically be within the natural variability. Impacts to EFH would be temporary; the potentially affected area would represent a very small fraction of the total EFH in the Gulf of Mexico; and the dependent fishery species are generally tolerant of wider salinity changes than the predicted increase due to the brine discharge. Big Hill expansion would cause a temporary impact to about 5 acres of EFH due to pipeline construction.	Big Hill expansion site would have EFH impacts the same as the impacts from Big Hill under Bruinsburg alternative. Chacahoula would discharge brine near Ship Shoal, an important fishing area. A small salinity increase that may be above the natural variation may be experienced at Ship Shoal. Chacahoula would affect about 1,067 acres of EFH, most of which would be a temporary impact due to pipeline construction.	Big Hill expansion site would have EFH impacts the same as the impacts from Big Hill under Bruinsburg alternative. Richton would affect about 183 acres of EFH due to temporary impacts from construction and to about 43 acres of fill for a new terminal and RWI at Pascagoula. Brine pipeline construction may affect submerged aquatic vegetation. DOE would coordinate with NOAA Fisheries and GUIS to minimize impacts to EFH and mitigate for permanent impacts to EFH.	Big Hill expansion site would have EFH impacts the same as the impacts from Big Hill under Bruinsburg alternative. Stratton Ridge would temporarily affect about 92 acres of EFH during construction of pipelines and would permanently affect about 17 acres due to the RWI, which is a permanent structure. Seventeen acres of EFH would be permanently affected due to the construction and operation of a RWI structure.	No impact.
Socioeconomics	Peak construction workforce of 474 for Bruinsburg site and its infrastructure. Peak construction workforce of 100 to 350 employees at expansion sites. Operations and maintenance workforce of 75 to 100 employees at Bruinsburg site and an additional 25 employees at each expansion site. Positive local economic benefits from increased employment. Small in-migration relative to regional population. No noticeable increase in competition for employment, traffic, or demand for housing or public infrastructure or services.	Peak construction workforce of 445 for Chacahoula and its infrastructure. Same expansion site workforce as under Bruinsburg alternative. Same operations and maintenance workforce as under Bruinsburg alternative. Similar socioeconomic impacts as under Bruinsburg alternative.	Peak construction workforce of 499 for Richton and its infrastructure. Same expansion site workforce as under Bruinsburg alternative. Same operations and maintenance workforce as under Bruinsburg alternative. Similar socioeconomic impacts as under Bruinsburg alternative.	Peak construction workforce of 431 for Stratton Ridge and its infrastructure. Same expansion site workforce as under Bruinsburg alternative. Same operations and maintenance workforce as under Bruinsburg alternative. Similar socioeconomic impacts as under Bruinsburg alternative, with exception of potential loss of jobs if Dow Chemical cannot access salt.	No impact; additional economic impact would not be generated.
Cultural Resources	Adverse effects to archaeological remains of Civil War activity at Bruinsburg, which could be mitigated. Residual (after mitigation) adverse effects on setting of Civil War landing area and march route. Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated.	Likely adverse effects to Native American and historic sites along Chacahoula pipeline routes, which could be mitigated. Similar cultural resource impacts as under Bruinsburg alternative.	Adverse effects to Native American archaeological sites within the Richton facility boundary, which could be mitigated. Likely adverse effects to Native American archeological sites along Richton pipelines, which could be mitigated. Possible residual effects to the feeling and setting of historic districts along pipelines and at terminal. Similar cultural resource impacts as under Bruinsburg alternative.	Adverse effects to Native American archaeological sites at the Stratton Ridge facility and along pipelines, which could be mitigated. Possible residual effects to any historic settings along pipelines. Similar cultural resource impacts as under Bruinsburg alternative.	No impact.
Noise	Noise from construction activities at the new and expansion sites would be audible, but the impacts would be minor. Noise from operations and maintenance activities would be audible only at the expansion storage sites, where the impacts would be minor. Noise from construction and operations and maintenance activities at the pipelines, terminals, and other infrastructure would have minor impacts.	Similar noise impacts as under Bruinsburg alternative, except that noise from operations and maintenance activities at the new site would be audible, but the impacts would be minor.	Similar noise impacts as under Chacahoula alternative.	Similar noise impacts as under Chacahoula alternative.	No impact.

Table 2.7.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Environmental Justice	The potentially affected populations include low-income, Black or African American, Native American or Alaska Native, Asian, and Hispanic or Latino populations. None of these populations would have impacts that appreciably exceed the impacts to the general population, or would be affected in different ways than the general population. Thus, there would be no disproportionately high and adverse impacts to low-income or minority populations.	Same environmental justice impacts as under Bruinsburg alternative.	Same environmental justice impacts as under Bruinsburg alternative.	Same environmental justice impacts as under Bruinsburg alternative, except that the potentially affected communities also include Native Hawaiian or Other Pacific Islander communities.	No impact.

1 mile = 1.609 kilometers

1 acre = 0.405 hectares

1 gallon = 0.0037854 cubic inches

1 inch = 2.54 centimeters

Table 2.7.11-2: Differences in Potential Impacts for Alternatives with Two Expansion Sites (Comparison with Table 2.7.11-1)

Resource	Bruinsburg, Chacahoula, Richton, or Stratton Ridge
Environmental Risks and Public and Occupational Safety and Health	Slightly more (less than 0.1) predicted oil spills than presented in table 2.7.11-1. 7 more predicted oil spills than presented in table 2.7.11-1. No other notable differences.
Land Use: Land Use Conflicts	81 fewer acres (33 hectares) than the value presented in table 2.7.11-1. No change in land use conflicts as presented in table 2.7.11-1.
Land Use: Visual Resources	No notable difference from table 2.7.11-1.
Land Use: Farmland	No notable difference from table 2.7.11-1.
Land Use: Coastal Zone Management	Less impact because the coastal zone associated with West Hackberry would not be affected.
Geology and Soils	No notable difference from table 2.7.11-1.
Air Quality	No notable difference from table 2.7.11-1.
Water Resources: Surface Water	Up to three water bodies would not be affected because construction and operation would not occur at West Hackberry.
Water Resources: Groundwater	No increased risk to the sole source aquifer at West Hackberry because brine disposal would not increase.
Water Resources: Floodplains	No notable difference from table 2.7.11-1.
Biological Resources: Plants, Wetlands, and Wildlife	5 fewer acres (2 hectares) of affected wetlands from the value presented in table 2.7.11-1.
Biological Resources: Threatened and Endangered Species	No notable difference from table 2.7.11-1.
Biological Resources: Special Status Areas	No notable difference from table 2.7.11-1.
Biological Resources: Essential Fish Habitat	No notable difference from table 2.7.11-1.
Socioeconomics	Less impact because construction workforce of up to 100 and increased operations and maintenance workforce would not be required for West Hackberry.
Cultural Resources	Less impact because Native American sites at West Hackberry would not be affected.
Noise	No notable difference from table 2.7.11-1.
Environmental Justice	No notable difference from table 2.7.11-1.

Chapter 3 Affected Environment and Potential Impacts

3.1 INTRODUCTION

This chapter describes the affected environment and potential environmental impacts associated with the Proposed Action and Alternatives. The following resources are addressed:

- Section 3.2 Environmental Risks and Public and Occupational Safety and Health,
- Section 3.3 Land Use,
- Section 3.4 Geology and Soils,
- Section 3.5 Air Quality,
- Section 3.6 Water Resources,
- Section 3.7 Biological Resources,
- Section 3.8 Socioeconomics,
- Section 3.9 Cultural Resources,
- Section 3.10 Noise, and
- Section 3.11 Environmental Justice.

Most resource sections follow a standard organization.

- First is a description of the methodology and pertinent background information, including relevant Federal and state regulations.

- Next is a discussion of common impacts, that is, the potential impacts that would be the same or similar across the proposed sites. Discussing common impacts streamlines the document by reducing duplicative analysis across multiple sites.

- Then each proposed site and the no action alternative are analyzed in the following order: (1) the proposed new sites: Bruinsburg, Chacahoula, Richton, and Stratton Ridge; (2) the proposed expansion sites: Bayou Choctaw, Big Hill, and West Hackberry; and (3) the no action alternative.

- The analysis of each site and associated infrastructure in organized in two parts: description of the affected environment and analysis of the potential impacts.

The sections for a few resource areas, namely Environmental Risks and Public and Occupational Safety and Health, Socioeconomics, Noise, and Environmental Justice, are organized in a slightly different manner to simplify the presentation, while still distinguishing the methodology, affected environment, and potential impacts.

The potential impacts described in this chapter include direct and indirect impacts. Direct impacts, as defined by the CEQ at 40 CFR 1508.8, are those impacts "which are caused by the action and occur at the same time and place." Indirect impacts are those impacts "which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." Both direct and indirect impacts include those impacts "resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial."

Chapter 4 analyzes cumulative impacts. Chapter 5 analyzes the irreversible and irretrievable commitment of resources.

3.2 ENVIRONMENTAL RISKS AND PUBLIC AND OCCUPATIONAL SAFETY AND HEALTH

The development of an additional storage site and expansion of existing SPR sites would change the potential for accidents associated with construction, operations, and maintenance activities. Greater activity levels typically increase risks; however, in some cases existing pipelines and other equipment would be replaced or modified, and these changes could reduce the potential for spills or the size of spills from this equipment.

This chapter analyzes the potential impacts associated with five categories of accidents at the proposed new or expansion SPR sites:

- Oil spills,
- Brine spills,
- Hazardous material spills,
- Fires, and
- Occupational (worker) injuries.

Section 3.2.1 summarizes the approach for this analysis, including a review of past accidents at existing SPR sites and how those experiences can be used to predict future incidents at the new and expansion sites. Section 3.2.2 then describes the expected future risks associated with these accidents, including the likelihood of the accidents occurring and the potential consequences if they do occur.

3.2.1 Methodology

Risk analysis is a process for identifying and determining both the likelihood of occurrence and the potential consequences of undesirable events including spills of materials such as oil and brine. Risk analyses allow decisionmakers to consider both the potential severity of such an event and its likelihood of occurrence, not just the upper bound consequences, no matter how unlikely they may be. The key concept is:

Risk considers both likelihood (or chance) of occurrence and potential consequences.

For this EIS, DOE examined the likelihood of such events occurring at the new and expanded SPR sites based on the historical frequency of occurrence at the existing SPR sites as well as in other oil distribution activities. The following sections review the historical frequency of oil spills, brine spills, hazardous material spills, fires, occupational injuries, and terrorism. The information in these sections is then used in section 3.2.2 to assess the likelihood and consequences of such events, except terrorism, at the proposed SPR sites.

3.2.1.1 Oil Spills

Oil spills associated with the proposed SPR expansion could occur during marine transport of the crude oil to the United States, transfer of the oil to marine terminals from tankers, and transfer from the terminals to the SPR storage sites through pipelines. If drawdown of SPR crude oil is required, the crude oil is again transported by pipeline to a terminal; from the terminal, the oil can enter the pipeline distribution system or be loaded onto ships or barges for transport to refineries. Thus, crude oil spills can occur during the fill or refill of storage caverns, as well as during drawdown and distribution.

When drawdown is required, the SPR site would need to be refilled. The crude oil spill risks of refill would be comparable to those of fill. Drawdown itself is complicated because the SPR crude oil is a replacement for imported oil. Drawdown and distribution result in shifts between transportation modes as the supply source changes from imports to the caverns, but roughly the same amount of oil is handled in each case.

While accidental releases can occur during long-term storage, the risk of a spill generally is dominated by transfer activities. Furthermore, the maximum quantity filled occurs with the initial fill. This initial-fill activity also represents the greatest incremental chance of spills of all the potential for a spill associated with current import activities because subsequent drawdowns and refills basically would just replace a transfer of oil from an import activity. This analysis focuses on the likelihood of an oil spill during initial-fill activities. Because it is not possible to predict how often or when a cavern would be drawn down and refilled, DOE did not attempt to provide quantitative estimates of the number and size of oil spills during operations (although section 3.2.2.1 does discuss the types of impacts that would occur if an oil spill did occur, including spills from operations).

Historic oil spill rates can be used as a reasonable indicator of the probable chance of accidental oil releases to the environment resulting from operations at an SPR site. Historic data might result in a higher or more conservative estimate of the likelihood of an oil spill because these statistics do not consider improvements in technology, spill control procedures, and operating procedures. New regulations, technology, and updated procedures could significantly reduce the chance of future spills.

The historic rates of oil spills during fill or refill for each of the proposed new and expansion storage sites are summarized in the following separate sections addressing spills from vessels, bulk transfer from terminals, pipelines, and storage sites. Spills from vessels, terminals, and storage sites are a function of the storage site capacity (generally as a surrogate for activity levels), and spills from pipelines are a function of both site capacity and pipeline length. The rates derived below are then applied to the particulars of each new and expansion site in section 3.2.2.1 to predict the number and size of spills associated with the proposed action.

Vessels

The Minerals Management Service (MMS) of the U.S. Department of the Interior has maintained an oil spill database of U.S. tanker spills since the 1970s. Using that database, the MMS estimated oil-spill occurrence, normalized as a function of the volume of oil handled (Anderson and LaBelle 2000). Only spills greater than 1,000 barrels were addressed because of the likelihood that larger spills probably would be identified and reported, and they are more likely to persist and cause impacts than smaller spills. Based on reviewing the annual MMS data, DOE observed that rates for crude oil spills from tankers in U.S. waters have decreased significantly over time.

The MMS data on spills from international transportation of crude oil during the period 1974 to 1985 are described in the 1992 SPR expansion draft EIS (DOE 1992a). That draft EIS reports rates of 0.090 spills per 100 MMB transported in offshore waters and 0.040 spills per 100 MMB transported in harbors or at piers. For U.S. waters, the spill rate in harbors and at piers is higher than the spill rate in offshore waters. Using 1985 to 1999 data from the MMS, the rates are 0.044 spills per 100 MMB in harbors and at ports and 0.029 spills per 100 MMB in offshore waters, or a combined rate of 0.073 spills per 100 MMB from tankers (Anderson and LaBelle 2000). DOE used the combined rate of 0.073 spills per 100 MMB in this EIS analysis.

Terminals

The 1992 draft EIS estimates a rate of 3.3 spills per 100 MMB from terminal transfer operations. This rate is based on the total number of U.S. oil spills from marine transfer operations and the total volume of crude oil and refined petroleum products imported and transferred during 1983 to 1986. This estimate has been revised based on the number of crude oil shoreline spills from the U.S. Coast Guard database and the total waterborne commerce for crude petroleum during 1999 to 2001. During that period, there were 967 shoreline spills and approximately 15.6 percent of all spills were of crude oil, so the revised estimate is 151 crude oil shoreline spills and 11,746 MMB of crude oil in waterborne commerce, or 1.29 spills per 100 MMB. DOE uses the rate of 1.29 spills per 100 MMB in this analysis.

Pipelines

The U.S. Department of Transportation (DOT) Office of Pipeline Safety maintains a database of reportable pipeline accidents. Reportable accidents are those with gross loss greater than or equal to 50 barrels (2,100 gallons); any fatality or injury; a fire or explosion not intentionally set; highly volatile liquid releases with gross loss of 5 or more barrels; or total costs greater than or equal to $50,000 (DOT 2005). During 1996 to 1999, there were 312 reportable crude oil pipeline accidents. Most of those accidents involved spills of 2,100 gallons (7,900 liters) or more. For that same period, there were 145 crude oil pipeline spills of 10,000 gallons (38,000 liters) or more, of which 33 were more than 100,000 gallons (380,000 liters) (Cutter Information Corp. 2001). According to the Bureau of Transportation Statistics, 1,330.9 billion ton-miles (1,900 ton-kilometers) of crude oil were transported by pipelines in the United States during this period (DOT 2005a).

In a more recent period, 2000 to 2003, the Office of Pipeline Safety reported a total of 225 crude oil pipeline accidents, and the Bureau of Transportation Statistics reported a movement of 1,131.5 billion ton-miles (1,700 billion ton-kilometers) of crude oil through pipelines. These data correspond to accident rates of 0.23 accidents per 100 million ton-miles (150 million ton-kilometers) transported for 1996 to 1999 and 0.20 accidents per 100 million ton-miles transported for 2000 to 2003. Based on a conversion factor of 7 barrels per ton (6.3 barrels per metric ton), the spill rate would be about 0.0028 accidents per 100 million barrel-miles for the 2000 to 2003 period. This rate is somewhat higher than the spill rate for pipelines estimated in the 1992 draft EIS (DOE 1992a), which was 0.0021 spills per 100 million barrel-miles. For this EIS, DOE uses the higher rate of 0.0028 spills per 100 million barrel-miles for analysis.

Storage Sites

Onsite spills typically are identified quickly, and they are likely to be contained, limiting the potential for reportable spills (i.e., those that enter waterways). During 2001 to 2004, there were 6 reportable oil spills from the existing SPR storage sites, none of which were greater than 10 barrels. The oil spills were reported to the appropriate agencies and cleaned up with no observable environmental damage, according to the annual Environmental Reports published by DOE. A substantially lower number of oil spills per year occurred in the 2001 to 2004 period than in previous years. For example, in an earlier period (1987 to 1990) described in the draft EIS (DOE 1992a), a total of 33 spills occurred at the existing SPR storage sites. Three of these spills exceeded 100 barrels and 25 of the 33 spills were less than 10 barrels. Furthermore, the amount of oil received by SPR during 2001 to 2004 was 69.3 MMB more than was received during 1987 to 1990, showing a large decrease in spills per amount received (EIA 2005). The oil spill rate decreased from 42.3 spills per 100 MMB of crude oil received in 1987 to 1990 to 4.3 spills per 100 MMB of crude oil received in 2001 to 2004. The rate of 4.3 spills per 100 MMB was used in this analysis.

3.2.1.2 Brine Spills

Table 3.2.1-1 summarizes data on brine spills from 22 years of operational experience at the existing SPR sites. The table also identifies the percentage of the brine spilled as a fraction of the total brine volume

Table 3.2.1-1: Reportable Brine Spills from Pipeline Systems at Existing SPR Sites

Year	Total Spills	Volume Transferred in Pipeline System (MMB)	Number of Spills per MMB of Brine Transferred	Volume Spilled (barrels)	Percentage of Total Throughput Spilled
1982	43	558	0.077	2,792	0.0005
1983	44	816	0.054	1,632	0.0002
1984	17	558	0.031	1,975	0.0004
1985	16	464	0.035	607,000	0.1308
1986	7	87	0.081	1,734	0.0019
1987	22	212	0.104	608	0.0003
1988	12	> 6.3	NA	586	0.0001
1989	17	591	0.029	825,512	0.1395
1990	12	439	0.027	74,650	0.017
1991	7	415	0.017	7,230	0.002
1992	9	11	1.23	302	0.003
1993	6	33	0.182	370	0.001
1994	2	15	0.133	90	0.0006
1995	3	29	0.103	825	0.0028
1996	5	80	0.062	30	0.00004
1997	0	38	0	0	0
1998	2	14	0.143	39	0.0003
1999	0	18	0	0	0
2000	0	18	0	0	0
2001	1	21	0.048	0.12	5.60 x 10-7
2002	2	53	0.038	13	3.9 x 10-6
2003	0	47	0	0	0
Total	227	4,523	0.050	1,525,388	0.033

MMB = million barrels

Source: DOE Site Environmental Reports for 1982 to 2003

transferred in the pipeline systems. Very large spill volumes occurred in 1985 and 1989, and a sizable spill occurred in 1990. Two spills accounted for almost all of the volume spilled in 1985 (one very large and one large), and no environment impacts were observed from either of these spills. In 1989, the one very large spill originally affected 8 acres (3.2 hectares) of marsh, but strong regrowth was seen in less than one year (Boeing Petroleum Services Inc. 1990b and 1990c). In 1990, a large spill directly into the Gulf of Mexico caused no adverse environmental impacts (Bozzo 1991).

3.2.1.3 Hazardous Material Spills

As discussed in section 2.3.10, spills of hazardous materials from SPR sites must be reported and recorded under several Federal and state laws and regulations, as well as SPR site operating procedures. The type and size of hazardous material spills recorded at existing SPR sites for the years 2003 and 2004 (the most recent years for which data are available) are presented in table 3.2.1-2. As shown, the spills of hazardous materials at existing SPR sites have been infrequent and small. Nine spills have occurred at three of the existing sites and none at the other existing site (Bryan Mound) during the two-year period.

Table 3.2.1-2: Existing SPR Site Spills Other than Crude Oil and Brine from 2003 to 2004

Material	Site	Quantity	Description
Lubricating oil	Big Hill	10 gallons	Spill occurred during transfer of material from bulk storage to 30-gallon day tank; spill was contained and cleaned up.
Diesel fuel	West Hackberry	3 gallons	Spill occurred from day tank of emergency diesel generator.
Battery acid	Bayou Choctaw	2 gallons	Spill occurred in truck maintenance area from overturned truck battery; spill occurred on concrete pad and was remediated.
Hydraulic oil	West Hackberry	4 gallons	Contractor truck hydraulic hose failed causing release of hydraulic oil onto the ground; cleanup complete.
Hydraulic fluid	Bayou Choctaw	0.5 gallons	Release occurred when a seal came off the manlift drive motor; the area was cleaned up immediately.
Raw sewage	Big Hill	Several gallons	Sewage Lift Station #4 overflowed small amount of sewage into sump area and surrounding grass. Pump auto selector switch and station high-level alarm failed to operate properly.
Hydraulic fluid	Big Hill	0.5 gallons	Contractor forklift leaked hydraulic fluids onto surrounding soil.
Hydraulic fluid	Bayou Choctaw	0.5 gallons	Hydraulic fluid leaked when onsite O-ring manlift blew out, causing spill onto building, 401 parking lot; spill cleaned up and new O-ring installed.
Brine pit sludge	Bayou Choctaw	2 gallons	A vacuum-box truck in use for brine pond clean up leaked pit sludge on the roadway outside of the entrance gate.

1 gallon = 0.0037854 cubic meters

Source: SPR Nonreportable Spills (DOE 2003b, 2004h)

This experience suggests that each of the candidate new sites could have one spill a year (9 spills divided by 4 sites divided by 2 years). Most of these spills could be expected to be in the 0.5- to 4-gallon (1.9- to 15-liters) range, although they could be as large as 10 gallons (38 liters). Larger or more frequent spills, or both, are certainly possible, but they are not considered likely based on the limited volumes of hazardous materials at the sites.

3.2.1.4 Fires

Table 3.2.1-3 summarizes reportable fire incidents for the existing SPR sites and terminals from 1992 to 2004. The table summarizes the circumstances of the incident and the SPR operator response. Reportable fire incidents at SPR sites and terminals include electrical fires, vehicle fires, crude oil fires, ignition of combustible gas, and other incidents for which SPR operator response and reporting was required. Several of the reported incidents resulted in minor injuries to SPR site workers or subcontractors or damage to operating equipment. None of the reported incidents resulted in environmental impacts or any long-term impacts to SPR site operations. One incident, an electrical switchgear fire at the St. James Terminal in 1994, required operation of the primary and backup

Table 3.2.1-3: Reported Fire Incidents at Existing SPR Sites and Terminals

Site	Year	Incident	Response
Big Hill	1992	Before pipeline repair work, gas tests taken inside the pipe at the drain point and at the repair point showed that no combustible gas was present. Welding began within 15 minutes of the gas test; after approximately 4 inches of weld, a flash occurred inside the pipe. Root cause: combustible gas collected in the line after the gas test was performed.	The operator used the wheel fire extinguisher to ensure no fire was in the underground piping. Maintenance workers installed a nitrogen packer to prevent reoccurrence. Job Safety Analysis was revised to include the use of a pipe balloon during all welding operations on the inside of pipes regardless of whether gas has been detected.
Bayou Choctaw	1992	A rental, portable centrifugal pump was in use to pump brine from the northern pond into the southern pond. Site security personnel observed that one of the pump tires was on fire. Root cause: electrical short circuit.	Operations personnel extinguished the fire using a fire extinguisher. New procedures were developed to inspect rental equipment.
Bryan Mound	1993	Shift supervisor entered control room and saw smoke pouring out of the Realflex meter system enclosure. A pre-alarm sounded and the operator manually activated the halon system; control room building was evacuated. Root cause: when replacement actuator was first installed it was powered with 115 VAC rather than 24 VAC because updated, as built drawings were not provided to allow the actuator to be connected correctly.	Emergency Response Team responded with fire truck. Two personnel using self-contained breathing apparatus investigated the control room. Library was purged of out-of-date drawings and procedures were reinforced so that correct as-built drawings must be furnished as soon as possible after any configuration change and task should not be closed until drawings have been completed and verified.
St. James Terminal	1994	Subcontractor reported loud noise and smoke coming from switchgear building. The switchgear appeared to be arcing from the load side to the line side, causing extensive heat, which in turn created fire. Root cause: misalignment of main incoming breaker; attributed to lack of adequate SPR-wide maintenance procedures and lack of adequate supervision by technical experts who could verify that existing maintenance procedures were performed and performed correctly; also, a lack of adequate ground-fault protection built into original switchgear design.	Site Emergency Response Team extinguished the fire after all power was confirmed de-energized. Incident caused site to be without commercial power to operate main line crude oil booster pumps. The main site's (350-kilowatt) emergency generator along with the site's spare (169 kilowatt) emergency generator was used to power the facility. Team identified 16 corrective action items. With the completion of all such items, probability of recurrence reduced.
Bayou Choctaw	1995	While attempting to check power on an actuator for a valve, a bolt of fire came from the rear of actuator. Electrician received minor burns. Incident most likely result of conductive contamination on wire insulation that reduced the insulating properties of the conductor, allowing the initial flash. Root cause: design of actuator power terminals and insulating barrier; terminals extend above insulating barrier.	Operations personnel locked out 480-volt actuator supply voltage at motor control center. New safety equipment was provided for electricians to test voltage of actuators. New procedures were established for electricians and instructions provided on how to clean wires of contamination.

Table 3.2.1-3: Reported Fire Incidents at Existing SPR Sites and Terminals

Site	Year	Incident	Response
Bayou Choctaw	1998	During grinding activities associated with out-of-service pipeline demolition, a vapor flash and loud noise occurred inside and around opening of pipe that previously was cold cut. Worker who experienced ear pain was examined by doctor and released. Direct cause was insufficient low explosive level (LEL) gas monitoring. Monitoring was performed only before task start up and not during the task performance to take into account changing conditions. Root cause: lack of clarity in safe work procedure.	Demolition work immediately shutdown pending a worksite investigation. Work resumed after investigation complete and corrective action taken. Safe work procedure revised to require that hot work tasks and related precautions be specifically identified. With completion of the corrective action, probability of this type of event recurring is reduced.
Bryan Mound	1999	Supervisor observed oil and white smoke coming from a flange on crude oil line. Contractor was in process of tightening bolts on the flange when apparent flash occurred and oil started coming out of the flange. About 6 gallons of crude oil estimated to have leaked out of the flange were confined in construction excavation. Personnel evacuated with no injuries. Root cause: contractor using a propane torch to apply heat shrink to the flange weld caused flash. Records do not indicate that LEL readings were taken within 30 minutes of commencement of hot work, as required by hot work permit.	Emergency Response Team responded with a fire truck and cooled the pipe with water from the fire truck. The oil in the excavation was covered with foam. Nitrogen was injected into the crude oil line upstream of the flange location to extinguish, inert, and cool the inside of the line. Continuous gas monitoring was implemented for all pipe tie-in work to ensure that any combustible gas is immediately detected and hot work shut down before ignition or an unsafe condition occurs.
West Hackberry	2002	Subcontractor operated track hoe fitted with special equipment for clearing trees. Heavy brush caught fire outside the site perimeter fence. No injuries were associated with the incident. Root cause: a pinhole leak apparently developed in the hydraulic hose allowing hydraulic fluid to spray directly onto the exhaust manifold, which ignited.	Track hoe operator was unable to extinguish fire with fire extinguisher. Site fire truck arrived on scene and used combination of water and dry chemical to extinguish the fire. West Hackberry fire department provided support.
Big Hill	2003	A small fire in the battery box caused a subcontractor bulldozer operator to jump off vehicle, causing a back injury. Fire was caused by aerosol can of starter fluid contacting battery. Operator required transport to local hospital for treatment. Root cause: subcontractor did not complete equipment checklist and did not maintain protective battery cover.	Personnel in the area immediately extinguished the fire with a dry chemical fire extinguisher. The established site operator and subcontractor procedures for equipment inspection were reviewed and reinforced.
Big Hill	2004	While an employee was drilling a hole in a swinging gate frame constructed of tubular steel, the drill bit penetrated the gate frame, and apparently flammable vapors trapped inside the tubing were released and ignited, causing a flash fire. Employee received first and second degree burns. Root cause: a biological material contaminant located inside the gate frame tubing at the time of assembly by shipbuilding and repairing industry.	The biological containments had not been previously identified at SPR sites. A lessons-learned notice was issued to all sites concerning this previously unknown hazard.

emergency generators at the St. James terminal, although no interruption in SPR site drawdown operations resulting from the incident was reported. The reportable fire incidents summarized in table 3.2.1-3 were subject to first response by the SPR site operators and Emergency Response Team, incident reporting, investigation, and root-cause analysis. Corrective actions were implemented for the reported incidents to reduce the probability of reoccurrence.

In 1978, during the workover of a well, a very large well pad fire caused a severe injury and one death. The non-burning oil spilled into Black Lake and was contained and recovered. Subsequent monitoring found that oil contamination was restricted to a small portion of Black Lake (NOAA 1992).

3.2.1.5 Occupational Injuries

To analyze the potential impacts of expanding the SPR on the number of occupational injuries, DOE obtained the incident rate of worker injuries and illnesses at existing SPR facilities and at comparable industrial facilities. DOE also obtained information regarding the safety and health management systems of the contractor currently operating the SPR.

3.2.1.6 Terrorism

The EIS evaluates the potential environmental impacts of a release of oil, brine, and other hazardous materials. The consequences could result from an accidental or deliberate system failure, with deliberate failures coming from sabotage or terrorism and accidental ones arising from design or construction flaws, human errors, natural events, and other factors. Because the EIS considers a range of release scenarios, and the proposed equipment design and control systems, which would mitigate the risks of a release, DOE believes that the EIS also informs about the range of potential consequences of a terrorist action. While more catastrophic failures can be imagined, such as simultaneous attacks on multiple pipelines, the leak detection, isolation, and other control systems would limit the total quantities released. Aircraft or incendiary devices attacking well heads might be spectacular, but would produce a localized fire with little if any offsite consequence. Attacks on ships are no different than the potential for such attacks on ships going to or from other facilities. While the range of potential consequences can be described, the probability of a terrorism or sabotage event cannot be predicted to the same degree.

DOE is one of the 17 critical infrastructure and key resource sectors identified in the National Infrastructure Protection Plan prepared by the Department of Homeland Security under Presidential Directive 7. This plan establishes a comprehensive risk management framework, under which critical energy assets and systems such as SPR are being identified and evaluated to determine the need for protective programs. As a part of the plan, the private sector is working closely with the government agencies to ensure sharing of that threat information and best practices. The efforts under the plan provide further assurance that terrorism is carefully and comprehensively addressed in site safety and operations plans, in interactions with local emergency support functions (like fire and police), and in employee training, among other management systems.

3.2.2 Impacts Common to All Alternatives

This section uses the historical accident rates described earlier to estimate the likelihood of new accidents associated with the proposed action. Included in the discussion is a projection of the possible consequences associated with each type of accident, if they were to actually occur.

3.2.2.1 Oil Spills

Table 3.2.2-1 presents the estimated number of oil spills associated with initial filling operations at each of the proposed new and expansion sites. With increased volumes moving in drawdown and refill operations, the overall potential for spills would increase proportional to the amount of drawdown and refill. A total drawdown and total refilling of the site is expected to be an extreme case for the activity in a single year. The values in table 3.2.2-1 represent a reasonable upper bound of the number of oil spills anticipated during any year of SPR storage site operation. Moreover, as stated above, only the initial fill

Table 3.2.2-1: Oil Spill Predictions by Site for Initial Fill

SPR Site	New Site Capacity/ Generation	Pipeline Length (miles)	Predicted Number of Oil Spills per Given Capacity				
			Vessel	Terminal	Pipeline	Storage Site	Total
Bruinsburg[a]							
Pipeline to Peetsville	160 MMB	38	0.12	2.06	0.17	6.88	9.2
Pipeline to Anchorage	160 MMB	109	0.12	2.06	0.49	6.88	9.6
Chacahoula[a]							
Pipeline to St. James Terminal	160 MMB	22	0.12	2.06	0.10	6.88	9.2
Pipeline to Clovelly	160 MMB	53	0.12	2.06	0.24	6.88	9.3
Richton[a]							
Pipeline to Pascagoula	160 MMB	88	0.12	2.06	0.39	6.88	9.5
Pipeline to Liberty	160 MMB	116	0.12	2.06	0.52	6.88	9.6
Stratton Ridge							
Pipeline to Texas City	160 MMB	38	0.12	2.06	0.17	6.88	9.2
Bayou Choctaw							
Pipeline to St. James	20 MMB	37	0.01	0.26	0.02	0.86	1.2
Big Hill							
Big Hill 80	80 MMB	17	0.06	1.03	0.04	3.44	4.6
Big Hill 96	96 MMB	17	0.07	1.24	0.05	4.13	5.5
West Hackberry							
West Hackberry	15 MMB	0	0.01	0.19	—	0.65	0.85

Notes:

[a] Oil spill predictions are not cumulative. The oil spill predictions are based on the total storage capacity of the site traveling through one pipeline.

MMB = million barrels

1 mile = 1.6093 kilometers

activity would be a new activity when looking at overall oil distribution activities. Subsequent drawdown and refills would be replacements for import-related transfer activities.

As shown in table 3.2.2-1, initial fills are estimated to cause anywhere from two oil spills at Bayou Choctaw up to almost 10 oil spills at Bruinsburg, Chacahoula, Richton, or Stratton Ridge, (i.e., any of the sites with an expected addition of 160 MMB in capacity). Most of these spills would be expected at the storage sites, with a smaller number of spills at the associated terminals. The number of oil spills associated with shipping vessels and pipeline operations is predicted to be less than one in every case. Based on historic spill statistics, which account for measures used to contain spills that do occur, the majority of the predicted oil spills would be of low volume. For example, the spills from storage sites would be expected to be less than 100 barrels based on a review of the spills that have occurred to date at the SPR sites.

The potential consequences of such infrequent, small accidental releases of oil are expected to be minor. They could result in localized soil contamination at the storage sites and terminal locations, which would be contained and cleaned up. At the same time, such small oil spills would result in some contaminants migrating into the air, including volatile components (such as toluene and benzene) and sulfur compounds (predominantly mercaptans and hydrogen sulfide gas). While such air contaminants can have toxic effects to both wildlife and people through inhalation (Park and Holiday 1999), they are expected to be released from SPR operations so infrequently and in such small quantities that they would be readily dispersed in the atmosphere and have little effect on ambient air quality along site boundaries.

The impacts of spilled oil on surface water resources or wetlands would vary depending on the amount of oil introduced and the characteristics of the receiving environment. Again, these impacts associated with the proposed action are not expected to be significant because any resulting oil spills in these areas are expected to be infrequent and small. Nevertheless, if a large spill were to occur, the immediate impact would be the presence of a layer or slick of oil floating on the water surface. This slick would pose the potential for damage to physical assets and for negative health effects to wildlife, domestic animals, or people that come into contact with it through dermal exposure to toxic compounds in the oil (Park and Holiday 1999). Where the slick reaches vegetated wetland and shore areas, the oil would adhere to vegetation. Within a short time after any significant spill, DOE’s emergency response procedures would be in operation, acting to contain the oil slick to a limited area and remove as much oil as possible from the environment. Under normal conditions only relatively small amounts of oil would be expected to escape this response action and remain uncontained in the environment.

Wind, waves, and currents would work to disperse any such uncontained oil, breaking up oil slicks into droplets or smaller slicks dispersed over a wide area (assuming a sufficiently large receiving water body). As mentioned, volatile components of the oil would evaporate, leaving behind heavier components that would begin weathering or breaking down into degradation products through a series of physical and chemical processes. Some of these products would be denser than water and sink into the water column and to the floor of the water body. Some components of the oil would oxidize to water-soluble compounds, and then dissolve into and disperse within the water column, posing potential health risks to wildlife and people through ingestion and bio-uptake. Many of the heavy oil components may only partially oxidize, forming tar balls. These dense spheres would sink to the bottom of the water column and could linger in the environment, collecting in bottom sediments. Some oil components could be removed from the water column through biodegradation and bio-uptake. Biodegradation would be more rapid in warm, nutrient-rich environments. In high-energy environments, oil-water emulsions can be formed through the action of waves or strong currents. Because of their tendency to sink to the bottom of the water column, oil-water emulsions also tend to sink to the bottom of the water column, and they could remain in the environment for months or years (EPA 2006).

Where oil spill response efforts contain and remove most spilled oil from the surface water environment, the impacts described earlier would be expected to occur at very limited levels. These impacts would be more pronounced in smaller, low-energy water bodies where little dispersion or dilution could take place and the effects of any uncontained oil would be concentrated in a smaller area. Oil remaining in rivers with strong flow or tidal flushing and in estuaries or the Gulf of Mexico, would disperse more rapidly, resulting in milder impacts over a wider area.

In some cases, the DOE oil spill response effort may involve the use of chemical dispersants. Dispersants remove spilled oil from the water surface by causing the oil to partially break down into products that are soluble in the water column or denser than water and sink. This could reduce impacts associated with the surface oil slick, and prevent the movement of floating oil into sensitive surface environments (marshes, shoreline areas). On the other hand, the use of chemical dispersants could increase the impacts of spilled oil on subsurface aquatic environments and organisms. Areas where dispersants were used on spilled oil would exhibit elevated concentrations of oil components, including toxic compounds, in the water column, and deposition of dense, insoluble oil components on the water-body floor. The decision on dispersant use is driven by an analysis of this trade-off, and identification of the course that would lead to the least environmental impact.

3.2.2.2 Brine Spills

Table 3.2.2-2 presents the expected number of brine spills associated with the cavern construction and initial fill at each site evaluated in this EIS. These estimates were developed using the volume of oil that would be handled during initial fill at each site, the SPR experience that 7 MMB of brine are generated for every 1 MMB of storage capacity formed within a cavern, and the historic brine spill rate described in section 3.2.1.2.

Table 3.2.2-2: Predicted Number of Brine Spills by Site for Cavern Construction and Initial Fill

SPR Site	Brine Generation[a]	Source of Spill	Pipeline Length (miles)	Predicted Number of Brine Spills[b]
Bruinsburg	1,120 MMB	Brine pipeline	14	56
Chacahoula	1,120 MMB	Brine pipeline	59	56
Richton	1,120 MMB	Brine pipeline	100	56
Stratton Ridge	1,120 MMB	Brine pipeline	10	56
Bayou Choctaw	140 MMB	Brine pipeline	1	7
Big Hill	560 to 672 MMB	Brine pipeline	1	28 to 34
West Hackberry	15 MMB[c]	Brine pipeline	Unknown	<1

Notes:

[a] Brine generation calculated as new oil storage capacity multiplied by seven
[b] During the entire construction period
[c] Brine discharge associated with initial fill

1 mile = 1.6093 kilometers

As shown in table 3.2.2-2, initial cavern creation and fill activities at each site are predicted to cause anywhere from less than one brine spill at West Hackberry to up to 56 brine spills at Bruinsburg, Chacahoula, Richton, and Stratton Ridge. Based on historic spill statistics and measures that would be in place to detect and stop brine spills when they occur, these estimated brine spills most likely would be of low volume (less than 50 barrels). Higher-volume brine spills, while possible, are very unlikely based on SPR experience.

For the Richton alternatives, the predicted number of brine spills would increase if the Leaf River is unable, because of low flow conditions, to supply the full amount of water needed for cavern development or drawdown. In this situation, the 88-mile pipeline between Pascagoula and Richton would supply water from the Gulf Coast. For example, if the Gulf Coast supplied one-third of the needed water volume for cavern construction, there would be another 19 predicted spills of salt water. These spills would involve water with lower salinity (and lower potential impacts) than would be associated with the 56 predicted spills of brine generated by cavern construction. Similarly, some spills could occur if salt water from the Gulf Coast is used during drawdown.

If a brine spill occurs, its impacts would depend on the size of the spill and the characteristics of the receiving environment. Spills to surface soils could result in those soils having greatly increased salt concentrations that prohibit the growth of vegetation in affected areas. Unless the spills are large or sustained, neither of which is predicted for the proposed action, the brine contaminants would be flushed away by rain and affected soils and vegetation would quickly recover.

Brine spills also could affect groundwater and air quality, although these impacts associated with the proposed action would be expected to be small considering the predicted frequency and magnitude of spills. In particular, shallow aquifers could experience small plumes of elevated salinities that would migrate readily along with the groundwater flow and dilute to normal levels some distance from the spill source. In addition, surface spills could result in emissions of nonmethane hydrocarbons to the air, but such emissions could be expected to be small, temporary, and of little consequence to air quality.

The impacts of brine spills to surface waters and wetlands would depend largely on the characteristics of the resources affected. A brine spill would result in the elevation of chloride concentrations to well above natural levels. Chloride concentrations could range to nearly the level of undiluted brine (greater than 200 parts per thousand) near the point of introduction of the brine. Chloride levels would decrease with distance from the spill site and over time, and through the actions of dilution, dispersion, and flushing in the receiving water body.

Although chloride is essential to life, at high concentrations it is toxic to most organisms. Chloride concentrations could exceed the acute and chronic toxicity criteria for aquatic life near the point of a spill immediately after the spill occurred. With time after a brine spill, chloride concentrations in the receiving water body gradually would return to normal (pre-spill) levels. The time required for return to normal levels would be site-specific and depend largely on the degree of flushing in the receiving waters.

The impacts of brine spills on surface water and wetland, and the rate of chloride dissipation in those resources, have been measured and observed in the aftermath of previous brine spills. These observations provide an indication of the likely impacts of brine spills resulting from the proposed SPR expansion. A very large brine spill occurred at Bryan Mound in 1989. Brine from that spill reached surrounding surface waters including the ICW. No impacts to surface water, sediment quality, or biota were observed in the ICW despite the significant volume of brine released to this water body. In the ponds and the moderately drained marshland affected by the spill, chloride concentrations in surface waters and sediments initially were elevated, but they returned to normal (pre-spill) levels within two months. In the poorly drained marshland affected by the spill, chloride concentrations returned to normal within four months. The decay of organic matter in some ponds caused temporarily depressed levels of dissolved oxygen and increased temperatures (Boeing Petroleum Services Inc. 1990b, 1990c).

3.2.2.3 Hazardous Material Spills

As discussed in section 3.2.1.3, the proposed action would be expected to result in one hazardous material spill per year at each of the new sites. Most of these spills would be expected to be in the 0.5- to 4-gallon (1.9- to 15-liters) range, although they could be as large as 10 gallons (38 liters).

The potential environmental consequences of a spill depend on the type of hazards posed by the material, the amount of the spill, and the location of the spill. In general, the spills are expected to be infrequent and generally involve small quantities of materials spilled onsite that are relatively easily remediated or contained onsite, and therefore, they would have negligible impact on the environment. This is demonstrated through the Annual Environmental Reports covering spills at each of the existing sites (DOE 2004f).

Pesticides and herbicides are used in limited and controlled quantities at the existing SPR sites. An accident scenario would involve the spill of 1 or 2 gallons (3.8 to 7.6 liters) of a pesticide compound during manual application. In a spill, protection of aquatic systems would be a high priority because pesticides and herbicides used on site (e.g., Rodeo® by Monsanto) are highly toxic to fish. Pesticides and herbicides also might adhere to sediments; however spills of 1 or 2 gallons (3.8 to 7.6 liters) of pesticide or herbicide would require relatively uncomplicated and localized cleanup. Minor impacts to plant life would occur only in the immediate vicinity of the spill. Because contaminated soil would be collected and disposed of offsite at an approved disposal facility, no long-term impacts on groundwater or surface water would be expected.

Fire protection chemicals (e.g., aqueous film-forming foam) are stored in relatively large quantities at the existing SPR sites. In a fire, any aqueous film foam released would be captured in collection ponds that border each fixed fire-control system, thus preventing the compound from reaching groundwater or surface water. These collection ponds are generally large enough to retain one discharge. Releases outside of the containment could occur in high winds or storms when the chemicals could be blown out of the containment area. In addition, if rainwater overfills the collection ponds, a release to surface water could occur. For portable fire-control systems, the largest spill scenario would involve spills of 55 gallons (210 liters) or less. Such a spill would be contained before it could reach surface water or groundwater.

While aqueous film foam does not pose a risk to human health, it exhibits varying degrees of aquatic toxicity and has a high biochemical and chemical oxygen demand. If allowed to flow freely into groundwater or surface water, it could cause severe environmental consequences. These materials also contain fluorocarbon **surfactants** (5 percent or less) that are not biodegradable. If discharged to adjacent surface water, it could result in temporary oxygen depletion in those waters in addition to inducing toxic effects in some aquatic species (DOE 1989). The most serious accident at an SPR site involving aqueous film foam occurred in 1986 at the West Hackberry site when 5,000 barrels of oil flowed into a nearby lake. The foam was used to blanket the oil on the lake. The combination of the oil spill and the foam blanket resulted in the death of 100 to 200 fish in the area (Bozzo 1991).

An accident involving ammonium bisulfite could result from a storage tank rupture. This spill scenario could involve up to 5,000 gallons (18,927 liters) of the material. Any spill likely would be contained by the brine ponds that border the ammonium bisulfite storage areas. If a tank rupture occurred simultaneously with high winds or storms, ammonium bisulfite could be blown outside of the pond area or rainwater might overfill the collection ponds. In this case, an ammonium bisulfite spill could have a temporary impact on adjacent onsite vegetation. A small area could be burned, but the vegetation likely would consist of a grass that would recover quickly. As brine released into the Gulf of Mexico is required to have oxygen content, it is possible that a spill of ammonium bisulfite into the pond could necessitate aerating the brine pond before continuing disposal. If the brine is released unaerated at the same time that a transient anoxic area is present at the diffuser location, the anoxic situation could be exacerbated. In addition, there could be releases of ammonia or sulfur gas from the surface of the brine (Personal Communication, 1991). The onsite Emergency Response Teams are trained in proper protection in handling ammonium bisulfite spills, and therefore, no adverse effects on workers would be anticipated from spill response activities. In dermal exposure, if exposed skin were immediately flushed with water, recovery likely would occur quickly. Ammonium bisulfite is not acutely toxic, and no long-term impacts of a spill would be anticipated.

Other hazardous materials (e.g., cleaning agents) at existing SPR sites are stored in 55-gallon (one barrel) quantities or less, so any spills of such materials likely would be small and contained without causing significant or long-term environmental contamination. Fuels such as diesel fuel and gasoline and some lubricating oils are stored in larger quantities, and any spills of these materials would cause impacts similar to those described for oil spills. Laboratory reagents generally are stored in smaller quantities, generally in indoor locations, and so, they are unlikely to reach outdoor areas if spilled.

3.2.2.4 Fires

In 1990, DOE performed an independent reevaluation of SPR drawdown-critical or mission-essential systems and facilities to identify needed upgrades to the SPR fire protection program and assess the need for new fixed-fire protection systems. The study indicated that there were no “eminent-danger” scenarios when a credible fire event could adversely affect the mission of SPR. The SPR fire protection program is designed to limit fire risk to the lowest practical limit (Edwards 1991b). The information presented in section 3.2.1.4 demonstrates that historic occurrence of fires since 1992 has, indeed, been low.

Nevertheless, a potential exists for fires to occur at the SPR expansion sites and proposed new sites. The 1990 DOE reevaluation identified three potential fire scenarios: a well-pad accident, a tank fire, and a pump fire. Although the possible consequences of each of these fire scenarios are potentially serious for damage to property, the probability of their occurrence is extremely small and the potential for offsite consequences is also very limited. The availability of automatically activated and manually activated fire protection and shutdown systems and the actions of onsite Emergency Response Teams likely would extinguish fires before severe consequences occurred. Also, as discussed in section 3.2.1.4, serious fire events are expected to be very rare.

The environmental consequences of fires may include short-term exceedance of ambient air quality standards, including standards for particulate emissions; short-term releases of toxic air pollutants (e.g., fluoranthrene and pyrene); and potential stormwater and surface water contamination from runoff of the materials that is burning, products of incomplete combustion, and firefighting agents such as foam.

3.2.2.4.1 Well-Pad Accident

The caverns used for oil storage are maintained under pressure, and therefore, a well-pad accident could result in severe onsite consequences with respect to fire. The only reportable fire at an SPR site that resulted in a fatality occurred in 1978 at the West Hackberry site. It was caused by a well-pad accident. As part of a workover procedure, contractors were pulling casing out of a well. After pulling 14 joints of casing out of the hole, the mud in the casing began flowing from the top of the casing into the hole. The mud and a packer, previously set in the lower sections of the casing, were forced up from the inside of the casing to the surface by pressure from below. Workers on the rig could not control the flow of the mud from the casing. The flow continued unchecked until the packer blew out of the casing followed by a flow of oil. An oil mist formed from the flow of oil was drawn into the air manifold intakes of the diesel engine on the rig and nearby diesel engines, causing them to overspeed. An explosion and fire occurred while two employees were still attempting to shut down the rig engine; both men were severely burned, and one later died from his injuries (DOE 1978).

The immediate cause of the accident appeared to be a poor packer seat in the casing. In addition, employees failed to follow the written workover procedure (e.g., depressurize the well before workover). Also, there was an inadequate safety valve on the rig, and the site was in the construction phase so that the full complement of emergency response equipment was not yet on the site. Since the time of this accident, new policies and procedures have been implemented to prevent similar occurrences in the future (DOE 1978).

3.2.2.4.2 Tank Fire

The crude oil surge tank at Big Hill has a double-deck, open-top, floating-pontoon roof design. It is equipped with a manually activated foam system for protection of the roof-to-shell seal area. Any involvement of this tank with a fire ordinarily would occur in the seal area. The initial response to any such incident would include determining the extent of the tank fire and activating the fixed-foam system (Boeing Petroleum Services, Inc. 1989).

As unlikely as it is, if the tank became fully involved in a fire, the possibility of a "boil over" exists. This could occur as heavy residuals that might contain water or water-oil emulsion accumulate and begin sinking toward the tank bottom. The result of the super-heated residuals contacting the water could result in a boil over. The contents of the tank then could erupt into extremely violent and quickly expanding steam-oil froth, sending a fireball hundreds of feet (meters) into the air, and project burning oil over the sides of the tank for several hundred feet (meters) in each direction (Boeing Petroleum Services, Inc. 1989). While this description is specific to the tank at Big Hill, similar scenarios would apply to any new or expansion site with a storage tank at the facility, a tank farm, or marine terminal.

To extinguish a fully involved tank, foam applications would be applied from ground level. In the example of a tank with a 100-foot (30-meter) diameter, a minimum application rate of about 790 gallons (3000 liters) per minute of foam would be required for about 55 minutes; such an application would require about 43,000 gallons (160,000 liters) of foam. In such a scenario, activation of the raw water injection system would release large amounts of slightly saline water at the Big Hill site that potentially could reach the groundwater or surface water in the site vicinity (Boeing Petroleum Services Inc. 1989).

3.2.2.4.3 Pump Fire

The pump pad areas at the SPR sites have many flanges, valves, and gaskets that often are manually controlled, and therefore, they offer the potential for human error. For example, valves may be left in the wrong orientation or bolts or screws may be left loose. Such error can lead to leaks or fires (Edwards 1991a).

Pumps operated at SPR sites generally can be shut off from a variety of locations. In a situation of a leak from a pump or other equipment, after a pump is shut down or the area of the leak is isolated, the likelihood of a fire is dramatically decreased as the source of additional fuel for a fire would no longer be available. The fire safety emergency shutdown system automatically shuts down any area where there is a leak or a fire. Specific areas of the SPR site also can be shutdown from the Operations Control Room or various locations around the site. For example, in a leak or a fire situation at a specific cavern during oil fill, all pumps and valves associated with that cavern and the pipelines leading to and from it, would be shut down remotely without any personnel entering the area of the leak or fire. Such mechanisms ensure that a leak or a fire can be contained quickly to the initial starting point and prevent potential injury during shutdown (Edwards 1991a). In an electrical power loss, manual shutdown of pumps and valves is also possible.

The crude oil pumps and related pumping facilities at existing SPR sites are protected by an automatic foam deluge system. These foam systems are subject to routine maintenance and testing, and they would significantly reduce the possibility of a major fire in the pump area. The foam deluge system would be activated by ultraviolet and infrared fire detectors. After they are activated, they can provide foam in a matter of seconds. The foam deluge would quickly suppress, extinguish, and blanket any pooled (two-dimensional) ground fire associated with any crude oil release. The foam deluge would contain but not extinguish three-dimensional fires associated with the pump seal or piping (Boeing Petroleum Services, Inc. 1989). Additional response activities would be needed to extinguish that type of fire. The probability of the occurrence of a pump fire is unlikely; as such a fire has never occurred on an SPR site. The onsite location of these pumps and redundant operational controls limit the potential for environmental impacts should a fire occur.

3.2.2.5 Occupational Injuries

Currently each SPR site operates under a centralized environmental management system that conforms to International Organization for Standardization (ISO) 14001. The SPR Contractor, DynMcDermott, voluntarily maintains certification to the ISO 14001 standard and has attained accreditation in the ISO 9001 Quality Management Program. In conjunction with these certifications, each SPR site, including the proposed expansion sites at Bayou Choctaw, Big Hill, and West Hackberry, has attained and maintained Occupational Safety and Health Administration (OSHA) Voluntary Protection Program Star Status and DOE Voluntary Protection Program Star Status since 1991 (DOE 2004g; OSHA 2006a; OSHA 2006b). The approval process for these programs requires applicants to submit a comprehensive application and undergo a rigorous OSHA onsite evaluation of their worksite and its safety and health management system.

All SPR sites exceeded OSHA Voluntary Protection Program Star status and achieved Star among Star status. The VPP STAR Program is designed for exemplary worksites with comprehensive, successful safety and health management systems. Companies in the Star Program have achieved injury and illness rates at or below the national average of their respective industries. Star participants are reevaluated every three to five years and incident rates are reviewed annually (OSHA 2004a). The reported Lost Workday Case Rate for the SPR sites was less than one workday lost (0.83 days) due to injury per 200,000 worker hours, as compared to the Bureau of Labor Statistics average of 5.3 days, the OSHA VPP Star Among Star level of 2.3, and the OSHA VPP Super Star level of 1.33 (NIST 2005.)

Based on this record, DOE expects that the proposed new and expansion sites would achieve OSHA and DOE VPP Certification and that proposed expansion sites would maintain certification and have lower rates of worker injury, illness, and lost work days than similar types of industrial facilities.

3.2.3 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that would occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained, and hence any additional environmental impacts such as those from spills of oil and brine would not occur. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the Chacahoula storage site and if the proposed site were developed by a commercial entity for oil and gas purposes some spill risk would exist. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity, which could involve brine-spill risk.

For the portions of the proposed storage site pipelines that follow existing ROWs, the risk of a spill associated with the No-Action alternative would be limited to spill risk that exists from the existing pipelines. For the portions of the pipeline in new ROW, the No-Action alternative would not have any spill risk. For the sites of terminals that are in developed petroleum storage areas it is possible that a commercial entity could develop those sites for storage and some spill risk would occur. For the terminal sites in undeveloped areas there would be no spill risk associated with the No-Action Alternative.

3.3 LAND USE

This land use analysis evaluates how SPR development might affect existing land characteristics and uses at each potential new and expanded SPR site and associated infrastructure in direct or indirect ways. The section is organized as follows: methodology, common impacts, affected environment and potential impacts for each site and its infrastructure, and the no-action alternative.

3.3.1 Methodology

DOE identified the existing land use conditions at each potential new or expanded SPR site and assessed potential land use impacts in the following four areas:

- Possible land use conflicts,
- Visual resources,
- Prime farmland, and
- Coastal zone management.

The approach to assessing each of these impact topics is discussed below.

The effects of Hurricanes Katrina and Rita on existing conditions are also noted in this section as appropriate. In August and September of 2005, these two hurricanes passed through the Gulf Coast region and affected environmental conditions in the vicinity of several existing and proposed new and expansion sites and their associated infrastructures in Louisiana, Mississippi, and Texas. To understand how the hurricanes affected existing conditions, DOE consulted with affected parties in these areas during the subsequent EIS scoping process and in meetings with other Federal, state, and local agencies. DOE assessed site observations following the hurricanes, reviewed information gathered from scoping, and conducted other research regarding changes in the affected environment from the hurricanes. In general, although the hurricanes caused extensive damage at and near some proposed facility locations, they did not change the character of the lands as rural and largely undeveloped. Thus, changes in the long-term uses of such lands as a result of the 2005 hurricanes are unlikely and not yet apparent.

3.3.1.1 Possible Land Use Conflicts

To understand potential land use conflicts from SPR development, DOE assessed land uses for a 2-mile (3.2-kilometer) radius around each proposed new or expansion storage site, RWI structure, pipeline route, power line, road, and oil distribution terminal and tank farm. For each proposed storage site, DOE based the affected environment section on previous SPR site characterization studies (e.g., DOE 1979, 1992; Magorian and Neal 1990; Maggorian et al. 1991; Neal 1993; Sprehe 2003) and updated information from site visits and data evaluation conducted in late 2005 and early 2006. DOE examined the land vegetation and land use classification types that could be affected during the construction and operation of each proposed new or expansion storage site and the associated infrastructure. DOE assessed potential conflicts with residential and commercial land uses and areas with special designations such as U.S. Forest Service lands; wildlife refuges; wilderness areas; wild and scenic rivers; scenic areas, roads, or trails; and parks. As part of this analysis, DOE assessed potential constraints and management controls at the county or parish, state, and Federal levels. The only major land use controls that were identified in this analysis were requirements regarding coastal zone management, which are discussed as a separate topic below.

DOE's evaluation of the magnitude of the potential land use conflicts takes into account the amount of land potentially affected, the type of land use that would be affected, the duration of the potential impact, and the extent of the conflict. It also considers the actions that DOE would take as part of the proposed action to help avoid or reduce land use conflicts and other land use impacts, including the following:

- Placing new pipeline and power lines in existing ROWs to the maximum extent feasible;
- Avoiding specially designated areas and consulting with affected agencies to minimize effects on these areas;
- Burying pipelines except when crossing levees;
- Revegetating and restoring the land as quickly as possible and where feasible;
- Storing equipment and materials in established storage areas;
- Providing the public with a construction schedule;
- Establishing community liaisons to work with affected landowners and public to resolve problems;
- Providing effective and efficient access to work sites with minimum interference to public;
- Painting buildings and structures in appropriate colors; and
- Shielding affected areas from public view where feasible.

3.3.1.2 Visual Resources

Any activity that introduces new or changed forms, lines, colors, and textures to the environment would have an impact on the visual character and quality of the area. DOE evaluated the potential visual impacts of the possible SPR activities by considering the types of site users and other project locations, amount of use, public interest in the particular visual landscapes, adjacent land uses, and the existence of specially designated areas, as described above. The construction and operation of each proposed new or expansion storage site, RWI structure, pipeline, power line, road, oil distribution terminal, and tank farm may cause contrasts with the existing landscape. For this analysis, DOE presumed that viewers would be more sensitive to visual contrasts on lands with special designations, such as national forests or wildlife refuges, which may be visited more often and serve a greater aesthetic or uniquely scenic purpose. The impact analysis also recognizes that throughout the region of influence for the various SPR storage sites, pipelines and industrial facilities are common, which would limit the contrast with the existing visual setting caused by SPR expansion.

3.3.1.3 Prime Farmland

DOE's actions in selecting sites for SPR program expansion could result in the temporary or long-term loss of land having certain soil or other natural resource characteristics that are of high value. Prime farmland is a resource that could be lost or damaged by surface-disturbing activities or conversion of land from one use to another. The Farmland Protection Policy Act (7 USC 4201 to 4209; 7 CFR Part 658) seeks to minimize Federal programs' contribution to unnecessary and irreversible conversion of farmlands to nonagricultural uses. Compliance with this law requires DOE to identify and consider adverse effects of the proposed action on the preservation of farmland, appropriate alternative actions that would lessen adverse effects on farmlands, and as far as practicable, ensure that the proposed action would be compatible with state, local and private programs and policies to protect farmland.

To comply with the Farmland Protection Policy Act, DOE has consulted with the offices of the U.S. Department of Agriculture's NRCS offices in Louisiana, Mississippi, and Texas to identify and evaluate prime farmlands that would be affected by SPR expansion. Using NRCS's rating system, DOE calculated farmland conversion impact scores for each proposed site and associated infrastructure and for each alternative considered in this EIS.

3.3.1.4 Coastal Zone Management

The Coastal Zone Management Act (CZMA) was enacted in 1972 to encourage coastal states to develop comprehensive programs to manage and balance competing uses of and impacts to coastal resources. The CZMA emphasizes the primacy of state decision making regarding the coastal zone. Section 307 of the CZMA addresses the consistency requirements for both states and the Federal Government and allows states to manage coastal uses and resources and facilitate cooperation and coordination with Federal agencies. It requires Federal agency activities with reasonably foreseeable effects on any land or water use or natural resource of the designated coastal zone to be consistent, to the maximum extent practicable, with the enforceable policies of a coastal state's federally approved coastal management program. The lead state agency that implements or coordinates a state's federally approved coastal management program is responsible for Federal consistency reviews. All three affected states in this EIS have primacy for the CZMA, and each has developed a Coastal Management Program.

DOE has consulted with the appropriate state agencies—namely the Louisiana Department of Natural Resources, Coastal Management Division; the Texas General Land Office, Coastal Resources Program; and the Mississippi Department of Marine Resources—to understand their concerns and issues regarding the proposed SPR sites and associated infrastructure that could be located in coastal zones. The consultation process with these agencies is still in progress. The agencies preferred that DOE coordinate its required coastal consistency determination for the selected alternative with both the applicable state agencies and with the USACE, which will have CWA Section 404 permitting responsibilities. The applicable state agencies in Texas, Louisiana, and Mississippi often use joint review processes with the USACE on permit applications affecting lands within the designated coastal zone. USACE will forward the determination to the coastal zone management agencies, which would conduct a consistency review and either object or concur with DOE's determination. This process satisfies the requirements of the CZMA.

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3.3.2 Impacts Common to Multiple Sites

The construction and operations and maintenance of a new or expanded SPR site and associated infrastructure would involve many similar activities across similar proposed locations. Using the methodology described above, DOE analyzed the likely impacts that might be common to all or most proposed new and existing storage sites and their infrastructure. Those impacts are discussed in this section. Additional site-specific impacts are discussed in sections 3.3.3 through 3.3.9.

3.3.2.1 Possible Land Use Conflicts

Storage Sites

The use of land for SPR petroleum storage purposes at any of the new or expansion storage sites generally would preclude the future use of that land for other purposes. SPR land use at the storage sites would include establishment of a buffer around the storage sites and other security measures. The buffer for each site would generally consist of a cleared area 300 feet (91 meters) beyond the outer security fenceline for line-of-site surveillance. SPR site access would be limited to those persons who require access for official SPR purposes. DOE would have exclusive use of the storage sites.

The proposed new Bruinsburg, Chacahoula, Richton, and Stratton Ridge storage sites would require construction of new petroleum storage facilities, as described in chapter 2. The potential conflicts for each proposed new site are analyzed in sections 3.3.3 through 3.3.6.

Expansion of storage capacity at Bayou Choctaw, Big Hill, and West Hackberry would require acquiring existing caverns or constructing new caverns. Because SPR storage facilities already exist on these salt domes, there would be no land use conflicts from expanding storage capacity. These sites have limited value for nonindustrial purposes. In addition, less construction would take place at the proposed expansion storage sites than at the proposed new storage sites because DOE would use existing support facilities and infrastructure. The likelihood of land use conflict at the existing storage sites is further limited because these sites are not located in or immediately adjacent to specially designated or protected areas, commercial areas, or residential areas. Thus, DOE does not expect land use conflict at the three expansion storage sites.

Pipelines

As described in chapter 2, all proposed new and expansion SPR sites, except Bayou Choctaw and West Hackberry, would require new pipeline infrastructure for water, brine, or petroleum. The existing pipeline infrastructure in the Gulf Coast region is extensive, and pipelines generally result in limited land use conflicts if they are located in existing corridors or in rural areas away from population centers. Where feasible, DOE has proposed pipeline routes that are not near residential or commercial areas and would not cross lands with special designations or purposes. Maximum feasible use of existing ROWs would reduce possible land use conflicts because construction would be required only to widen an existing, maintained corridor, and any land use change would be limited to the construction period at that location and the expansion of the ROW. The width of pipelines easements would vary with the type of terrain the pipeline crosses (e.g., upland or wetland) and other characteristics. Construction easements would range from 50 to 100 feet (15 to 30 meters) for a single pipeline and 120 to 150 feet (30 to 46 meters) for multiple pipelines. Permanent easements would be 50 feet (15 meters) for one pipeline and 50 to 100 feet (15 to 30 meters) for multiple pipelines.

With the exception of pipelines crossing levees, DOE would bury pipelines. Buried pipelines would create some temporary surface disturbance and trenching, but in the long term, land use impacts would be limited. A pipeline ROW would preclude some land uses that would involve excavation or could otherwise damage the pipeline. Other uses, including recreation, hunting, and most agriculture would still be allowed. Pipelines would traverse levees aboveground, and these pipelines would be designed to have no effect on levee operation and would not pose land use conflicts.

Operations and maintenance activities associated with pipeline ROWs include inspections, mowing of nuisance vegetation along the pipeline ROW, and maintaining grass covers to prevent erosion. Section 2.3.10 describes these operations and maintenance activities. These activities generally would not create land use conflicts, except possibly where pipelines cross land with special designations for the Bruinsburg, Richton, and Stratton Ridge. These three situations are discussed in the site-specific sections below.

Electric Power Lines

The construction and operation of new electric transmission and distribution lines would be required for proposed new sites, but not the expansion sites. The ROWs would be relatively narrow, with a maximum width of 100 feet (30 meters). All new electric transmission poles and lines, with one exception, would be constructed along ROWs or roads that already exist or would be built to support new SPR pipelines; the general level of land use impact or conflict for these power lines would be low. The exception would be a 5.5-mile (8.6 kilometer) power line from the Bruinsburg site to the Grand Gulf substation would be in a new ROW by itself. This ROW would be through rural, largely forested habitat. The potential land use impacts may be higher where the power lines would cross lands with special designations or in residential areas. As described further below, this would occur for the proposed Bruinsburg, Richton, and Stratton Ridge sites.

RWI Facilities

DOE would construct new RWI systems for all potential new sites. RWI systems would not affect any nearby specially designated or protected lands, residential areas, or commercial areas at the other new sites with the exception of the Stratton Ridge site. The proposed RWI site at Stratton Ridge would be located within and along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. Potential for land use conflicts associated with the construction and operations and maintenance of the Stratton Ridge RWI system is discussed in section 3.3.6.

The proposed expansion sites have existing RWI facilities. The facilities at Bayou Choctaw and Big Hill, however, would be upgraded if one of the alternatives, other than the no-action alternative, is selected. Because the expansion of the RWI systems would not constitute a change in existing land uses, it would not constitute a conflict. The West Hackberry site would use the existing RWI system with no changes; therefore, it would not pose any land use conflicts.

The operation and maintenance of all new and expanded RWI systems are not expected to have long-term impacts on surrounding water that could affect commercial or recreational fishing. Sections 3.7 and 3.10 further discuss the potential impacts of the construction and operations and maintenance of the RWI systems on biological resources and noise.

Brine Discharge

Brine from Chacahoula, Richton, and Stratton Ridge would be discharged into the Gulf of Mexico. New brine disposal pipelines would be built for all new sites. For Big Hill, the existing system would be upgraded.

Sections 3.6 and 3.7 address the potential for the construction and operation of the offshore brine disposal system to affect water quality, navigation, aquatic organisms, and commercial fishing operations. Any land use conflicts from this construction would be limited to the location of the offshore pipeline during the brief period for constructing that pipeline segment. Permanent land use conflicts would not arise because the brine pipelines and diffusion system would not limit access to the Gulf of Mexico or harm recreational or commercial resources. Thus, the site-specific land use analysis does not discuss offshore brine disposal land use conflicts.

Brine from Bruinsburg, Bayou Choctaw, and West Hackberry would be disposed of in underground injection wells. New wells would be constructed for these sites, except West Hackberry. The new wells for the new sites would constitute a new land use, as is discussed in the site-specific analysis. For the Bayou Choctaw expansion site, DOE would build six new wells near an area with existing underground injection wells. This upgrading of existing systems at the expansion sites would not constitute a change in existing land uses.

Terminals and Tank Farms

New tank farms and other facilities at oil distribution terminals would be required at the following locations:

- Anchorage, LA, and Peetsville, MS, for the Bruinsburg site;
- Pascagoula, MS, and Liberty Station, MS, for the Richton site; and

- Texas City, TX, for the Stratton Ridge site.

The terminals at Anchorage, Liberty Station, Pascagoula, and Texas City would be located in existing industrial areas and therefore would not present a change in existing land uses. The terminal at Peetsville would be located in a rural area where the terminal would represent a new land use but would not be likely to conflict with existing land uses. The potential land use conflicts for the Peetsville terminal is discussed in the site-specific analysis below.

3.3.2.2 Visual Resource Impacts

Storage Sites

SPR storage sites would include storage caverns created in large salt domes and a variety of support facilities and infrastructure. The layout of these facilities is illustrated in chapter 2. While a large number of viewers would not see the storage site areas because public access would be limited, the sites would appear industrial in nature and contrast with surrounding natural vegetation.

Construction activities at new or expanded SPR storage sites might result in temporary visual impacts from new buildings, trenches, construction equipment emissions, access roads, night lighting, and dust. Construction activities would result in long-term changes to the existing landscape. Visual impacts also might arise from operations and maintenance of buildings and associated infrastructure, lighting, fencing, and cleared areas. Buildings and facilities at the SPR storage sites would generally be designed and constructed for their safety and functionality, not for their visual appeal. Because the potential new storage sites would generally not be observable from specially designated, commercial, or residential areas, there would be limited visual conflict and contrast. The Bruinsburg storage site, discussed in the site-specific analyses below, could have a higher magnitude of visual impacts because of its proximity to areas with higher visual sensitivity.

The expansion of Bayou Choctaw, Big Hill, and West Hackberry would not provide a large visual contrast with the existing landscape because of the existing industrial land use at these sites. In addition, because less construction would take place at the three existing SPR storage sites, the visual effects of such construction would be smaller in magnitude than the changes associated with the new sites. Also, none of the expansion storage sites is located in specially designated land, commercial, or residential areas.

Pipelines

The construction of pipelines and the operations and maintenance of pipeline ROWs would change the character of vegetation across the new or expanded ROWs. Where new pipelines would be built in developed areas, they would be located below public property such as roads and other ROWs. New or expanded ROWs would be cleared and grubbed, which would require removing and trimming of any trees and removing surface vegetation, rubbish, and existing structures. While these activities might result in visual contrasts with the existing landscape, the peak of impact would be during construction activities, which would last from six to ten weeks at any point along a pipeline. The contrast would be substantially reduced after construction is complete and the ROW is revegetated or otherwise restored. DOE would give all possible consideration to preserving trees in the ROW. DOE also would grade the ROW to facilitate laying the pipeline and would build temporary facilities such as roads and sand bridges for use during pipeline construction.

Operations and maintenance activities would involve the mowing of nuisance vegetation along ROWs, maintaining grass covers, or constructing and maintaining terraces, plugs, and bulkheads. These activities would cause visual contrasts with the landscape, which would be more substantial at close viewing range and would diminish with longer range. Views of pipelines and pipeline ROWs are quite common in this region, especially in Louisiana and Texas, which may limit the contrast with the existing visual setting caused by new pipelines. Overall, any visual contrast would be minimal, except possibly where the pipelines are in specially designated areas, such as parks. Pipelines associated with the proposed Bruinsburg, Richton, and Stratton Ridge sites would traverse lands with such special designations. The potential visual impacts for these pipeline segments are discussed in the site-specific analyses below.

DOE would bury all pipelines except those traversing levees, which would minimize visual contrasts with the existing landscape. Pipelines would traverse levees aboveground, and these pipelines would add new characteristics to the views of the levees. When identifying proposed pipeline routes, DOE selected routes along existing pipeline ROWs, power line ROWs, and roads to the extent practicable. Expansion of existing ROWs would provide less contrast with the existing landscape because the incremental visual changes would be small.

The construction and operations and maintenance of new ROWs would result in a greater visual contrast with the existing landscape than the expansion of existing ROWs. The number of viewers who could observe the new pipeline ROWs would likely be limited because, with few exceptions, they would be located in rural areas. In the few instances where pipelines would cross developed areas, the long-term visual impacts would be small because these ROWs would follow existing ROWs such as roads.

Electric Power Lines

New electric power and lines would be required for the proposed new SPR sites. All new power lines, with one exception, would be constructed along existing ROWs or roads, or along ROWs or roads that would be built to support new pipelines. The exception would be the 5.4-mile (8.7-kilometer) power line from the Bruinsburg site to the Grand Gulf substation, which would be through rural, largely forested habitat. The new power lines might pose a visual contrast with the existing landscape. Relatively few people, however, are likely to view these power lines because the ROWs are located in rural areas that lack unique visual characteristics of special interest to the public. In general, the potential visual impacts associated with lines and poles in rural areas would be associated with a continuation of urbanization and development, and not directly associated with SPR development.

The power lines and poles associated with the Bruinsburg and Stratton Ridge sites could interact with specially designated lands and therefore might have a greater potential visual impact, as discussed in the site-specific analyses.

RWI Facilities

A typical RWI structure would be a steel and concrete platform sufficiently elevated to withstand a 100-year flood. A fence with security lights would surround the entire structure. The construction and operations and maintenance of new RWI systems would contrast with the visual landscape of the water body and adjoining land. While they may constitute a change in the viewshed, RWI systems that are not located near specially designated lands, commercial, or residential areas would have few potential viewers. Of the new SPR sites, only the proposed RWI site for Stratton Ridge would have potential visual impact issues. It would be located within and along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. Potential visual impacts associated with this system are discussed in section 3.3.6.3 below.

Expanding the RWIs for existing facilities would provide little visual contrast, considering the present infrastructures and their existing impacts on the visual landscape. Because the West Hackberry site would use the existing RWI system, no additional visual impacts would occur there.

Brine Discharge

The brine from all new and expansion sites except Bruinsburg, Bayou Choctaw, and West Hackberry would be discharged into the Gulf of Mexico. The discharge would have little visual impact because the brine would not be visible. In addition, brine discharges are not expected to have substantial effects on nearby plants and fish, as discussed in section 3.7.

At the three SPR expansion sites—Big Hill, Bayou Choctaw, and West Hackberry—the existing brine discharge systems would be upgraded, which would not contrast greatly with the existing landscape and, therefore, would have a low level of visual impact.

The Bruinsburg brine discharge system would require the construction of 60 new underground injection wells offsite, each requiring 230 square feet (21 square meters) of land. While there may not be a large number of viewers of the Bruinsburg well sites, they would appear industrial and would contrast with the existing viewscape.

Terminals and Tank Farms

The new tank farms and other terminal facilities at Anchorage, Pascagoula, and Texas City would be located in existing industrial areas and would provide little visual contrast to the existing landscape. Potential viewers of these facilities would not likely be visually sensitive to any changes in the viewshed. The new tank farms at Peetsville and Liberty Station would be located in rural areas. These new facilities would contrast with the existing forested and agricultural landscape, as discussed in the site-by-site analysis.

3.3.2.3 Prime Farmland Impacts

SPR development activities would cause farmland conversion by shifting the use of land to nonfarm uses, with irretrievable losses occurring when the land is developed and committed to other uses for the long-term. Any prime or unique farmlands located on proposed SPR storage sites, RWI facilities, and oil distribution terminals would be permanently converted to nonfarm uses because the potential use of that land for agricultural purposes would be lost.

The construction of pipelines and power lines would temporarily prohibit agricultural use of farmland within the construction easement during the construction period of up to six to ten weeks at any specific location. With proper management practices, the impacts of new or expanded ROWs would be small and would not convert farmland to nonagricultural uses. These practices would include the following:

- Consultation with landowners and farms to address field access, irrigation, revegetation, timing, and other sensitive cropping issues;

- Stripping and segregating topsoil from subsoil when digging trenches and grading agricultural lands, and replacing the segregated topsoil after the trench is backfilled and the subsoil is restored to grade; and

- Restoring and returning land temporarily affected by construction to agricultural use.

DOE, in consultation with the U.S. Department of Agriculture's NRCS, scored all of the individual sites and all of the alternatives using the farmland conversion impact rating. This scoring system is specified in the Farmland Protection Policy Act regulations (7 CFR Part 658). It considers a wide variety of factors related to potential farmland conversion impacts, including the amount of prime or unique farmland that would be converted; the amount of statewide and locally important farmland; the use of the land and nearby land; the distance to urban built-up areas and urban support services; on-farm investments; and compatibility with existing agricultural use. Under the Farmland Protection Policy Act regulations, "sites receiving a total score of less than 160 need not be given further consideration for protection and no additional sites need to be evaluated" (40 CFR 658.4(c)(2)). All of the proposed new and expansion sites and all of the alternatives have scores less than 160 and need not be given further consideration for protection.[1] Thus, the site-by-site analysis below does not address farmland.

3.3.2.4 Coastal Zone Management Impacts

For those sites and associated infrastructure that would be located in designated state coastal zones, DOE would be required to comply with the applicable parts of each state's Coastal Management Program. Coastal zone management is an important local and regional planning tool to limit the potential adverse effects on coastal resources. The types of problems that can occur from development within coastal resources include accumulation of contaminants and pollutants, coastal erosion, land loss, loss of wetlands, and a decline in the natural functioning of habitats and natural resource relationships. Use of lands for SPR purposes in coastal zones would not be expected to cause any major Coastal Management Program concerns, except for impacts on wetlands at some sites. Specific coastal zone management issues and processes relevant to the various SPR sites within coastal zones are identified in the site-specific discussions. The Bruinsburg and Bayou Choctaw sites and infrastructure are not located within designated coastal zones and therefore would not be affected by coastal management processes. The other sites and/or their infrastructure are located in coastal zones. See figures 3.3.2-1 through 3.3.2-3 below for maps showing the locations of designated coastal zone management areas for Louisiana, Mississippi, and Texas relative to the proposed storage sites and associated infrastructure.

3.3.3 Bruinsburg Storage Site

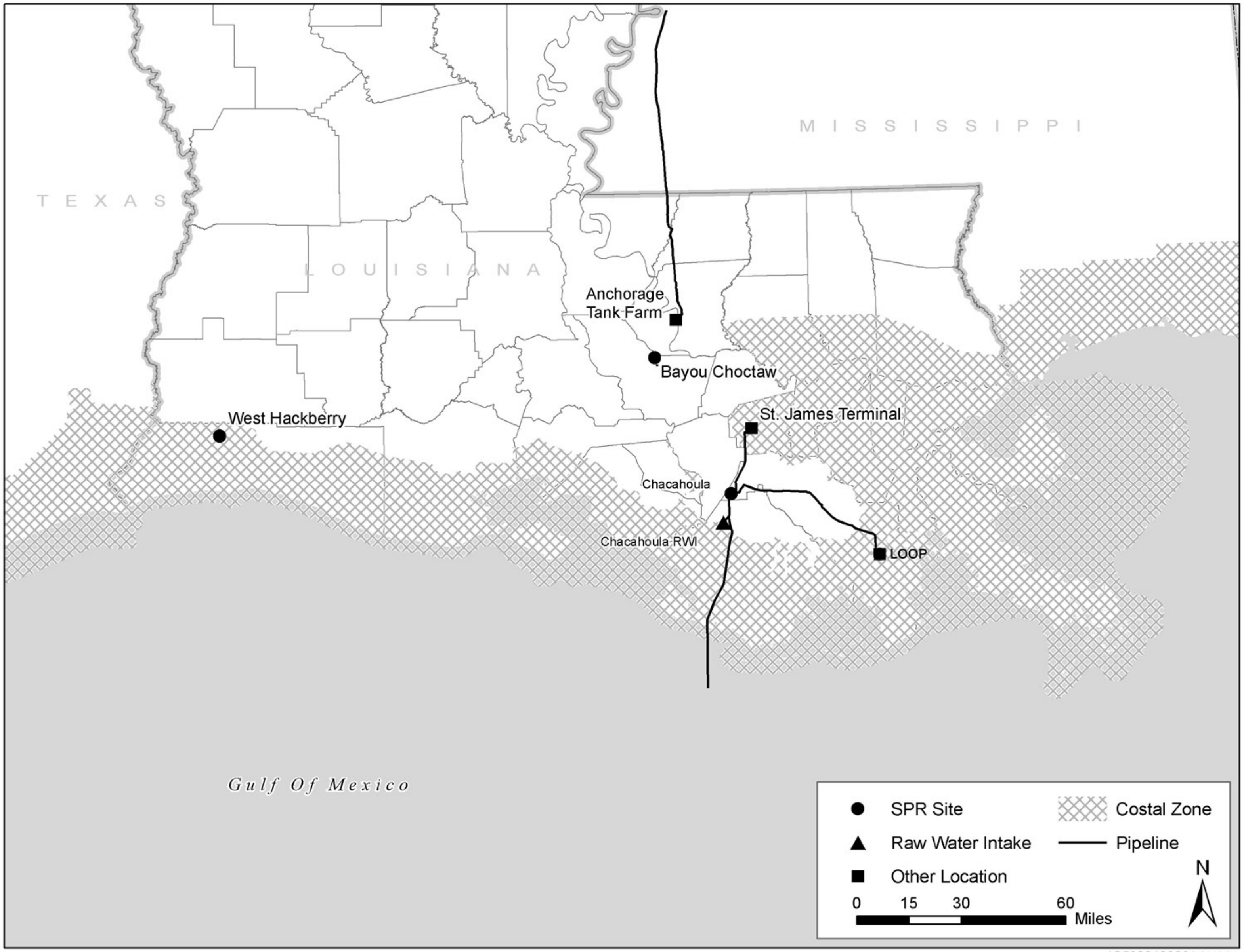
3.3.3.1 Affected Environment

The Bruinsburg salt dome is located in Claiborne County, MS, about 3 miles (4.8 kilometers) east of the Mississippi River. See figures 2.4.1-1 through 2.4.1-3 in chapter 2. With about 70 percent of the land area in the County forested, timber production is an important regional land use. The hardwood forests also provide hunting and fishing opportunities. Agriculture is also an important industry in the County.

The potential Bruinsburg storage caverns would be located on a floodplain where the Union Army, under General Grant, disembarked after crossing the Mississippi River on April 30, 1863. The facilities for the storage site (e.g., administrative buildings, brine pond, pumps) would be located outside the floodplain in an area overlooking the caverns. Section 3.9 discusses further details on the historical nature of the site. The proposed storage site, which is privately owned, would consist of 364 acres (147 hectares) including a 300-foot (91-meter) security buffer. Nearly half of the site is cultivated for producing cotton, corn, hay, soybeans, and wheat. Hunting blinds for deer and other game species are distributed around the perimeter

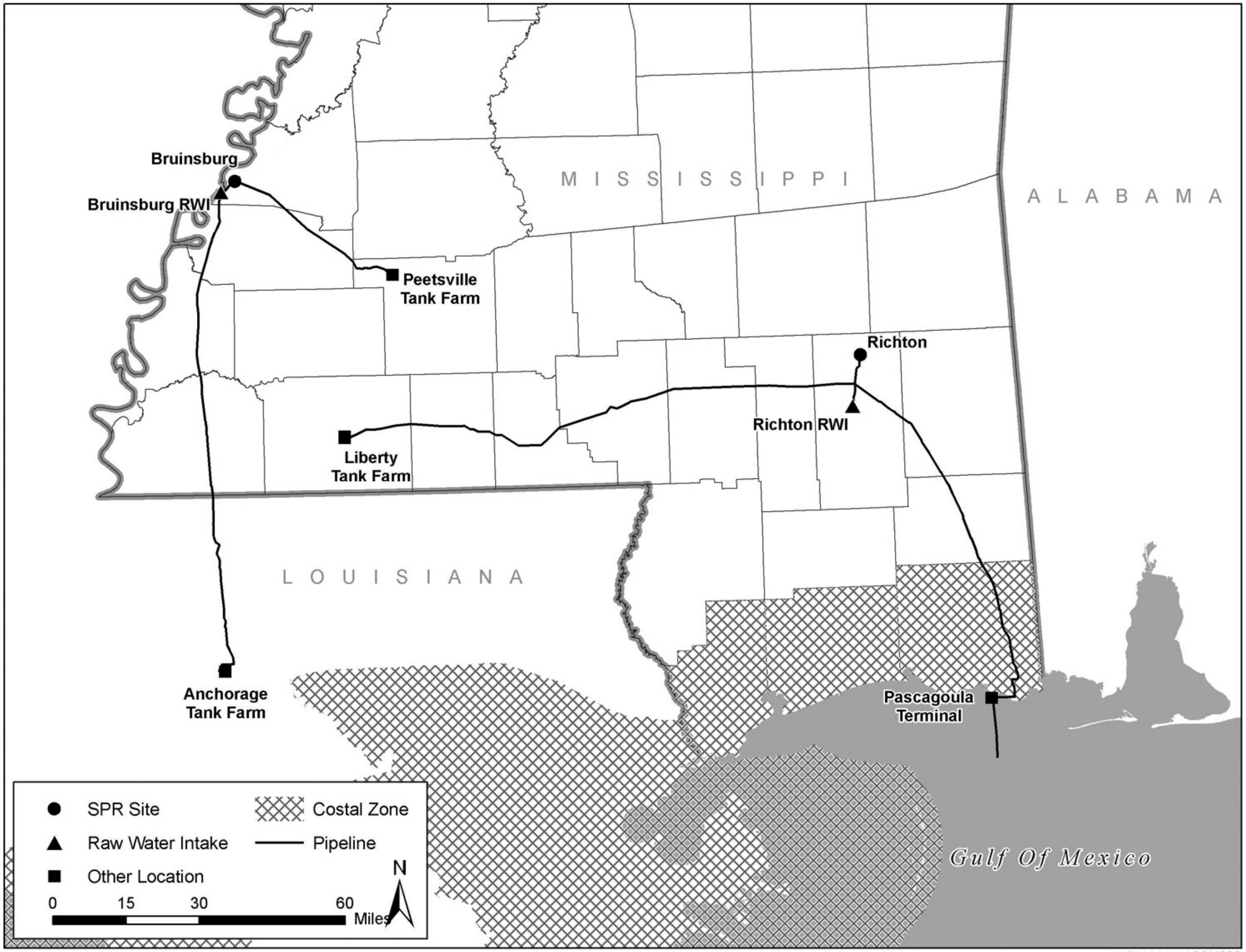
[1] The location of some of the proposed sites and their infrastructure changed slightly since DOE consulted with NRCS. Additional consultations to incorporate the new information were not feasible for inclusion in this EIS. Nonetheless, the nature of these minor changes would not increase the score for any site and its infrastructure to be greater than 160 points.

Figure 3.3.2-1: Coastal Zone Management Areas in Louisiana



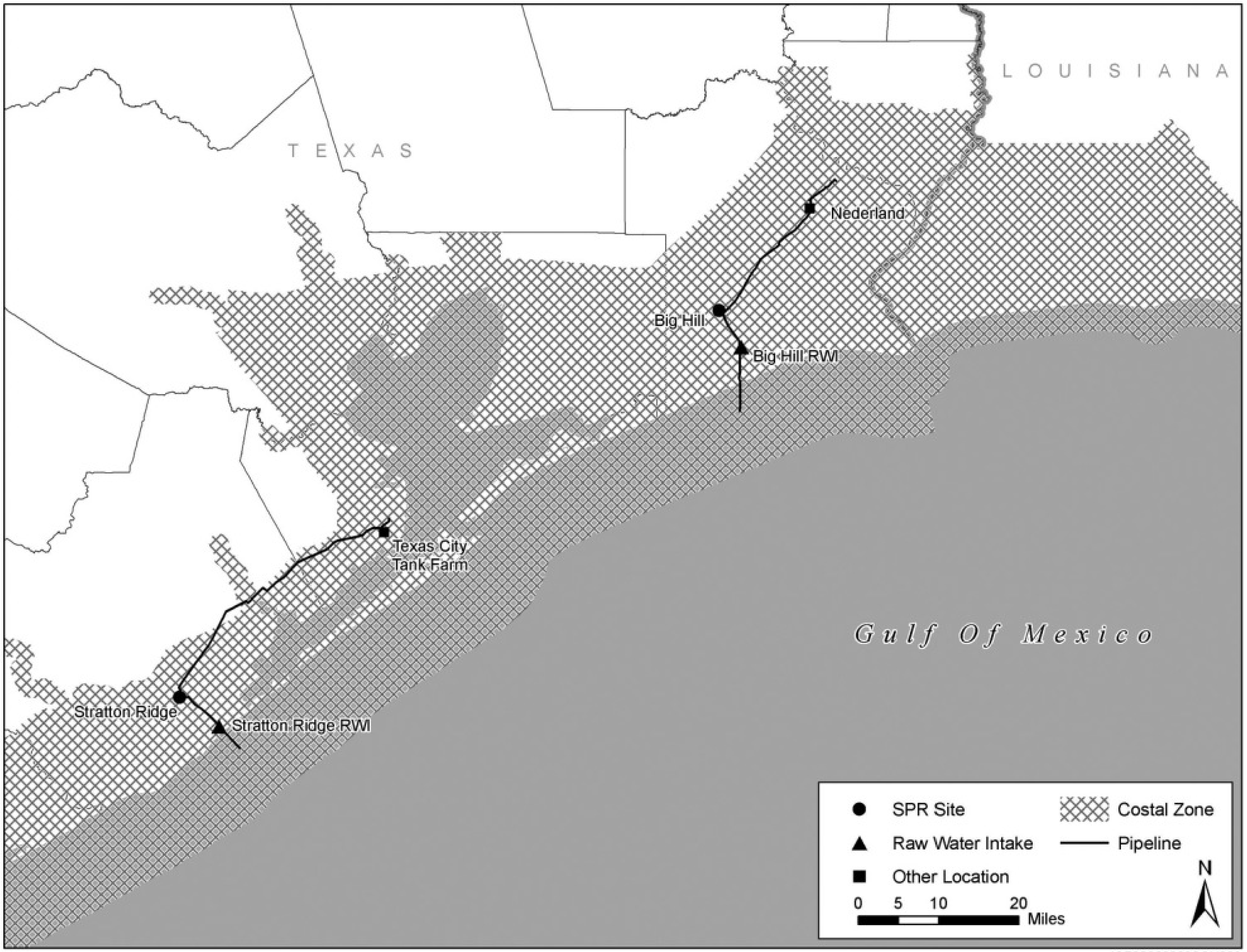
ICF20060808SSH001

Figure 3.3.2-2: Coastal Zone Management Areas in Mississippi



ICF20060808SSH002

Figure 3.3.2-3: Coastal Zone Management Areas in Texas



ICF20060223SSH003

of the cotton fields. The remainder of the site is forested wetlands. It also has a barn and silo. Scattered residences are nearby, with the closest home approximately one-half mile (0.8 kilometers) from the proposed site. The Bruinsburg site would require the development of several pipelines and power lines, as described in section 2.4.1 (see figure 2.4.1-3). These pipelines and power lines would be located in mainly rural areas with some agricultural land and wetlands. The crude oil pipeline ROW to the Peetsville, MS, terminal would cross three special purpose areas:

- Natchez Trace National Scenic Trail is an ancient trail that connected portions of the Mississippi River to salt licks located in central Tennessee. The trail also was used by traders in the late 18th and early 19th centuries. The trail is managed by the National Park Service.

- The Natchez Trace Parkway, a 440-mile (710-kilometer) highway also is managed by the National Park Service.

- The Homochitto National Forest in the southwest Mississippi is managed by the U.S. Forest Service for a variety of recreational, wildlife, and forestry uses. The crude oil pipeline would travel through private property contained within the proclamation boundary of the National Forest.

The Winsor Ruins, a fire-damaged plantation house that is a well-known historic symbol of Mississippi, and prehistoric earthwork sites of potential cultural importance to the Choctaw, are located near the crude oil pipeline to Peetsville, MS. Section 3.9 discusses further details on the historical nature of this area.

Sixty brine disposal wells would be developed offsite on 73 acres (30 hectares) of undeveloped land along the Mississippi. A RWI system on the Mississippi River would be constructed about 4 miles (7 kilometers) east of the site. The water intake structure would be located in an agricultural and forested area, less than 2 miles (3.2 kilometers) from the small town of St. Joseph, LA, on the other side of the river.

The Bruinsburg site would require a new oil distribution terminal with aboveground storage tanks in Anchorage, LA, as shown in figure 2.4.1-5. The proposed 71-acre (28-hectare) terminal would be located south of the Exxon/Mobil and Placid Refineries. The existing land use for the area where the proposed facility would be located is row crop agriculture. Most of the area surrounding the proposed site is currently in industrial, agricultural, and some residential use. A second terminal would be constructed in Peetsville, MS, in a rural, partly forested area, as shown in figure 2.4.1-4. The proposed 71-acre (28-hectare) tank farm would be adjacent to an existing pipeline pump station. Managed forests and scattered rural housing surround the site.

The Bruinsburg area did not receive substantial damage from Hurricanes Katrina or Rita in 2005. The locations of the proposed Bruinsburg pipelines, RWI, and other infrastructure associated with the proposed SPR site were also outside the path of hurricane-force winds.

3.3.3.2 Potential Impacts

3.3.3.2.1 Possible Land Use Conflicts

The Bruinsburg area has no historical land uses associated with oil and gas development. Only a fraction of the land in the vicinity has been disturbed by railroads, roads, canals, and other infrastructure or development. Considering the nonindustrial and undeveloped nature of the area, the land proposed for potential development of the storage site and the underground injection wells could be used for various purposes. There are no specially designated lands or residential or commercial areas close to these proposed locations. There are no known plans for any significant new land uses in the area. While the proposed SPR storage and injection well sites are undeveloped, general land use patterns would not conflict with the construction or operation of these SPR facilities.

As discussed in the common impacts section 3.3.2 above, the construction and operation of pipelines and power lines would not conflict with existing land uses, save the following two exceptions:

- The crude oil pipeline to the Peetsville Terminal, MS, would cross the Natchez Trace National Scenic Trail and the Natchez Trace Parkway in an existing utility ROW. The expansion of the ROW would require clearing additional vegetation and would slightly expand the scope of the existing land use of the ROW.

  - Mitigation: If one of the Bruinsburg alternatives is selected for expansion, DOE would coordinate with the National Park Service to obtain the proper ROW easements through the trail and parkway. DOE would work with the National Park Service to ensure that land use conflicts are minimized to the maximum extent practicable.

- The same pipeline would travel through private property contained within the proclamation boundary of the Homochitto National Forest for 6.8 miles (11 kilometers). Approximately 5.6 miles (9 kilometers) of the pipeline would go through a new corridor along highway 550 and the remainder would be along an existing power line ROW. Along these ROWs, vegetation would be cleared and trees would not be allowed to regrow within the 50-foot (15-meter) permanent easement. The remaining area affected by construction would be allowed to regenerate to natural habitat. The pipeline in the existing ROW would slightly expand the existing land use of the ROW. The new ROW along the highway would add a new land use.

The RWI structure would not create any land use conflicts. It would be located in a small undeveloped area near agricultural and forested lands along the Mississippi River. While less than 2 miles (3.2 kilometers) from the town of St. Joseph, LA, the construction or operation of the structure would not create any land use conflicts because of the town’s distance across the Mississippi River.

The proposed new tank farm in Anchorage, LA, would be located on land currently used for row crop agriculture. The site, however, is adjacent to an industrial area that already includes tank farms and a petroleum refinery. The construction and operation of the new terminal would create no substantive land use conflicts.

The proposed tank farm in Peetsville, MS, would be located in a rural, partly forested area. While the terminal would create a new land use, this use would not be likely to pose any substantive conflicts with existing land uses in the area.

3.3.3.2.2 Visual Resources

The development of the Bruinsburg storage site would have a visual impact on recreational sightseers or parties interested in the Civil War who may be sensitive to changes in the visual quality of the historic landscape. While the proposed storage site is not located in or near special status lands or developed areas, the area has historical significance. A portion of a historic road in or near the facility boundary may be still visible on the floodplain and along the route of on the escarpment. Section 3.9 discusses further details on the historic nature of this area. Construction and operations and maintenance could affect potential viewers who might be sensitive to changes in the existing landscape.

Visual impacts could be associated with the proposed crude oil pipeline to Peetsville, MS, which would cross the Natchez Trace National Scenic Trail, Natchez Trace Parkway, and the privately owned within proclamation boundary of the Homochitto National Forest. These special status and cultural areas may be frequented by sightseers who may be sensitive to changes in visual quality. Construction of the ROWs would cause temporary disruption to the landscape in the form of dust, emissions from construction equipment, and trenches. As part of the proposed action, the pipeline would be underground and DOE would attempt to preserve the natural landscape setting.

The RWI and brine disposal systems associated with the proposed Bruinsburg site are not located in or near special status or developed areas. Few potential viewers of those sites would be affected, and those viewers would be minimally affected because there are no special visual attributes of public interest in the area.

The terminal in Anchorage, LA, would be constructed adjacent to similar industrial facilities. Visual impacts would be low because the area has no special visual resource attributes. The terminal in Peetsville, MS, which would be adjacent to an existing pump station, would change the visual character of the rural and partly forested area. The area, however, would have relatively few viewers and does not have any special scenic views of particular interest to the public, such as national forests or wildlife refuges.

3.3.3.2.3 Coastal Zone Management

Because the Bruinsburg site, pipelines, RWI and brine disposal systems, and terminals would not be in the designated Mississippi or Louisiana coastal zones, no special coastal zone management requirements are part of any land use at the proposed SPR site.

3.3.4 Chacahoula Storage Site

3.3.4.1 Affected Environment

The Chacahoula storage site would be located in northwestern LaFourche Parish, LA, about 40 miles (64 kilometers) from the Gulf of Mexico (see figures 2.4.2-1 through 2.4.2-3). The proposed site, which is in wetlands typical of southern Louisiana, would encompass 350 acres (142 hectares) including the security buffer. See Section 3.7 Biological Resources and Appendix B Flood Plains and Wetlands Assessment for discussion of potential development in wetlands. Adjacent lands contain sugar cane fields. No private homes are on or immediately adjacent to the proposed site. Because of its low elevation, the Chacahoula site is vulnerable to storm surges from major tropical storms and heavy precipitation. The land proposed for the SPR site is privately owned with separate owners of the surface and mineral rights.

Hydrocarbons, brine, and sulfur have been extracted from the salt dome, and there is evidence of oil and gas exploration and development on the south and northeast sides of the dome. Sulfur production occurred between 1955 and 1970 along the northeastern part of the dome. The Texas Brine Company operates three brine caverns in the south-central dome area. With the exception of the brining operations, no other activities are present on the dome. Most land available for facility construction is located at the west end of the dome.

A single road to the former sulfur mining area crosses part of the dome. Shell-gravel roads flank the southern and western perimeter of the site, providing potential access to oil and gas wells. The Donner barge canal traverses the western perimeter of the dome and provides access to the dome from rail connections several miles south.

The Chacahoula area was in the path of Hurricane Katrina and, as a result, there was substantial damage to housing and other facilities in the region, most substantively along the coast. The area is still recovering from this damage. The proposed Chacahoula site received only minor direct effects from the hurricane because it is located in undeveloped wetlands.

The proposed Chacahoula site would be enclosed by a perimeter road, fence, and cleared security buffer area. The ROW associated with the RWI system would follow an existing pipeline and a 4.3-mile (6.8-kilometer) access road would be built along the pipeline route toward Highway 90. The brine disposal system to an offshore diffuser in the Gulf of Mexico would follow an existing pipeline ROW. The crude oil pipeline would follow the existing Shell pipeline, while the pipeline to the St. James terminal would follow an existing crude oil pipeline to the terminal.

3.3.4.2 Potential Impacts

3.3.4.2.1 Possible Land Use Conflicts

Historically, the Chacahoula site area has land uses associated with oil and gas development and other industrial developments such as Texas Brine Company's brine operations. Railroads, canals, and other infrastructure and development have disturbed a portion of other land in the vicinity. Because the proposed site is in an industrial area largely covered by wetlands, the land would not be useful for many land use purposes. Wetlands areas on the proposed site would remain interconnected with those outside the site. If an SPR storage facility were located on the proposed site, land use patterns would not change in any substantial way. No national or state parks or other specially designated land is located on or near the proposed Chacahoula SPR site. Overall, there would be minimal conflict with established land uses for the Chacahoula site.

No residential, commercial, or specially designated areas are located in or near the pipelines, power lines, RWI system, or other infrastructure for the Chacahoula site. Section 3.3.2.1 describes common land use impacts associated with construction and operation and maintenance of new and expansion sites and associated infrastructure not located in such areas.

3.3.4.2.2 Visual Resources

No special visual resource issues are associated with this SPR site location and its associated infrastructure, which are generally located in rural, undeveloped areas. Section 3.3.2.2 describes common visual impacts associated with construction and operation and maintenance of new sites and associated infrastructure.

3.3.4.2.3 Coastal Zone Management

The Chacahoula site in Lafourche Parish is not covered in the Louisiana Coastal Management Program; therefore, the proposed storage site would have no special environmental requirements related to coastal management. Portions of the site infrastructure, however, such as parts of the crude oil and brine pipelines would be built in the coastal zone. DOE will coordinate with the Louisiana Department of Natural Resources, Coastal Management Division to identify and address any coastal zone issues associated with the infrastructure for the Chacahoula site.

3.3.5 Richton Storage Site

3.3.5.1 Affected Environment

The proposed Richton site would be in Perry County, MS, 3 miles (4.8 kilometers) from the Town of Richton (see figures 2.4.3-1 through 2.4.3-3). The proposed site on the Richton salt dome, including security buffer, would encompass about 346 acres (140 hectares). Land in Perry County is used primarily for agriculture and forestry. The County's major crops are corn, sorghum, soybeans, and wheat. More than 80 percent of the County is forested land, some of which is harvested as timber. Slightly less than half of the forestland in Perry County lies in De Soto National Forest, which is managed by the U.S. Forest Service.

There is no hydrocarbon production in the dome area and the potential for future production is low. Sulfur and oil have been found near the dome, but not in commercial quantities. Several small oil and gas fields are located within 10 miles (16 kilometers) of the dome.

A substantial portion of the proposed SPR site is privately owned and primarily used for forestry and agriculture. The proposed SPR site includes a working plantation of slash pine and a small chicken farm located on the southwest corner of the site. Some land is used for recreation such as hunting. A golf course is adjacent to the proposed SPR site, and private homes are east of the proposed site along a road on the southern portion of the property. Two utility corridors cross the dome.

SPR development for the Richton site would include two multi-purpose pipelines to Pascagoula and an oil distribution pipeline to Liberty Station, MS, where it would connect to the Capline pipeline. The outfall pipeline for brine disposal 13 miles offshore would cross the GUIS to reach waters of the Gulf of Mexico. The brine disposal pipeline would also traverse the pass between Horn and Petit Bois Islands. These islands were designated wilderness by Congress in 1978 and are managed to maintain their primeval character in accordance with the Wilderness Act of 1964.

DOE would build tank farms and other terminal facilities at both locations, as shown in figures 2.4.3-4 and 2.4.3-5. The 49-acre (20-hectare) Pascagoula terminal would be located on the former Naval Station Pascagoula Base Realignment and Closure site, which is on the north side of manmade Singing River Island. The site lies just south of the main port of Pascagoula and currently consists of buildings, parking lots, roads and other infrastructure used to support former base operations. The dock at Pascagoula would be refurbished and an RWI facility would be constructed on the existing dock. A power line would also be constructed following the route of a bridge to Singing River Island.

The proposed 66-acre (27-hectare) terminal at Liberty Station would be in an agricultural and forested area with some industrial uses, including oil distribution facilities. The Town of Liberty is located within 2 miles (3.2 kilometers) of the proposed site.

The Richton area was in the landfall path of Hurricane Katrina and the area received some water and wind damage. The area largely has returned to pre-hurricane conditions.

3.3.5.2 Potential Impacts

3.3.5.2.1 Possible Land Use Conflicts

The proposed Richton site has no history of oil- and gas-related activity at or near the site. Constructing, operating, and maintaining the Richton site as an SPR facility would generally be a new land use that would preclude other future land uses. It would change existing land conditions and characteristics. The land ownership and land use changes would be long-term. Section 3.3.2.1 discusses common land use impacts associated with the construction and operations and maintenance of the proposed new SPR sites and associated infrastructure.

Construction of pipelines and utilities in new ROWs for the Richton site would constitute a new long-term land use commitment. While the Secretary of the Interior has authority under the GUIS enabling statute to consider allowing new ROWs or easements for the transport of oil and gas pipelines to cross the Gulf Islands National Seashore, this authority may not extend to the Richton alternative brine/waste disposal pipeline. The permitting effort for the brine disposal pipeline route would be in addition to full analysis under NEPA and other statutes by the National Park Service. Wilderness status places potential restraints on possible developments on or near Horn and Petit Bois Islands. Construction of the brine disposal pipeline for the Richton alternative would require the identification and implementation of measures to provide an undisturbed, wilderness experience for visitors in accordance with the regulatory framework. The pipeline to Liberty Station, MS would cross the Percy Quin State Park for about 0.5 miles (0.7 kilometers) in a new ROW. If one of the Richton alternatives is selected, DOE would work with the National Park Service on any issues associated with pipeline routes through the GUIS, and with the State of Mississippi to re-align the pipeline to cross the state park in an existing ROW.

DOE expects no substantive land use impacts associated with the terminal facilities in Pascagoula or Liberty Station because they would be located in areas that have existing industrial uses. The facility development would not constitute a new type of land use in the area. However, the proposed SPR development of the Pascagoula terminal includes activities that may not be compatible with the yet to be developed plans for the Island. Therefore, DOE would work with state and local officials on any issues related to the proposed Pascagoula terminal and RWI.

3.3.5.2.2 Visual Resources

There are no special visual resource issues associated with the construction and operation and maintenance of the Richton storage site, RWI structure, or brine disposal system. Section 3.3.2.2 describes common visual impacts associated with construction and operations and maintenance of new SPR sites and associated infrastructure.

Visual impacts could be associated with the crude oil pipeline segment through the Percy Quin State Park. This park may be frequented by sightseers who may be sensitive to the changes in visual quality. Construction of the ROW would cause temporary disruption to the landscape in the form of dust, emissions from construction equipment, and trenches. As part of the proposed action, the pipeline would be underground and DOE would attempt to preserve the natural landscape. One section of the pipeline would be located approximately 240 feet (73 meters) from residential areas. Residents in these nearby areas might be affected by pipeline construction activities during the six- to 10-week construction period, and they might be sensitive to corresponding changes in the visual landscape. Long-term effects of the pipeline would be minimal since the pipeline would be buried and only the ROW and the power lines along the ROW to the RWI might contrast with the visual landscape.

3.3.5.2.3 Coastal Zone Management

Because the Richton storage site would not be in the designated Mississippi coastal zone, there would be no special coastal zone management requirements as part of any land use at a proposed SPR site. The potential use of the Pascagoula Singing River Island as a terminal and RWI site must be considered as a potential impact to coastal zone resources since it is in the coastal zone. DOE will coordinate with the Mississippi Department of Marine Resources to identify and address any coastal zone issues associated with the Pascagoula site.

3.3.6 Stratton Ridge Storage Site

3.3.6.1 Affected Environment

The Stratton Ridge site is in south-central Brazoria County, TX 3 miles (4.8 kilometers) from both Clute, TX, and Lake Jackson, TX (see figures 2.4.4-1 through 2.4.4-3). The site is characterized by surrounding wetlands, bayous, lakes, and creeks. The Stratton Ridge site is an uplands area despite its relatively low elevation.

Regional land has a mix of industrial and rural uses. The site would encompass 370 acres (150 hectares) including the security buffer and would be directly west of the Brazoria National Wildlife Refuge, which is managed by the USFWS. The petrochemical industry is substantial in the local economy. Dow Chemical operates a major commercial chemical facility that uses salt from the Stratton Ridge salt dome to produce chlorine and to manufacture many products. Other economic activity includes cattle ranching and farming. Rice is the major crop. The area also has a long history of oil- and gas-related land use. The Stratton Ridge site has been used for brine and petroleum storage in a wide range of cavern sizes. These storage caverns are privately owned. These regional land uses have co-existed for many years.

DOE would need to acquire the land including mineral rights on the salt dome for the proposed SPR storage site from private owners. Under current conditions, cattle and feral pigs roam throughout the site and their presence and activities, such as grazing and burrowing, influence the vegetation communities. Pipeline, power line, and rail ROWs cross through the site and nearby areas. The Freeport Liquefied Natural Gas project has proposed building a nearby natural gas storage cavern, which would be constructed along the northern border of the proposed SPR site. Surrounding land generally is used for cattle ranching or low-density residential areas. Across the highway from the proposed site is a field used by the Brazoria County model airplane club.

Approximately 3 miles (5 kilometers) of the co-located RWI pipeline, brine disposal pipelines, and two power lines to the RWI would cross the southwestern edge of the Brazoria National Wildlife Refuge, which is part of the Texas Mid-Coast National Wildlife Refuge Complex. Also, 4.7 miles (7.6 kilometers) of the crude oil pipeline to Texas City would cross the refuge along its northern border adjacent to the existing Bryan Mound pipeline ROW. The Brazoria National Wildlife Refuge provides habitat for migratory waterfowl and other birds. In addition, a section of a brine disposal pipeline would pass near a small section of houses near the Gulf Coast in an existing publicly owned ROW. This pipeline may result in the need for a new road and additional road improvements.

The proposed RWI structure would be located on the coastal side of the ICW across the waterway from the Brazoria National Wildlife Refuge (figure 2.4.4-3). DOE also would construct a 1,000-foot (300-meter) new road from Bay Street to the RWI structure.

Hurricanes Katrina and Rita did not substantially affect the Stratton Ridge area.

3.3.6.2 Potential Impacts

3.3.6.2.1 Possible Land Use Conflicts

The SPR facilities at the proposed storage site would be a new land use that would be consistent with industrial land use in the area. SPR development would preclude other long-term land uses at the Stratton Ridge site. The proposed SPR storage site at Stratton Ridge may substantially conflict with access to salt resources that Dow Chemical would likely mine and convert into products that support its business operations and the economy of the Stratton Ridge region. Dow has estimated that 18 years of equivalent salt consumption (based on current uses) would be precluded by the SPR land use at Stratton Ridge.

Dow and local governments in the area have also raised concerns about potential eminent domain acquisition of its land at Stratton Ridge, which may preclude Dow's business expansion and/or additional investments in its Stratton Ridge area operations and cause other effects to development of the Stratton Ridge site for other purposes.

Overall, use of the proposed Stratton Ridge dome for SPR purposes is likely to result in conflicts with other potential future land uses in the area. If the salt at the Stratton Ridge dome were to be precluded from future use by Dow operations because of the SPR land use, the salt resource would be irretrievably lost (see also chapter 6 on irretrievable and irreplaceable resources).

About 3 miles (4.8 kilometers) of the RWI pipeline, brine disposal pipelines, and two power lines in the same new ROW would cross the Brazoria Wildlife Refuge and privately owned land in the refuge's proclamation area. In addition, 4.7 miles (7.6 kilometers) of the crude oil pipeline would cross the refuge on the northern border in an existing ROW. These ROWs would create land use conflicts and an act of Congress may be required to allow this development through the refuge. The new and expanded ROWs would be cleared and trees would not be allowed to regrow within the permanent easement. The remaining area affected by construction would be allowed to regenerate to natural habitat. Visitors to the refuge would likely value undeveloped and undisturbed land.

> <u>Mitigation</u>: If one of the Stratton Ridge alternatives is selected, DOE would coordinate with the USFWS to obtain the proper ROW easements. USFWS also has indicated that Congressional approval for pipeline rights-of-way across the Brazoria National Wildlife Refuge would be needed. DOE would coordinate with USFWS to ensure that land use conflicts are minimized to the maximum extent practicable, including boring the power lines underground through the refuges. For further discussion of potential mitigation measures, see section 3.7.6.2.2.

A short pipeline that would pass near houses near the Gulf Coast would not create a land use conflict because it would be located underground in a publicly-owned ROW and would not interfere with existing land uses.

The proposed RWI site would be located within and along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. The potential noise impact from the operation of the RWI pumps is discussed in sections 3.7.6.2.3 and 3.10.2.

3.3.6.2.2 Visual Resources

Visual impacts may be associated with the construction of the pipelines and power lines through the wildlife refuge. Recreational sightseers visiting this special status area might be sensitive to changes in visual quality. Construction of the new and expanded ROW segments would cause temporary impacts to the viewshed. DOE would attempt to preserve the natural landscape setting by placing the pipelines and power lines underground, supporting post-construction wetlands regrowth, and working with USFWS to minimize and mitigate any impacts to the refuge. ROW maintenance activities would occur infrequently and would only temporarily disturb revegetated land, thereby minimizing any long-term visual impacts of the ROWs (see section 3.7.6.2 for the discussion of potential mitigation measures).

Potential visual impacts may be associated with the RWI located on the ICW across from the Brazoria National Wildlife Refuge. The area around the RWI system would consist of shorter marsh types of vegetation, and would contrast greatly with the surrounding landscape. Users of the wildlife refuge may be sensitive to such a change in the landscape.

3.3.6.2.3 Coastal Zone Management

The Stratton Ridge site and associated infrastructure is within the Texas coastal zone. DOE will continue to interact with the Texas General Land Office, Coastal Resources Program as needed to fulfill its coastal zone management responsibilities for the Stratton Ridge site. This process is summarized in section 3.3.1.4 above.

3.3.7 Bayou Choctaw Expansion Site

3.3.7.1 Affected Environment

Bayou Choctaw is a current SPR storage site (see figures 2.5.1-1 and 2.5.1-2). DOE would not be required to purchase any additional land to expand capacity by 20 MMB. To expand capacity by a further 10 MMB, however, DOE would purchase 4 acres including an existing privately owned storage cavern. The site is located about 8 miles (13 kilometers) from Plaquemine, LA, and just east of the ICW.

The extensive water diversions and flood control structures throughout the area have made water levels at the site particularly uncertain; however, the existing SPR site is normally dry and protected from spring flooding by the site's flood control levees and pumps. The area surrounding the site is fresh water wetlands, which includes substantial stands of bottomland hardwoods with interconnecting waterways. The original cypress wetlands at the SPR site was clear-cut long before SPR development began.

The Choctaw oil and gas field was already a mature producer before the advent of SPR oil storage. The region has experienced widespread petroleum extraction activity; however, most wells in the area have been abandoned.

DOE has six operating SPR caverns on the salt dome. Union Texas Petroleum operates seven hydrocarbon storage caverns and two brine caverns on the dome, interspersed with the SPR caverns. Union Texas Petroleum's operations on the dome support the local petrochemical industry. Two new caverns are proposed to be solution mined and one existing cavern would be acquired from an adjacent storage facility. In addition, DOE would construct six new underground injection wells and associated 0.6-mile (0.9-kilometer) extension of the brine disposal pipeline from the existing wells to the new wells.

Hurricane Katrina passed near the Bayou Choctaw area after it made landfall. The nearby Baton Rouge area served as a major source of housing to hurricane evacuees from the primary damage areas on the Louisiana coast. While there was substantial disruption of economic activity in the area, the Bayou Choctaw SPR site was not substantively affected by the hurricane or the relocation effects from evacuees.

3.3.7.2 Potential Impacts

3.3.7.2.1 Possible Land Use Conflicts

Expansion of the SPR at this existing site, including the underground injection wells, would maintain current land use at the site and in the region. Construction activities would require some additional site disturbance, but this disturbance would not conflict with any existing SPR operations or represent a change in existing land use. Given the existing SPR operations at the site, the land would not be compatible with or desirable for nonindustrial purposes. Land use patterns would not change in any substantial way with SPR expansion. Section 3.3.2.1 describes common land use impacts associated with expansion and operations and maintenance of existing SPR sites and associated infrastructures.

3.3.7.2.2 Visual Resources

Bayou Choctaw is an existing SPR site. There are no special visual resource issues associated with the proposed expansion at this SPR site. Section 3.3.2.2 describes common visual impacts associated with expansion of existing SPR sites and associated infrastructure.

3.3.7.2.3 Coastal Zone Management

Because the Bayou Choctaw site would not be in the designated Louisiana coastal zone, there would be no special coastal zone management requirements as part of any land use as an SPR site.

3.3.8 Big Hill Expansion Site

3.3.8.1 Affected Environment

The existing Big Hill SPR storage site is located in southwestern Jefferson County, TX (see figures 2.5.2-1 and 2.5.2-2). It is in a small industrial area with large croplands and pastures to the north and west, and extensive wetlands to the south and southeast that stretch to the Gulf Coast. Most of the storage site is uplands habitat consisting of tall grass.

The closest residential areas are 5 miles (8 kilometers) away near the unincorporated communities of Winnie and Stowell. The area is a major waterfowl area with extensive recreational opportunities such as hunting and bird watching. Agricultural production is the primary land use in Jefferson County; TX, more than half of the acreage in the County is dedicated for farming. Oil and gas production constitutes the other major land use activity in the County with commercial marine and crude oil pipeline distribution facilities nearby.

DOE would develop additional SPR caverns in a 210-acre (83 hectares) area, including the security buffer, directly north of the current storage site. Private parties separately own the proposed expansion site and its mineral rights. While two 0.5-MMB liquid petroleum gas storage caverns are located just north of the proposed expansion area, these operations are not expected to pose any construction or operational issues for the expansion.

The Big Hill area was in the path of Hurricane Rita. Damage to the coast south of the site was extensive, and the urban areas nearby sustained some losses from flooding and wind. Power in the Big Hill area, including for the Big Hill SPR facility, was lost for a short time. The area is still recovering. The Big Hill SPR site did not suffer any substantial permanent damage.

3.3.8.2 Potential Impacts

3.3.8.2.1 Possible Land Use Conflicts

Because Big Hill is a current SPR site, any expansion could take advantage of the existing infrastructure. Construction necessary to expand the facility would be limited primarily to preparing the site, solution mining the new storage caverns, building a new brine pond, installing an additional crude oil pipeline along an existing ROW, and refurbishing the existing brine pipeline. Considering the existing SPR operations at the site, the land would not be compatible with or desirable for most nonindustrial purposes. Expansion of the SPR facilities would not change land use patterns in any substantial way. There would be minimal conflict with other established land uses. No specially designated lands are present at the Big Hill expansion site.

The crude oil and brine pipeline ROWs are in existing and maintained corridors. The crude oil pipeline ROW for the proposed Big Hill site expansion would pass within 0.25 miles (0.4 kilometers) of the J.D. Murphee Wildlife Management Area (see figure 2.5.2-1 in chapter 2). The construction corridor would expand only a short distance out of the existing pipeline ROW. It would not overlap with the management area. Land disturbance along pipeline ROWs would be limited to the construction period. Thus, infrastructure associated with the Big Hill site would have minimal conflicts with existing land uses.

3.3.8.2.2 Visual Resources

The expanded crude oil pipeline ROW would pass within 0.25 miles (0.4 kilometers) of the J.D. Murphee Wildlife Management Area. Because the construction corridor would not overlap with the Management Area and the pipelines would be buried underground, visual impacts would be limited to the construction period.

3.3.8.2.3 Coastal Zone Management

The Big Hill site and associated infrastructure is within the Texas coastal zone. DOE will continue to interact with the Texas General Land Office, Coastal Resources Program as needed to fulfill its coastal zone management responsibilities for the Big Hill site. This process is summarized in section 3.3.1.4 above.

3.3.9 West Hackberry Expansion Site

3.3.9.1 Affected Environment

The West Hackberry site is an existing SPR storage facility covering about 570 acres (230 hectares) in Cameron Parish, LA, about 4 miles (6 kilometers) from the town of Hackberry (see figures 2.5.3-1 and 2.5.3-2). The West Hackberry storage site and immediately surrounding area are flat to low wetlands with the exception of the elevated area overlying the salt dome south and southeast of Black Lake. Originally, DOE acquired five previously developed brine caverns and converted them to oil storage capacity. DOE has since developed 17 additional storage caverns at the site. About 53 acres (21 hectares) of privately owned land would be developed for the SPR expansion, though a larger parcel would be purchased.

The major historical land use of the area has been oil and gas exploration and development. While the site was explored for sulfur, DOE has no records indicating that the dome was mined for sulfur. Olin Corporation and its predecessors have been producing brine at the dome since 1934. Five of the caverns derived from their brine operations formed the initial storage sites for the SPR program at West Hackberry. Other caverns historically have been used for hydrocarbon product storage.

The West Hackberry site was in the path of Hurricane Rita. Effects along the coast south of the site were extensive, with substantial loss of housing and other structures because of flooding and wind. The West Hackberry SPR site was affected by precipitation and wind from the hurricane, but the area received no substantial long-term effects.

3.3.9.2 Potential Impacts

3.3.9.2.1 Possible Land Use Conflicts

Expanding this existing storage site would maintain current land use at the site and in the region. Construction activities would require additional site disturbance, but this disturbance would not conflict with any existing SPR operations or surrounding land uses. Considering the existing SPR operations at the site, the land would not be compatible with or desirable for most nonindustrial purposes. Expanding the facility would not change land use patterns in any substantial way. There would be minimal conflict with other established land uses. Section 3.3.2.1 describes common land use impacts associated with expansion and operations and maintenance of existing SPR sites and associated infrastructures.

While the expansion would use existing infrastructure such as the existing RWI system, concerns for additional SPR use at the West Hackberry site would include site susceptibility to potential complications from tidal influences and heavy precipitation events. Additional site controls such as water barriers, canals, or pumps may be necessary to keep the storage site dry. The additional site controls would have minimal land use impact and, if they are needed, would allow for continued safe and effective SPR operations.

3.3.9.2.2 Visual Resources

West Hackberry is an existing SPR site. There are no special visual resource issues associated with expanding storage capacity at this site. Section 3.3.2.2 describes common visual impacts associated with expansion and operation and maintenance of existing SPR sites and associated infrastructures.

3.3.9.2.3 Coastal Zone Management

The West Hackberry area is within the Louisiana designated coastal zone, and coastal zone management requirements would apply to this site. Coastal zone objectives in the two nearby environmental management units (Hackberry and West Black Lake) address the following issues:

- Reduce the subsidence potential from non-environmental sources;
- Reduce the water level in the environmental management units and reduce the chance of future flooding;
- Inhibit saltwater intrusion;
- Restore vegetation and remove environmental management units from tidal action;
- Restore bank to inhibit shoreline erosion;
- Encourage development in areas that are best suited for growth;
- Limit flood hazard potential as much as possible;
- Limit harmful effects of community waste while ensuring efficient treatment of this waste;
- Restrict the use of having detrimental effects to water resources in sensitive areas; and
- Plan for orderly growth in communities with the resources to accommodate it.

If DOE expanded SPR operations at the site, DOE would continue to be responsible for supporting these management goals.

3.3.10 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. Existing oil and gas activities occur near the Chacahoula storage site the proposed site could be developed by a commercial entity for oil and gas purposes. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity. For the sites of terminals that are in developed petroleum storage areas, it is possible that a commercial entity could develop them for petroleum storage.

3.4 GEOLOGY AND SOILS

The construction and operation of the proposed new or expansion SPR sites could result in impacts related to or affecting the geology and soils of the area where the SPR facilities would be located. These impacts could include erosion, subsidence, seismic activity, **soil liquefaction**, brine and oil seepage into soils, impacts associated with multiple uses of a salt dome, and stability of a salt dome. The following subsections describe the methodology for evaluating the potential impacts, discuss the common impacts for all of the sites, and evaluate the potential impacts for each specific site by considering the affected environments.

3.4.1 Methodology

To form independent conclusions about the likelihood and severity of potential impacts at each potential SPR site, DOE analyzed geology and soils using previous NEPA documents that predicted impacts, existing site reports that evaluated actual impacts, SPR design criteria requirements, and other available references characterizing geological features. The following sections briefly describe the methodology for evaluating each potential impact on geology and soils.

3.4.1.1 Erosion

Site preparation activities would temporarily expose the land surface and could potentially lead to increased soil erosion. The amount of erosion would depend mainly on site-specific characteristics such as soil type, the amount of excavation and filling of soils, the exposed area of soils, and the duration of exposure. To evaluate the potential for erosion, DOE considered its experience at existing SPR sites and the erosion control measures that should be taken.

3.4.1.2 Subsidence

Subsidence is the geological sinking or downward settling of an area on the Earth's surface, resulting in the formation of a depression.

Construction and operation of storage caverns would lead to local surface subsidence directly above the caverns. For this EIS, DOE evaluated the potential for subsidence, due to construction and operation of storage caverns, using two methods. The first method is based on the historical local subsidence data measured at the existing SPR sites from filled caverns that have been actively monitored. Subsidence surveys indicate that local subsidence above caverns at existing SPR sites (Bayou Choctaw, Big Hill, West Hackberry) occurs at annual rates of 0.47 to 3.4 inches (12 to 85 millimeters) corresponding to total cavern volumes between 72 MMB (Bayou Choctaw in 1988) and 219 MMB (West Hackberry in 1988). DOE estimated the subsidence rate at each site by comparing the planned cavern volume with that of the exiting caverns, and then used the estimated subsidence rate to calculate the local subsidence over a period of 30 years. The second method is based on the numerical analysis results and experience on salt caverns used for underground storage (Bauer 1997; Bauer 1999; Neal 1991a; Van Eijs 2000). Experience suggests a general rule that 10 percent of the cavern volume is lost over 30 years (caused by the salt creeping and naturally closing openings) and that 80 percent of this loss leads to subsidence (Neal 1991a). DOE used this general rule, together with the planned cavern capacity at each site, to estimate the subsidence at the surface central area over the caverns. DOE assumed that the subsidence bowl is cone-shaped with a distance between the surface edge and the outer walls of the caverns equal to the maximum depth of the caverns. For the proposed new sites, the methods described above are used to evaluate the possible subsidence. For the proposed expansion sites, the possible subsidence is evaluated based on the site-specific historical subsidence data.

3.4.1.3 Seismic Activity

> **Seismic** applies to the activity of naturally or artificially induced earthquakes or earth vibrations, where the seismic waves are the elastic waves produced by these vibrations.

The DOE SPR Level III Design Criteria require sites to be located in areas falling within seismic zone 0 or 1 in order to minimize seismic risk (DOE 2001a). For this EIS, DOE first evaluated the potential for the candidate sites to experience earthquakes by comparing the known seismic intensity of each site with this seismic criterion. Second, DOE evaluated the potential for the proposed cavern construction and operation activities to induce seismic activity by analyzing the known location of faults and using its experience at the existing SPR sites.

3.4.1.4 Soil Liquefaction

> **Soil liquefaction** is a process that occurs when saturated sediments are shaken by an earthquake. The soil can lose its strength and cause the collapse of structures with foundations in the sediment.

Soil liquefaction is a condition that occurs when loosely packed deposits change from a solid to a liquid state because of increased pressure and reduced stress. This may result from seismic shaking or other events. DOE evaluated the potential of soil liquefaction by comparing the seismic intensity of each site with the minimum intensity required for causing soil liquefaction.

3.4.1.5 Stability of Salt Domes

The geological stability of a salt dome depends mainly on local seismicity, fault formation, and salt evolution. DOE evaluated the geological stability of salt domes in the Gulf Coast region based on these factors. DOE also considered the effect of the construction and operation of caverns on the stability of salt domes.

3.4.1.6 Brine and Oil Seepage from Caverns

Section 3.2 evaluates the potential for brine and oil leaks from pipelines and other proposed surface activities. This section supplements that evaluation by examining the potential for such leaks from the storage caverns themselves. The likelihood of brine and oil seepage from a salt cavern into soils depends on the tightness of salt around the cavern. The DOE SPR Level III Design Criteria (DOE 2001a) specifies the minimum thickness of impervious salt around an SPR cavern to ensure the structural stability and tightness of the cavern (see table 3.4.1-1). For this EIS, DOE used these criteria to evaluate the likelihood of brine and oil seepage by considering the thickness of impervious salt around the cavern at each candidate site.

Table 3.4.1-1: DOE SPR Level III Design Criteria on Cavern Dimensions

Parameter	Allowed Minimum
Cavern center-to-center spacing	750 feet (229 meters)
Thickness of salt between two adjacent caverns (P)	480 feet (146 meters)
Distance between cavern wall and dome edge	300 feet (91 meters)
Distance between cavern wall and adjoining property line	100 feet (30 meters)
Cavern roof apex to top of salt (S)	450 feet (137 meters)
Ratio P/D[a]	1.78
Ratio S/D	1.0

[a] D is the average constructed diameter of the cavern

3.4.1.7 Multiple-Use Impacts

Interactions could occur between various operations in a single salt dome, depending on the distance between two operations. The DOE SPR Level III Design Criteria (DOE 2001a) specifies the minimum distances between two caverns and between a cavern and an adjoining property (see table 3.4.1-1). DOE used these criteria to evaluate the potential multiple-use impacts of the proposed action by considering the distance between the proposed new caverns and the existing operations of caverns (if any) at each site.

3.4.2 Impacts Common to Multiple Sites

This section analyzes the basic kinds of potential impacts caused by geology and soil conditions at each site. Based on the analysis of information that appears in sections 3.4.3 through 3.4.9, and following the methodology described in section 3.4.1, DOE believes some categories of potential impacts warrant more detailed and site-specific evaluation. We based our evaluation on subsidence associated with cavern construction and operation and the potential results caused by multiple uses of the candidate domes.

3.4.2.1 Erosion

Surface construction at the SPR sites, along pipelines, at new RWI sites, and in other new facilities could lead to erosion of soils caused by excavation, filling, and exposure of soils. The amount of erosion would depend mainly on site-specific characteristics that affect the amount of excavation and filling of soils and the exposed area of soils, the types of soils, the duration of exposure, and the local topography. In general, soil erosion could cause temporary and negligible deposits of soil on lands adjacent to construction sites. Implementation of standard erosion control measures such as seeding, sodding, rip-rapping, installation of sediment retention and detention basins, and **silt** fencing would prevent or reduce erosion of soils caused by construction.

The operation and maintenance of SPR facilities would consist mainly of filling the caverns and transferring the crude oil to oil distribution networks during drawdown. No soil erosion impacts would occur from filling and drawdown activities. Soils would stabilize soon after they are revegetated following construction.

The primary impacts associated with erosion would be to surface waters and biological resources, which are evaluated in sections 3.6 and 3.7, respectively. Because of the limited construction time and the implementation of the standard erosion control measures described above, DOE concludes that erosion impacts on geology and soils would be temporary, cover a small area, and negligible. The following site analyses do not address erosion from site-specific construction or operation and maintenance activities.

3.4.2.2 Subsidence

The construction, operation, and maintenance of RWI facilities, crude oil distribution facilities, brine disposal facilities, and support facilities are expected to result in little to no surface subsidence. This conclusion is based on the soils known to exist at each site (characterized in the site-specific affected environment descriptions below), the engineering precautions that would be integrated into the facility designs, and the past experience of minimal to no subsidence caused by these kinds of facilities at existing SPR sites. DOE believes no adverse subsidence impacts would be expected from such activities, and therefore this issue is not addressed in the analysis of each site.

Activities associated with the construction and operation of the storage caverns would lead to local surface subsidence over the cavern, so this potential impact is evaluated for each site in the site-specific sections. For salt domes, the local subsidence over the caverns is produced mainly through slabbing and cavern creep closure. Slabbing creates loose slabs of salt on the cavern walls and roof in sheared or impure salt with properties that vary with direction. The potential for slabbing at the SPR caverns would be extremely low because of the depth and purity of the salt where the SPR caverns would be constructed. Creep closure is an active process in any salt cavity where stress differentials (the pressure difference between the open cavern and the surrounding solid salt formation) exist. Construction and operation of the SPR caverns would result in stress differentials and thus the cavern creep closure. After an SPR site closes, subsidence would continue at a rate that depends on how well the cavern capacity is backfilled and how high the pressure in the former storage cavern is maintained. DOE plans to take steps during site decommissioning to minimize the extent of continued subsidence after closure.

In addition to a local change in topography, one possible impact of the subsidence would be the formation of ponds over the caverns at upland sites where the land surface has subsided to a level below the groundwater table. Proper engineering design, monitoring, and control, such as surface pavement with drainage systems, would prevent pond formation. Local subsidence at wetland sites like the proposed new Chacahoula site could submerge the platform at the area over the storage caverns. Proper engineering design, monitoring, and controls (e.g., raising the height of the platform) would prevent submergence of the platform.

The local subsidence would be limited to the area overlying the caverns. There would not be one depression for each cavern, but rather a single depression over all of the caverns. Such a localized effect would not contribute to the regional subsidence that occurs throughout the Gulf Coast region. Underground fluid withdrawal (groundwater and petroleum) and natural compaction and drainage of organic soils—not SPR site development and operation—are the main reasons for the regional subsidence (NAS 1991). For example, groundwater withdrawal in Houston, TX, has caused some coastal areas to subside by more than 6.6 feet (2 meters). The Mississippi River delta area of southern Louisiana is subsiding because of natural compaction and loss of sediment transport from the Mississippi River, and the New Orleans, LA, area is one of the principal areas of organic soil subsidence.

3.4.2.3 Seismic Activity

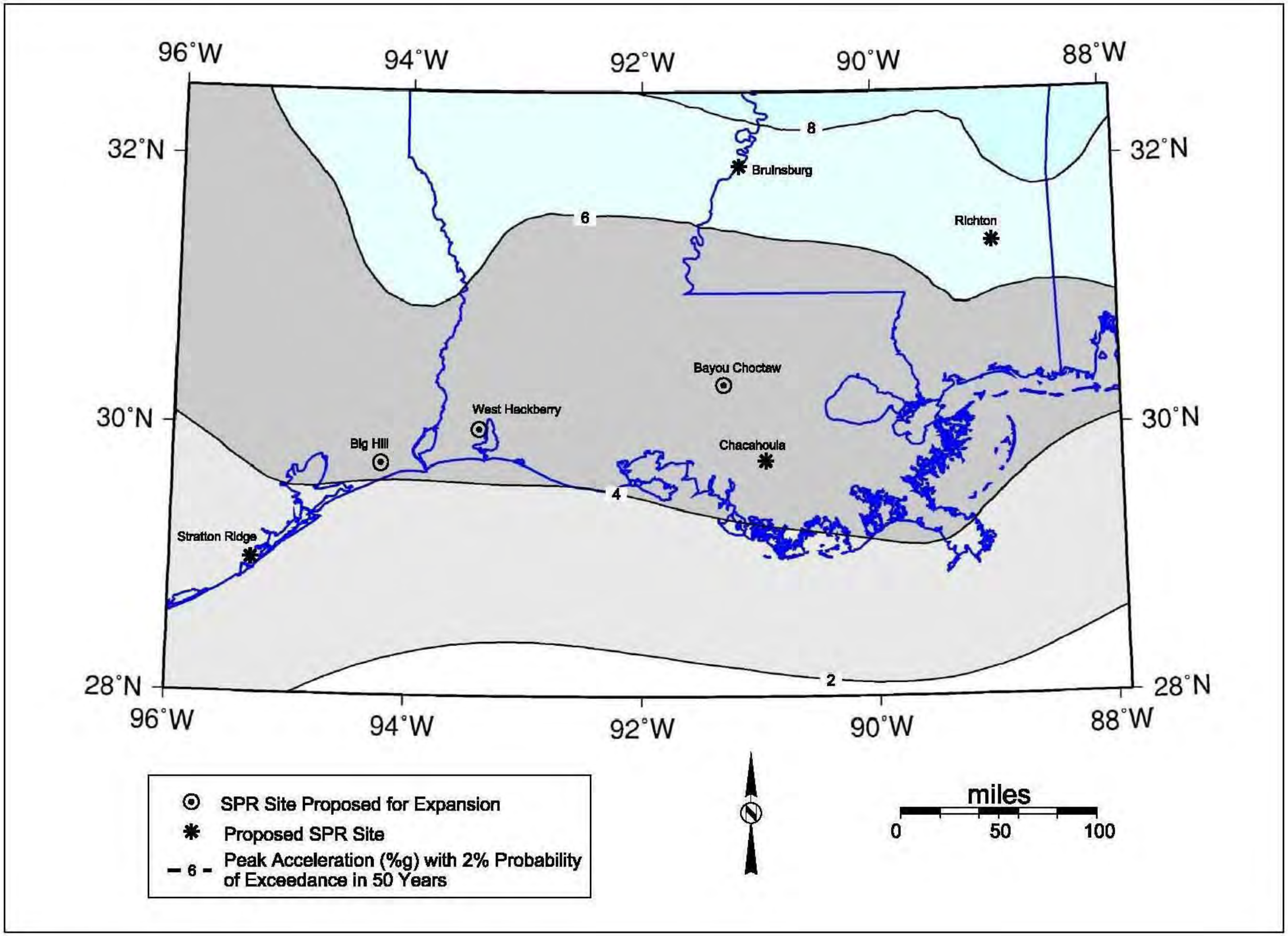
There is very little potential for regional seismic activity (natural earthquakes) at the candidate sites (USGS 2002). According to the Seismic Risk Map for the Uniform Building Code 1994, the gulf coast region is within seismic zone 0 or 1, the lowest risk zone (ICBO 1997). Although the region has a number of active faults, the faulting is not of natural geological origin, which most likely would not induce earthquakes (FEA 1976).

Figure 3.4.2.3-1 shows the peak acceleration with 2 percent probability of exceedance (i.e., annual frequency of exceedance of 0.0004) in the Gulf Coast area (created from http://equint.cv.usgs.gov/eq-men/html/custom2002-06.html). The peak acceleration at all of the SPR sites would be smaller than 7.5 percent *g*, where *g* is the acceleration of gravity. An earthquake with peak acceleration smaller than 7.5 percent *g* (magnitude smaller than 4.7) would not likely result in damages at the existing and proposed SPR sites.

> **Caprock** is a layer of rock that is often found covering some or all of a soft dome

Faults exist locally in the **caprock** and/or around the perimeters of salt domes. The known location of faults around each of the candidate sites is discussed in the site-specific affected environment sections below. The possibility that increased pressure or subsidence from site construction and operation would activate nearby faults and induce seismic activity is very unlikely. As required by the SPR Level III Design Criteria, a detailed subsurface geophysical investigation would be conducted during the detailed design stage to ensure that a

Figure 3.4.2.3-1: Peak Acceleration with 2 Percent Probability of Exceedance in 50 Years in the Gulf Coast Area



salt dome is adequate for cavern development, which would prohibit the construction of new caverns in an area with near-surface faults that might be activated. Therefore, the site-specific sections do not evaluate the potential for proposed construction and operation activities to stimulate earthquakes.

At the new Bruinsburg site and the Bayou Choctaw and West Hackberry expansion sites, brine would be disposed of through underground injection systems. This would include a new injection well field at Bruinsburg and existing or expanded well fields at Bayou Choctaw and West Hackberry. While this injection would increase the pressures in the pore spaces of the receiving formation in areas near the injection wells, such increased pressures would not be expected to increase the potential for seismic activity. While such a risk could be a concern in seismically active regions, where the frictional resistance within faults may be overcome by increased hydrostatic pressure, DOE's SPR Level III Design Criteria require sites to be located in areas of minimal risk. This issue would be examined during the site-specific underground injection permitting process and any risks would be further mitigated; therefore potential impacts associated with induced seismic activity resulting from underground injection of brine at the proposed Bruinsburg, Bayou Choctaw, and West Hackberry sites were not evaluated in this EIS.

3.4.2.4 Soil Liquefaction

Each of the following site-specific affected environment descriptions generally characterizes the types of soils at the candidate expansion sites. While these soils and the landforms at the different sites have the potential to behave in a manner that could result in liquefaction in a seismic shaking, the potential for this impact is very low. The Bruinsburg site is located in seismic zone 1 with design peak horizontal acceleration at the ground surface equal to 0.075 g, and the other sites are located within seismic zone 0 with design peak horizontal acceleration at the ground surface equal to 0 g (ICBO 1997). The peak horizontal acceleration at the ground surface required to induce soil liquefaction is more than 0.1 g (Youd and Idriss 2001). Therefore, soil liquefaction is not discussed in the following site-specific sections.

3.4.2.5 Stability of Salt Domes

The geological stability of salt domes depends mainly on local seismicity, fault formation, and salt evolution. As stated in Section 3.4.2.3, the peak acceleration at all of proposed SPR sites would be smaller than 7.5 percent *g*. An earthquake with peak acceleration smaller than 7.5 percent *g* would not likely endanger the stability of a salt dome. The faults in the region are either non-active or active with movement that is very gradual along the fault. The construction and operation of SPR caverns would be unlikely to activate nearby faults. The "self-healing" property of salt would minimize the formation of discontinuities in the salt dome because salt tends to fill in any cracks that develop. The growth rate of salt domes is extremely slow in the Gulf Coast region, approximately 2.3×10^{-4} inches (5.8×10^{-3} millimeters) per year (DOE 1978b; Jirik and Weaver 1976). Therefore, the salt domes in the Gulf Coast region are geologically stable and there would be no threat to the storage cavern integrity.

Since the construction and operation of caverns would follow the DOE SPR Level III Design Criteria that ensure cavern integrity and stability, the SPR caverns would not endanger the geological stability of the salt domes. The successful construction and operation of storage caverns during the past decades clearly shows the geological stability of the salt domes in the Gulf Coast region. Therefore, the stability of salt domes is not discussed in the following site-specific sections.

3.4.2.6 Brine and Oil Seepage from Caverns

Four mechanisms may lead to leakage of brine or oil from a salt cavern:

- Flow paths of sufficient **permeability** in the salt or associated natural seepage pathways such as faults and joints;
- Flow through hydraulic fractures generated in the walls of the cavern;
- Leakage along the salt-cement interface in the cased wellbore of the wells used to inject and withdraw fluids from the caverns; and
- Upward migration through any wells that were drilled previously into the dome and since have been abandoned.

Each of these mechanisms and their potential to result in leakage from the SPR caverns is discussed in the site-specific sections.

Rock salt is essentially impermeable with a permeability of about 10^{-21} to 10^{-19} square meters, and as shown in table 3.4.1-1, DOE's design criteria would require that at least 300 feet (90 meters) of salt separate the cavern wall from the edge of the dome. In addition, DOE would conduct detailed geophysical surveys for each new site to ensure that the new SPR caverns would not touch any potential seepage pathways. Thus, brine or oil would be very unlikely to leak through the salt itself or associated potential seepage pathways.

Because salt tends to creep but not break, hydraulic fractures are a potential concern only if the crest of the cavern sinks significantly after the storage cavity is formed. The potential for such sinking is minimized by the DOE design criteria that require the top of the salt to be at least 450 feet (140 meters) thick (see table 3.4.1-1). The potential for hydraulic fractures is also minimized by the short time needed to fill the caverns to capacity after construction and by operating the caverns at the highest possible pressure to reduce cavern creep closure and surface subsidence (Neal 1991a; Bauer 1997; Bauer 1999). As a result, any fractures that do form in the top of the dome overlying the caverns would not be expected to propagate through the whole roof salt and reach the caprock. The remaining unfractured roof salt and the caprock would prevent leakage of brine or oil from a salt cavern.

With the borehole and casing sealed according to standard practices, the leakage of brine or oil from a salt cavern along the salt-cement interface in the cased wellbore would be unlikely.

For a site with exploration and production wells previously drilled into the dome (such as the site at Richton), brine and oil could leak from the storage caverns through unknown abandoned wells that intersect the caverns. Proper site selection and detailed geophysical surveys would ensure that any such wells are identified, and then best management practices, such as sealing any unused wells that are located above the storage caverns, would virtually eliminate the potential for such leakages.

To protect against cavern leakage, the cavern would be pressure-tested before oil is injected. The total allowable leakage would be less than 100 barrels of oil per year. DOE anticipates that cavern integrity would surpass this requirement.

For these reasons, the likelihood of oil or brine migrating from the storage caverns is low. In addition, the caverns are thousands of feet below sea level, and the rock aquifers at this depth would contain saline water that would be unusable as a potable source. Because the likelihood of oil or brine migration from a cavern is low and the surrounding aquifers are not potable water sources, potential impacts would be negligible. The potential impacts associated with oil and brine leaking from the caverns is not addressed in the following site-specific sections.

3.4.2.7 Multiple-Use Impacts

Two categories of potential multiple-use impacts are associated with the proposed action. First, multiple uses of a dome such as sulfur production, brine production, and cavern storage of other materials, could lead to accidental releases, increased levels of subsidence, cavern flooding, and possibly even fire or cavern collapse. For a site with previous and existing mining and storage operations, multiple-use impacts would be eliminated by locating the new caverns far from the existing dome operations in accordance with the SPR Level III Design Criteria (DOE 2001a), as shown in table 3.4.1-1. With proper engineering design based on the SPR Level III Design Criteria, the proposed new caverns would have no adverse interaction impacts; nevertheless, each site-specific section discusses the extent to which the candidate domes have been utilized for other activities.

The second category of potential impact would include the loss of access to mineral resources, including salt, caused by the construction and operation of the SPR sites. In chapter 5, this EIS addresses the potential impacts of irreversible and irretrievable commitment of resources.

3.4.3 Bruinsburg Storage Site

3.4.3.1 Affected Environment

> **Piercement** is a dome or anticlinal fold in which a mobile plastic core (i.e., salt) has ruptured the more brittle overlying rock. Also known as a diapir, dipiric fold, piercement dome, or piercing fold.

The Bruinsburg dome in the Mississippi embayment and a part of the north Louisiana-Mississippi salt dome basin, is characterized by thousands of feet of **fluvial deltaic** and near-shore sediments punctuated by numerous **piercements**. The Bruinsburg salt dome is an irregular shape; its approximate dimensions are 2,600 feet (810 meters) (north-south) by 3,400 feet (1,030 meters) (east-west) at a depth of 2,500 feet (760 meters). The top of the salt dome is at a depth of approximately 2,000 feet (610 meters) with an area of about 240 acres (96 hectares). There is an **overhang** in the western area of the dome (Swann 1989). The north flank of the dome has a minimally overhanging, but near-vertical salt margin (Rautman and Lord 2005, p. 2). A cross-section diagram of the dome and surrounding area is shown in figure 3.4.3-1.[1]

On the western side of the caprock, a fault trends mostly northward and tangential to the dome margin (Rautman and Lord 2005). A number of faults also offset sedimentary horizons overlying the caprock (Swann 1989).

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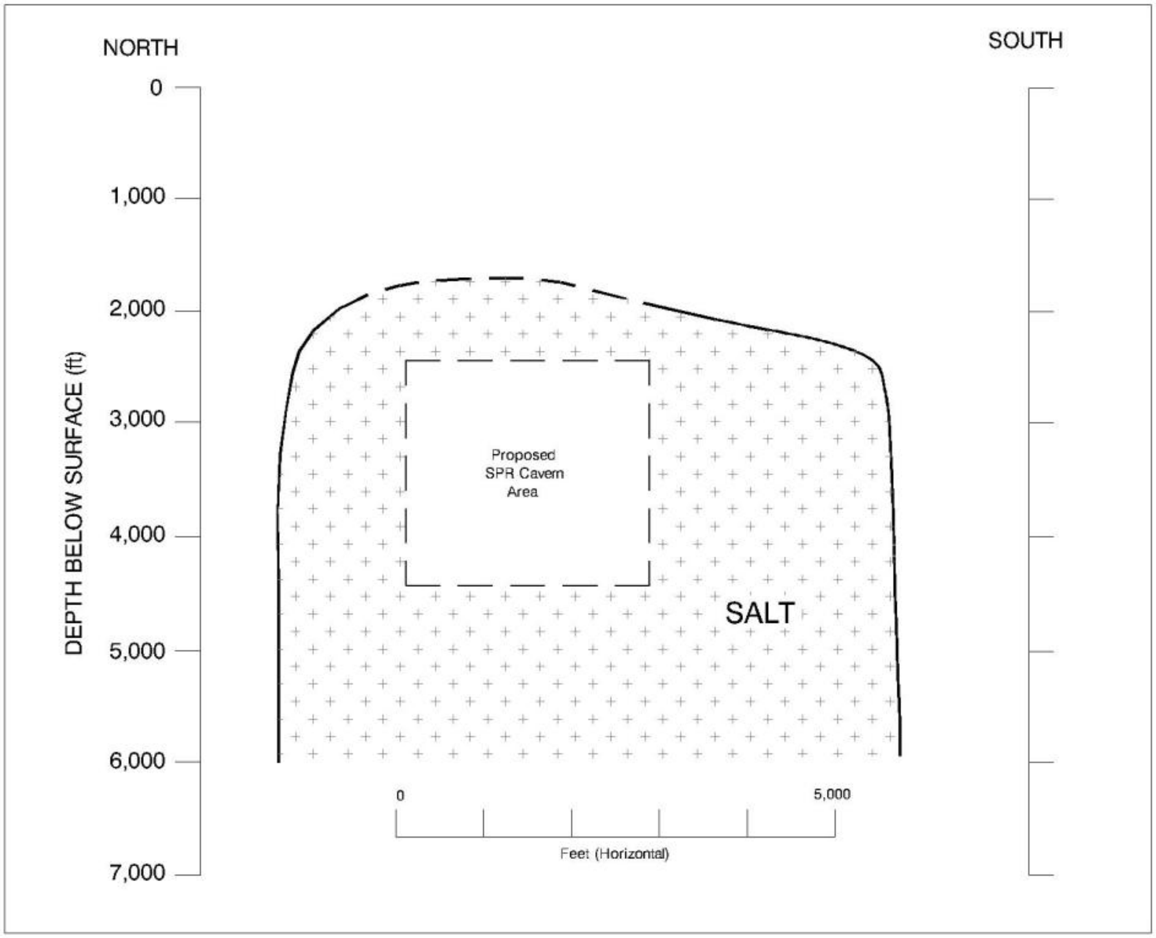
[1] DOE recently conducted seismic surveys of the Bruinsburg salt dome to measure the size of the dome to determine its capability to provide 160 MMB of oil storage capacity. Analysis of the surveys indicates that the salt dome is smaller than initially thought and would likely be capable of accommodating only 70 MMB, instead of the planned 16 caverns with 10-MMB capacity each in the salt strata above 5,000 feet (1,500 meters) below the surface that would be required under current SPR operating criteria (Rautman et al. 2006). Surveys of salt dome characteristics at depths below 5,000 feet (1,500 meters) indicate that there may be an ability to develop oil storage caverns below 5,000 feet (1,500 meters), but doing so would be more difficult technically and would involve uncertain operational risks. This EIS retains the Bruinsburg site as presented in the draft EIS.

Figure 3.4.3-1: Cross-Section Diagram of the Bruinsburg Dome



No pre-existing leached cavities are in the Bruinsburg salt dome (Rautman and Lord 2005).

The area considered for brine disposal is just south of Highway 552 and north of Alcorn, MS. The area is dominated by cleared and level land of several hundred acres. Two geological formations could be used as the brine disposal reservoir: the Wilcox sand, which is more than 1,300 feet (400 meters) thick and 3,100 feet (950 meters) below surface, and the Sparta sand, which is about 750 feet (230 meters) thick and more than 1,800 feet (550 meters) below surface.

3.4.3.2 Operation and Maintenance Impacts

Subsidence

At the potential new Bruinsburg site, DOE would construct 16 new 10-MMB caverns arranged in four rows of four caverns each, for a total capacity of up to 160 MMB (see figure 2.4.1-2). By comparing the total volume of the new caverns with that of the existing caverns at sites with measured subsidence data, the local subsidence above the caverns can be estimated as 1.05 to 2.44 inches (27 to 62 millimeters) per year, resulting in total subsidence of 2.6 to 6.1 feet (0.80 to 1.9 meters) over 30 years.

With a general rule of 10 percent volume loss over 30 years resulting from salt cavern creep, the total volume loss would be 144 million cubic feet (4.1 million cubic meters); 80 percent would lead to a subsidence volume of 115 million cubic feet (3.3 million cubic meters). Assuming that the subsidence bowl is cone-shaped with the surface edge of 4,450 feet (1,360 meters) (maximum depth of the caverns) from the outer walls of the caverns, the maximum subsidence at the surface central area over the caverns can be calculated as 3.2 feet (1.0 meters) which is in the range of 2.6 to 6.1 feet (0.80 to 1.9 meters) estimated above. The local subsidence would be most likely in the range of 2.6 to 6.1 feet (0.80 to 1.9 meters) over 30 years. Further subsidence after site closure would be reduced by decommissioning methods that would backfill or otherwise help keep the pressure up in the former storage caverns.

Given the groundwater level at the site and the amount of projected subsidence, ponds likely would not form over the caverns; therefore, the main impact would be the formation of a depression over the cavern area, which would tend to capture local drainage at that location.

Multiple-Use Impacts

No multiple-use impacts would be expected at the Bruinsburg site because the site has no pre-existing storage caverns.

3.4.4 Chacahoula Storage Site

3.4.4.1 Affected Environment

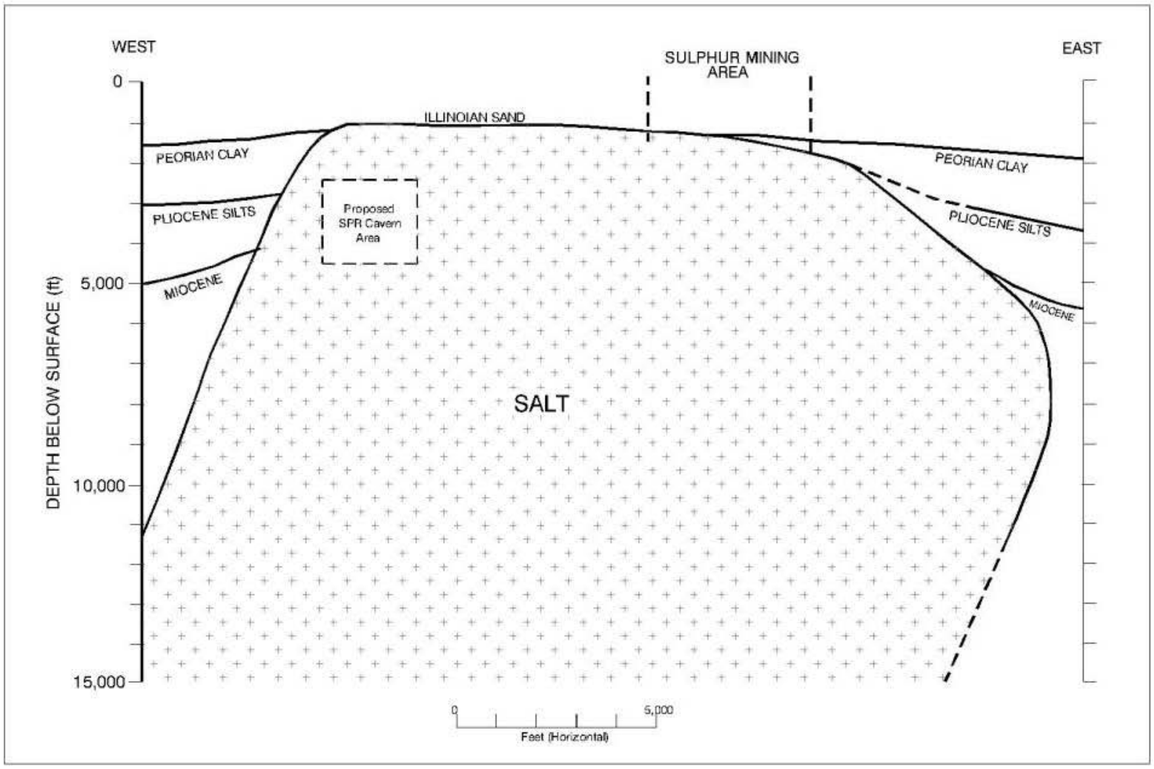
The Chacahoula salt dome is near the center of the Holocene Mississippi Delta, which has created the land in south Louisiana, between the old Lafourche and Teche distributive channels (Magorian and Neal 1990). The distributive channels once drained off the Mississippi River. The dome is an elliptical piercement structure that has a broad rounded top and sloping sides, with depths between 2,000 and 12,000 feet (610 and 3,700 meters). The dome is large enough, about 1,700 acres (690 hectares) at 2,500 feet (760 meters) below ground, to construct a large storage facility with multiple caverns. An overhang occurs approximately between 6,600 and 10,000 feet (2,010 and 3,040 meters) below ground on the east side. There is no indication that the overhang would affect the storage areas of the dome inside the 2,500-foot (760-meter) below ground salt contour (Magorian and Neal 1990; PBE 2004b). A cross-section diagram of the dome and surrounding area is shown in figure 3.4.4-1.

Caprock overlying the dome is primarily composed of anhydrite, with gypsum and calcite probably present. Sulfur is a minor constituent of the caprock. Caprock is thin or absent over much of the dome, but has enough thickness in the northeast corner to have enabled minor sulfur extraction (DOE 1978b; Magorian and Neal 1990).

Up to 1,500 feet (460 meters) of unconsolidated and partially consolidated muds, sands, and shales overlie the central portion of the dome. Unconsolidated and partially consolidated sands and shales underlie the sediments and extend downward to about 7,500 feet (2,300 meters) below sea level. Sand, shale, and limestone are found below 7,500 feet (2,300 meters) underground, probably reaching depths in excess of 22,000 feet (6,700 meters) below ground. The salt piercement has forced these sediments upward in the immediate vicinity of the dome. Faulting within the lower formations adjacent to the dome is extensive and complex (DOE 1978b).

Extracting operations at the dome have produced hydrocarbons, brine, and sulfur. Sun Oil Company made the first discovery of petroleum in 1938 and has produced 50 MMB of oil and one trillion cubic feet (28 billion cubic meters) of gas on the south and northeast sides of the dome, with many oil and gas production wells drilled. Texas Brine Company operates three brine production caverns in the south

Figure 3.4.4-1: Cross-Section Diagram of the Chacahoula Dome



central part of the dome. The area in the northeastern part of the dome was mined for sulfur from 1955 to 1962; because of these operations, the site is subject to ponding. Local surface subsidence of 1.0 feet (0.3 meters) or more has occurred (Magorian and Neal 1990; PBE 2004b).

3.4.4.2 Operation and Maintenance Impacts

Subsidence

The proposed new caverns would result in additional surface subsidence; however, because the new caverns are far from the abandoned sulfur mining area (see figure 3.4.4-1), the new surface subsidence would not result in further sinking of previously affected areas. Based on a general rule of 10 percent initial volume loss over 30 years, similar group patterns observed in the cavern field at the West Hackberry dome, and quantitative analyses, the local subsidence over 30 years was estimated as 5 feet (1.5 meters) (Neal 1991a).

Because the Chacahoula site is in a submerged wetland, the majority of the proposed cavern area is currently under water. Local subsidence in these conditions could result in the platforms over the storage caverns becoming submerged. Proper engineering design, monitoring, and control, such as raising the height of the platforms, should prevent this problem. Thus, the main impact associated with the predicted subsidence at this site would be an increase in the water depth overlying the cavern area.

Multiple-Use Impacts

As previously mentioned, hydrocarbons, brine, and sulfur have been extracted respectively from the south and northeast sides, in the south central part, and in the northeastern part of the salt dome (Magorian and

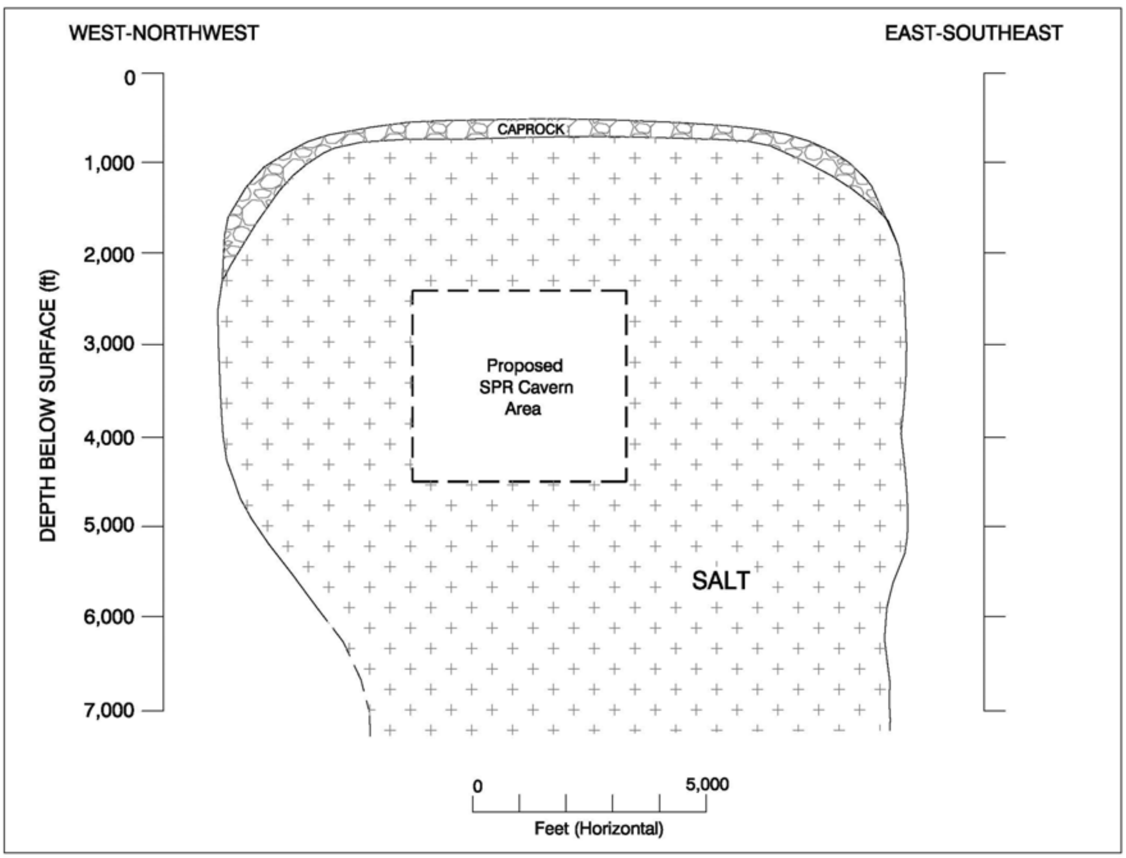
Neal 1990; PBE 2004b). With the proposed new caverns located in the western part of the dome and far from these operations, no adverse multiple-use impacts would be expected.

3.4.5 Richton Storage Site

3.4.5.1 Affected Environment

The Richton salt dome is a large, oblong piercement dome. At the 2,200-foot (670-meter) depth, the dome measures approximately 5 miles (8 kilometers) (northwest-southeast) by 3 miles (4.8 kilometers) (east-west). The dome is mushroom-shaped with a large overhang on the western edge and a somewhat less well-defined overhang on the eastern edge. Sulfur exploration wells indicate that the shallowest salt is found at 720 feet (220 meters) below land surface. About 5,500 acres (2,200 hectares) within the 2,000-foot (600-meter) deep salt contour are potentially suitable for crude oil storage caverns (DOE 1986; Neal 1991b). A cross-section diagram of the dome and surrounding area is shown in figure 3.4.5-1.

Figure 3.4.5-1: Cross-Section Diagram of the Richton Dome



The top of the caprock lies at a depth of approximately 510 feet (160 meters) below land surface. The caprock is approximately 210 feet (65 meters) thick. The caprock has a number of small fractures, which is typical of piercement domes. Most of these fractures are closed at present; however, sulfur exploration drilling and DOE boreholes in the caprock indicate that some of the fractures may be open. Because the roof salt is over 1,000 feet (305 meters) thick, these fractures would have no adverse impact on the storage caverns.

The predominant **stratigraphic** units overlying the dome are sedimentary formations extending to a depth of approximately 660 feet (200 meters) immediately over the caprock of the dome. Alluvium, which consists primarily of fine-grained sand, silt, **clay**, and sandy gravel, is found in the stream valleys around the site. The predominant formation immediately over the salt dome, the Citronelle Formation that dates to the Pliocene age, has a maximum thickness of approximately 220 feet (66 meters), and consists of gravelly, coarse-grained to fine-grained sand with lenses of silt, silty clay, and clay. These same deposits make up the upper stratigraphic units of the edge of the salt dome. Below these deposits are other sedimentary deposits that are of middle Oligocene to Paleocene age and extend to a depth of more than 2,300 feet (700 meters) and a sequence of Cretaceous and Jurassic sedimentary rocks with thickness of 9,800 to 19,000 feet (3,000 to 5,800 meters) (DOE 1986).

Faults are present in the vicinity of the Richton dome. The Phillips fault zone is located north of the dome and parallel to the Wausau salt ridge. It is the only postulated **basement fault** in the area. Most other faults are present only in the Eocene Wilcox Formation, but a few faults are exposed at the surface. A fault that is present at depths below the Paleocene Midway Group, known as F-7, intersects the northwestern edge of the Richton dome. Development of the fault is thought to be the result of salt dome deformation, and movement along the fault is most likely created by the migration of the salt. Evidence for two other possible faults was observed in the Hattiesburg Formation atop the dome, but this movement is minor and may not extend into the salt. None of these faults appears to have been active during the Quaternary period (DOE 1986; PB-KBB Inc. 1992).

3.4.5.2 Operation and Maintenance Impacts

Subsidence

From quantitative analyses using the measured subsidence data at existing sites and detailed analyses based on a general rule of 10 percent initial volume loss over 30 years, DOE estimates that the local subsidence at the surface area over the caverns would be 2.6 to 6.1 feet (0.8 to 1.9 meters) over 30 years. The subsidence would decrease rapidly as it gets far from the area immediately above the cavern field.

Because groundwater can be found just below the land surface at Richton, this depression would become filled with water. DOE proposes to use proper engineering design, monitoring, and control, such as drained paved areas, to prevent the formation of subsidence-induced ponds over the caverns. With such measures, the subsidence is expected to change the local topography immediately over the new cavern area, but local drainage patterns would probably not be significantly altered.

Multiple-Use Impacts

There is no existing activity, historical mining, or oil production at Richton (PB-KBB Inc., 1992, p.9). Many sulfur exploration wells have been drilled into the salt dome. Best management practices would ensure that no existing wells would intersect the caverns and that the wells above the storage caverns would be fully sealed. Although oil and gas fields exist to the north and south within 10 miles (16 kilometers) from the salt dome, no multiple-use impacts would be expected because they are not within the actual salt column of the Richton salt dome. Thus, DOE expects that no multiple-use impacts would occur at this site.

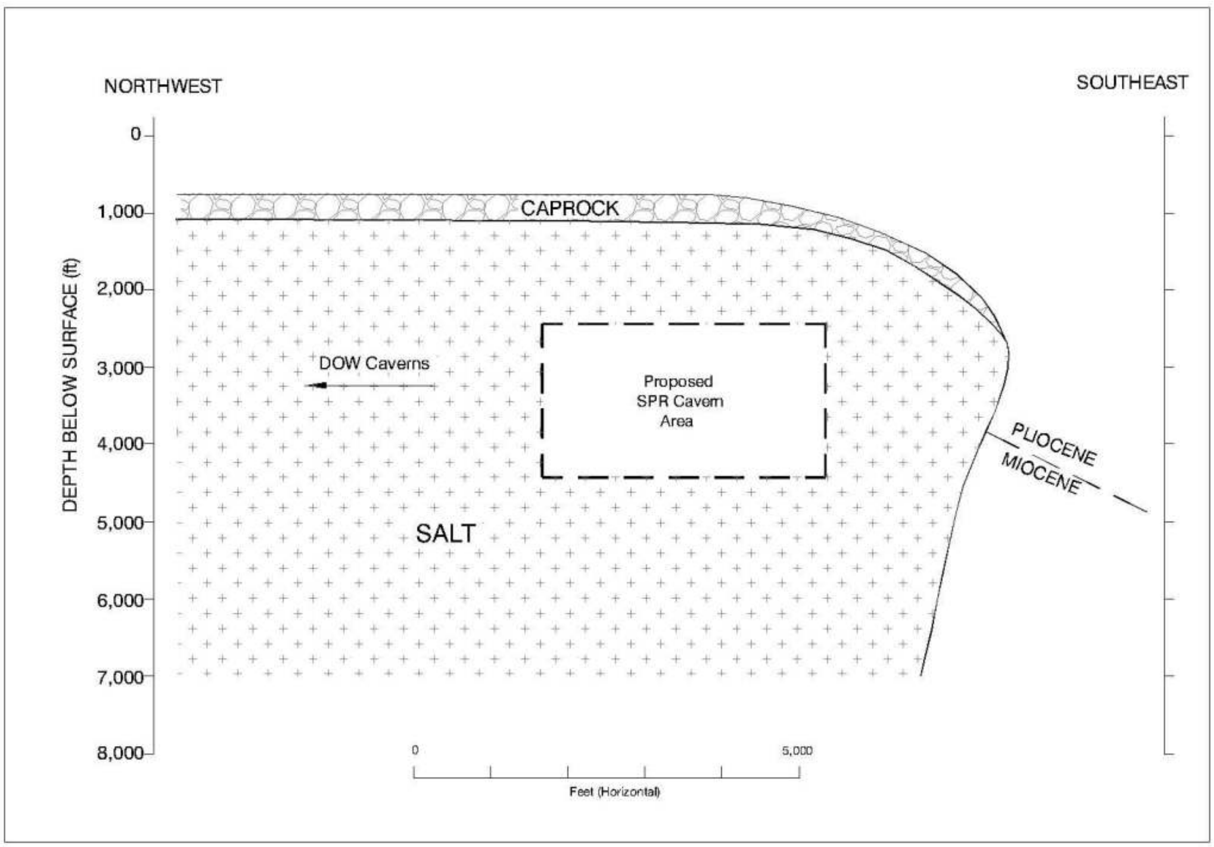
Since the Freeport LNG facility would be more than 2,000 feet from the SPR caverns, the subsidence caused by the SPR caverns in the area of the Freeport LNG facility would be small. The integrity of pipelines on the Stratton Ridge salt dome would be affected by the differential subsidence (ratio of subsidence difference to length between two locations along the LNG pipeline). The differential subsidence due to the construction and operation of the SPR caverns would be small and would not likely damage the integrity of LNG pipelines. Therefore, the multiple-use impacts would be negligible for the SPR caverns and the Freeport LNG facility.

3.4.6 Stratton Ridge Storage Site

3.4.6.1 Affected Environment

The Stratton Ridge candidate site ranges from 9.8 to 13 feet (3 to 4 meters) above sea level with local topography characterized by surrounding marshes, bayous, lakes, and creeks (DOE 1991b). The salt dome is irregular in shape with approximate dimensions of 3 miles (4.8 kilometers) (north-south) by 4 miles (6 kilometers) (east-west). The top of the caprock is at a depth of 870 feet (260 meters), and the top of the salt is at a depth of 1,300 feet (390 meters). A cross-section diagram of the dome and surrounding area is shown in figure 3.4.6-1.

Figure 3.4.6-1: Cross-Section Diagram of the Stratton Ridge Dome



There is a salt overhang on the southeastern corner of the dome, but it would not affect the proposed SPR site because of the distance between the overhang and the proposed storage site location (DOE 1991b). A trough-like depression extends generally in a north-south direction on the east-central part of the dome. This depression is apparently the result of an active slump fault at the site. In addition, caprock shifting and associated casing failures have occurred in the area of this suspected fault, releasing ethane into the caprock in at least one instance. Seismic work performed in December 1990 by Cockrell Oil Company demonstrates that this fault completely cuts off the east side of the dome with a 60 degree dip. There is a definite topographic rise on the upthrown side of the surface projection of this fault, supporting this interpretation; however, there is ample room for the proposed new SPR caverns on the high side of the fault, far enough back so that continuing fault movement would not damage well casings (Neal 1991b).

Radial faulting, typically found around the perimeters of salt domes, exists on the southern edge of the dome. Other faulting has also been identified in the caprock. These caprock faults are of a much smaller displacement than the radial faults (Neal 1991b). The radial faults and the other faults in the caprock would not affect cavern development and operation because they do not extend deep into the salt mass.

The surface soils immediately overlying the Stratton Ridge dome are the Edna fine sandy loam and the Edna-Aris complex. They feature a subsurface clay layer up to 4.9 feet (1.5 meters) thick, and both are poorly drained, with low permeability and slow surface runoff. These soils would not readily permit water to pass into the water table (USDA 1991).

Approximately 57 brine and petroleum product storage caverns with a wide range of sizes are currently in use at the Stratton Ridge dome (DOE 1991b). Subsidence is occurring over the extensive cavern field operated by a number of chemical and petroleum companies such as Dow Chemical, British Petroleum, Conoco, and Occidental, at rates comparable to those experienced at existing SPR sites (USDA 1991; Neal 1991b). The Texas Railroad Commission recently permitted Freeport LNG Development L.P. to drill at least three wells as part of an effort to construct a liquefied natural gas storage facility at the Stratton Ridge dome (Rautman 2005). In addition, corrosion problems have occurred at the existing commercial caverns in the salt dome at Stratton Ridge because of the presence of dissolved hydrogen sulfide in groundwater (Douglas 1979).

3.4.6.2 Operation and Maintenance Impacts

Subsidence

Local subsidence has occurred in the areas of the current cavern operations at Stratton Ridge, and it is causing a saucer-shaped depression to form over the group of caverns owned by Dow Chemical Company, Inc. The data provided by Dow for the period between 1986 and 1990 estimate the rates being experienced at existing SPR sites on other salt domes. The extent of current cavern volume loss resulting from creep closure is such that perennially wet areas could develop at Stratton Ridge even without SPR development (Neal 1991b). During operation and maintenance, local subsidence would continue to increase because of the 16 new SPR caverns with a total capacity of up to 160 MMB. The local subsidence most likely would be in the range of 2.6 to 6.1 feet (0.80 to 1.9 meters) over 30 years. The subsidence would decrease rapidly as it gets farther from the cavern field.

Because wet areas could develop at the Stratton Ridge site even without SPR development (Neal 1991b, p.4), DOE would use proper engineering design, monitoring, and controls, such as drained paved areas, to prevent the formation of subsidence-induced ponds over the caverns. Impacts associated with subsidence would be limited to the area immediately over the dome, including the proposed SPR site. In addition, the hydrogen sulfide present in the groundwater could travel through fissures in the caprock and lead to increased rates of corrosion and casing failures (Neal 1991b). DOE would use proper engineering design and monitoring to limit the erosion caused by the hydrogen sulfide and to monitor the casings.

Multiple-Use Impacts

Dow Chemical, British Petroleum, Conoco, and Occidental currently operate an extensive cavern field at the Stratton Ridge salt dome consisting of approximately 57 brine and petrochemical product storage caverns with a wide range of capacities (DOE 1991b). Thus, multiple-use impacts may be possible from an accidental release of light hydrocarbons traveling through caprock fissures to an SPR site from an industrial storage site (Neal 1991b) and becoming a source of fire and contamination at the SPR site. However, because (1) no adverse effects have occurred at existing SPR sites adjacent to caverns storing light hydrocarbons, and (2) the distance between the new SPR caverns and existing light hydrocarbon storage operations would not be smaller than that at the existing SPR sites, following the SPR Level III Design Criteria, DOE expects negligible multiple-use impacts.

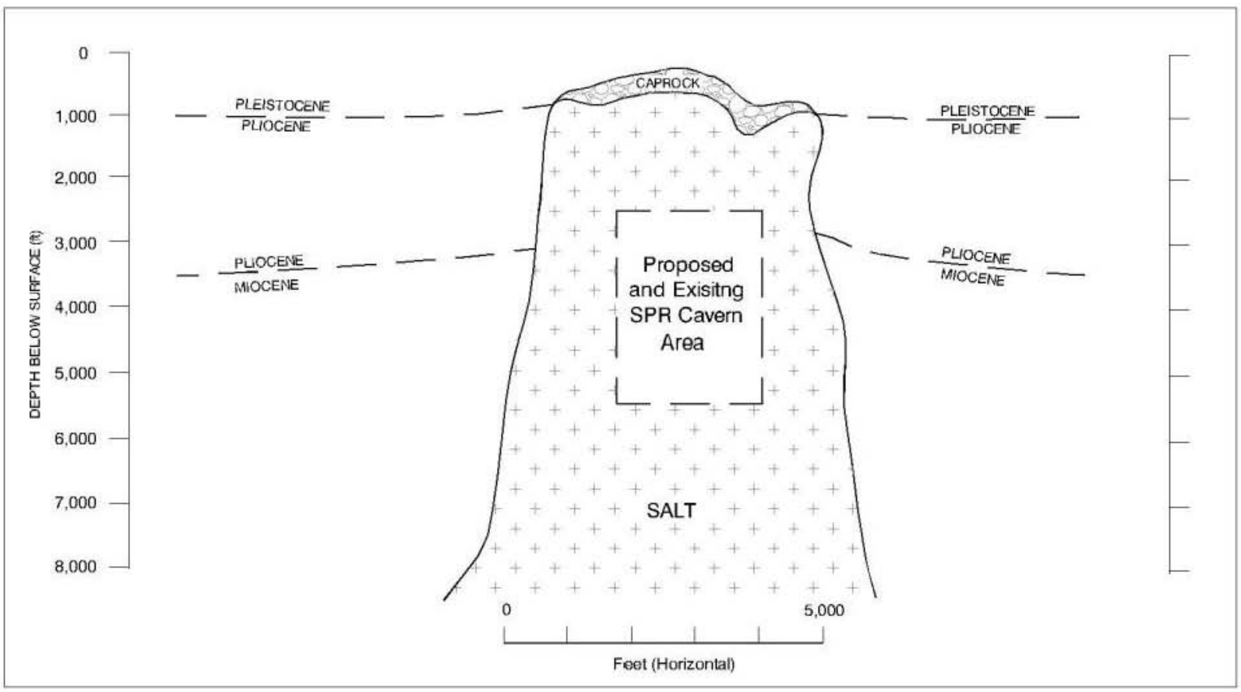
Since the Freeport LNG facility is more than 2,000 feet (610 meters) away from the SPR caverns, the subsidence increment in the area of the Freeport LNG facility would be small. What would affect the integrity of pipelines is the differential subsidence (ratio of subsidence difference to length between two locations). The differential subsidence due to the construction and operation of the SPR caverns would be small and would not likely damage the integrity of LNG pipelines. Therefore, the multiple-use impacts would be negligible for the SPR caverns and the Freeport LNG facility.

3.4.7 Bayou Choctaw Expansion Site

3.4.7.1 Affected Environment

The Bayou Choctaw dome is nearly circular in plain view, having a broad irregular top at a depth of 500 to 1,200 feet (152 to 366 meters) below sea level. The sides of the dome show steeply dipping contours, with the east side dipping at about 79 degrees and gradually increasing to a vertical angle. An overhang on the west side significantly decreases the area available for solution-mined storage cavern construction. The caprock overlying the Bayou Choctaw salt dome is composed of insoluble residues of salt and its alteration products. The caprock has a highly irregular surface and its general thickness varies from 200 to 400 feet (61 to 122 meters) (DOC 1976; DOE 1978b). A cross-section diagram of the dome and surrounding area is shown in figure 3.4.7-1.

Figure 3.4.7-1: Cross-Section Diagram of the Bayou Choctaw Dome



Unconsolidated and partially consolidated muds and sands overlie the dome caprock with a thickness of 240 feet (72 meters) to 840 feet (260 meters). Outside the dome, unconsolidated and partially consolidated sands and shales underlie the sediments and extend downward to about 9,000 feet (2,700 meters) below sea level. These sediments have been forced upward by the salt piercement in the immediate vicinity of the dome (DOC 1976; DOE 1978b).

Oil production has occurred all around the dome with the greatest density of drilling on the southeast and north flanks (DOE 1978b). Currently six storage caverns, each approximately 12.5 MMB, operate at the Bayou Choctaw site (PBE 2004a).

3.4.7.2 Operation and Maintenance Impacts

Subsidence

The 1982 to 1988 survey data show that the site has subsided at a rate of 0.5 to 1.3 inches (12 to 34 millimeters) per year (Neal 1991a). The 1991 survey data show that little subsidence was occurring at the site, probably only 0.1 inches (3.0 millimeters) per year (DOE 1991b). Operation and maintenance of the three new caverns (two would be constructed and one would be acquired) would increase the subsidence rate; but the increment would be small considering the small cavern volume increase (20 MB of two constructed caverns versus 86 MMB of six existing SPR caverns and one acquired cavern). Therefore, potential impacts associated with subsidence at the dome area would be negligible.

Multiple-Use Impacts

By locating the two new caverns far from the six existing operating caverns following the SPR Level III Design Criteria (see figure 2.5.1-2), no adverse interaction impacts would be expected during operation and maintenance.

3.4.8 Big Hill Expansion Site

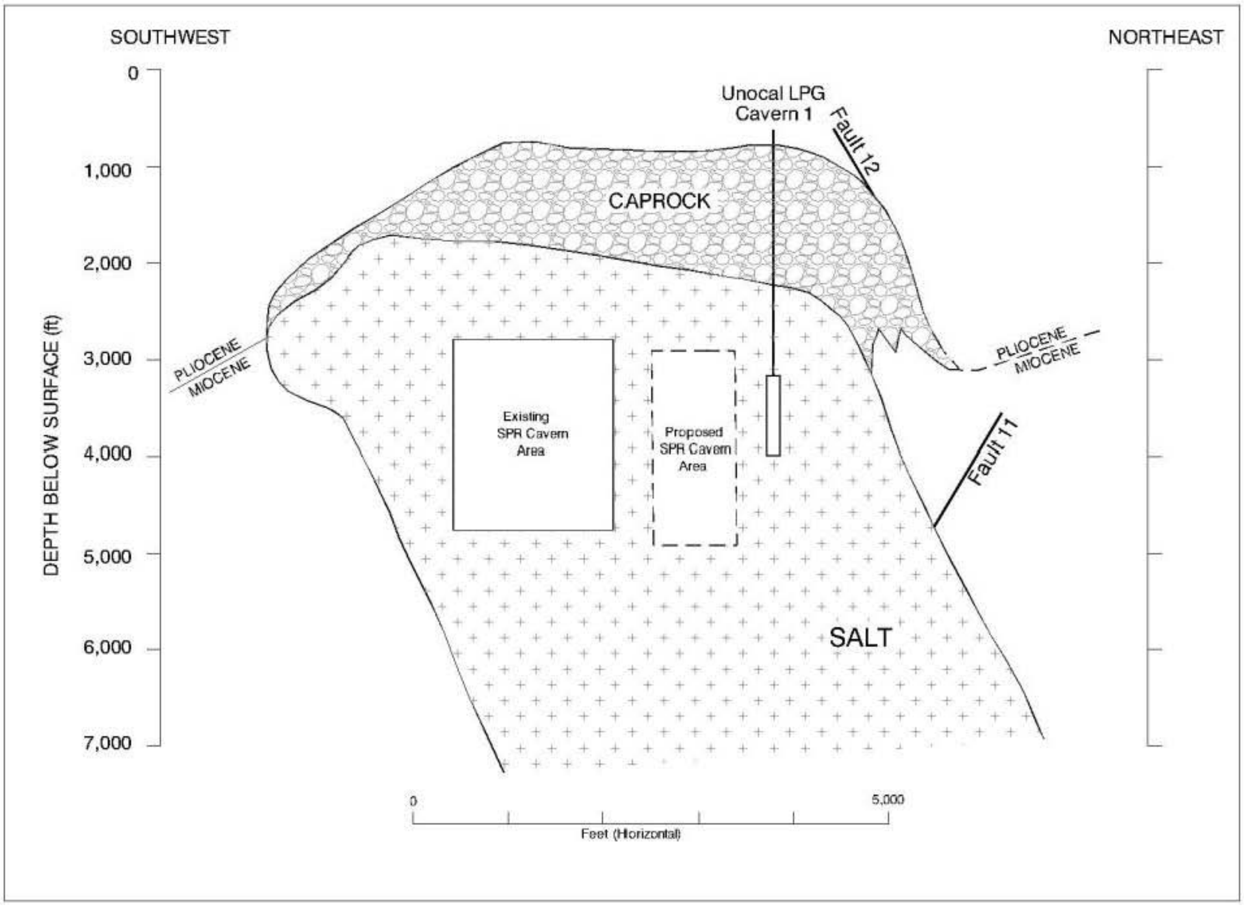
3.4.8.1 Affected Environment

The Big Hill salt dome is a moderately elliptical piercement dome, with a nearly circular horizontal cross section, an irregular top, and steep sides. It is approximately 1.3 miles (2.0 kilometers) (north-south) by 1.0 mile (1.6 kilometers) (east-west).

Beaumont clay and Lafayette gravel in particular have been identified as major sediments overlying the dome. These deposits and other sands and clays have been unevenly deposited by meandering rivers in local floodplains and deltas (DOE 1978d; DOE 1989a). Sediments surround the dome, extending to depths exceeding 9,800 feet (3,000 meters) (DOE 1978d). More shallow sediments from silty loam soils are found at the surface.

A cross-section diagram of the Big Hill dome and surrounding area is shown in figure 3.4.8-1. The salt dome is covered by a roughly circular surface mound that rises to a maximum elevation of about 36 feet (11 meters) above sea level and forms a significant topographic feature in the local area (DOE 1978d; DOE 1989a). The dome has three prominent overhangs, including one minor overhang on the western flank and major overhangs on both the southern and eastern flanks (Neal 1991b; DOE 1991b). The shallowest known salt is found on the west perimeter of the dome at approximately 1,700 feet (530 meters) below sea level. The deepest salt encountered at the site is on the south flank of the dome at 5,700 feet (1,750 meters). An estimated 420 contiguous acres (170 hectares) within the 2,000-foot (600-meter) underground salt contour and extending to 5,900 feet (1,500 meters) deep are potentially

Figure 3.4.8-1: Cross-Section Diagram of the Big Hill Dome



suitable for the development of crude oil storage caverns. The existing cavern depth interval of 2,200 to 4,200 feet (670 to 1,300 meters) could be used for additional cavern development. The total potential storage volume is 270 MMB (DOE 1978d).

The top of the caprock lies at a depth of approximately 330 feet (100 meters) below the surface and covers the majority of the salt mass. The thickness of the caprock varies between 850 and 1,400 feet (260 and 410 meters), making it one of the thickest in the Gulf Coast region (DOE 1991b). The caprock is composed of porous sandstone that overlies dolomitic limestone, gypsum, and anhydrite (DOE 1978d). Because of cavities or large pores in the caprock, previous SPR drilling encountered several zones of lost circulation (loss of drilling mud) (DOE 1991b). Because of the upward pressure exerted by the rising salt, the caprock is severely fractured and faulted. One major surface fault has resulted in 98 feet (30 meters) of displaced caprock and likely extends into the dome. Otherwise, the fault patterns identified by extensive drilling in the Big Hill caprock and in the areas flanking the dome are characteristic of the fault patterns of domes. This pattern generally reflects radial faulting with subsidiary concentric, **normal faults** between the radial faults (DOE 1978d).

Uncertainty remains regarding an apparent north-south trending shearing zone at the site. There is no evidence that this **shear zone** has affected the existing SPR cavern field (Neal et al. 1991c).

3.4.8.2 Operation and Maintenance Impacts

Subsidence

Survey data indicate that the site has subsided 0.24 to 0.60 inches (6 to 15 millimeters) per year between April 1989 and May 1994 and 0.24 to 0.36 inches (6 to 9 millimeters) per year between May 1994 and January 1999 (Bauer 1999). The decrease is probably due to the operational procedure of maintaining the caverns at a relatively high operating pressure and the corresponding decrease in creep closure rate of the caverns with time (Bauer 1999). During operation and maintenance, the site likely would subside at a rate higher than the existing rate of 0.24 to 0.36 inches (6.1 to 9.1 millimeters) per year because of the new caverns. Assuming that the subsidence rate is proportional to total cavern volume and that the total existing cavern volume is 170 MMB, the new subsidence rate can be estimated as follows:

- Approximately 0.35 to 0.53 inches (9.0 to 13 millimeters) per year with total new cavern volume equal to 80 MMB; and
- Approximately 0.38 to 0.56 inches (9.5 to 14 millimeters) per year with total new cavern volume equal to 96 MMB.

At the highest subsidence rate of 0.56 inches (14 millimeters) per year corresponding to the largest total new cavern volume of 96 MMB, the land surface would subside 1.4 feet (0.43 meters) over 30 years. Because the top of the most shallow aquifer at the Big Hill site is approximately 6.6 feet (2 meters) below land surface, no formation of ponds would be expected during the life of the operation. In addition, engineering controls such as surface pavement with drainage systems would prevent the formation of such ponds. Thus, DOE expects no subsidence impacts would occur at this expansion site, even for the 96 MMB storage capacity alternative.

Multiple-Use Impacts

There are two small liquefied petroleum gas storage caverns of 0.5 MMB each owned by Unocal Corporation in addition to the 14 existing SPR caverns in the salt dome. There are also oil fields on the northwest and southwest flanks of the dome, although no commercial oil production has ever occurred from the caprock (DOE 1992a, p. 7-3). With the new caverns located far from the existing operations (see figure 2.5.2-2), DOE expects that no adverse multiple-use impacts would occur.

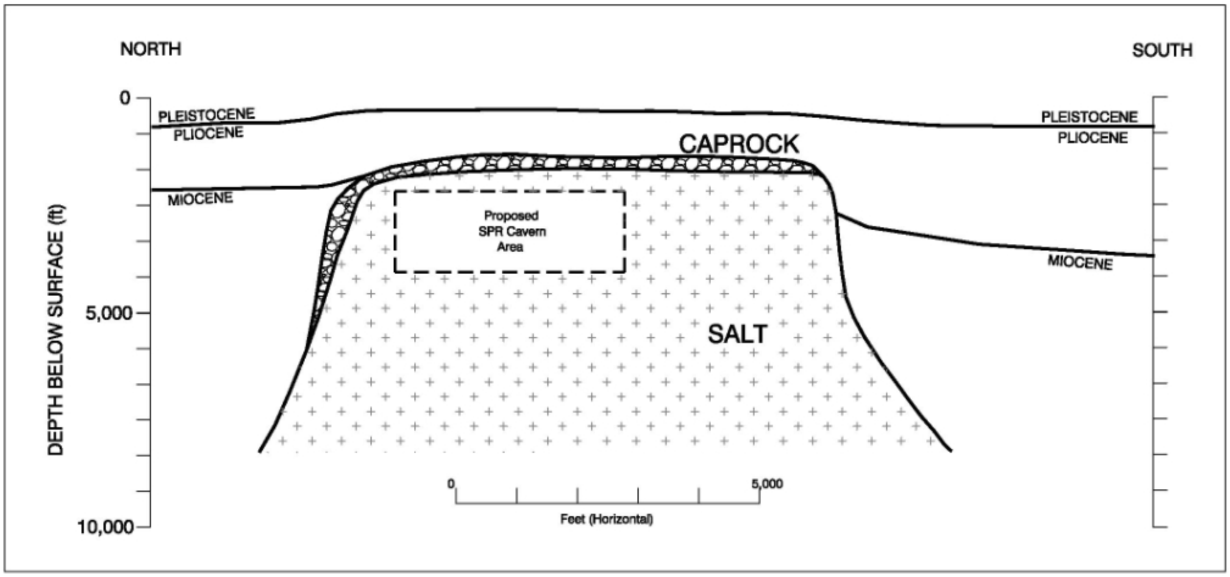
3.4.9 West Hackberry Expansion Site

3.4.9.1 Affected Environment

Unconsolidated and partially consolidated muds, sands, and shales overlie the central portion of the West Hackberry dome, with thicknesses ranging from 1,500 to 2,000 feet (460 to 610 meters). Unconsolidated and partially consolidated sands and shales extend to a depth of 9,500 feet (2,900 meters) on the flanks of the dome. Above the dome, the sediments have been forced upward by the salt, forming a mound with an elevation of 19 feet (5.8 meters) above mean terrain (DOC 1977).

The West Hackberry dome itself is an elliptical piercement structure, having a broad nearly flat top at an average depth of 2,000 feet (610 meters) below sea level. The slope of the dome sides range from slightly less than 60 degrees to steeper than 75 degrees on the north side. The surface area within the 2,000-foot (610-meter) depth contour of the salt stock is about 1,750 acres (710 hectares). An overhang is on the southeast side of the dome (DOC 1977; DOE 1978d). A cross-section diagram of the dome and surrounding area is shown in figure 3.4.9-1.

Figure 3.4.9-1: Cross-Section Diagram of the West Hackberry Dome



Caprock covers the entire salt mass above the 3,000-foot (914-meter) depth contour, with a maximum thickness of 525 feet (160 meters). Caprock depth ranges from less than 1,500 feet (457 meters) in the southwest to more than 4,000 feet (1,220 meters) on the north and south perimeter (DOC 1977). The caprock is intensively fractured, faulted, and broken into fragments resulting from upward pressures exerted by the rising salt stock (DOE 1978d).

Faulting in formations overlying and adjacent to the dome is extensive and complex. Three major northeasterly trending faults may have influenced the orientation of the dome axis. These faults have created a zone of weakness through which the salt may have risen. A secondary series of radial faults is interpreted to occur on the northwest and southeast perimeter of the dome (DOC 1977).

3.4.9.2 Operation and Maintenance Impacts

Subsidence

Data from January 1983 to October 1988 show a subsidence rate of 2 to 3 inches (51 to 76 millimeters) per year at West Hackberry, while data from January 1993 to October 1996 show that the subsidence rate had decreased to 1 to 2 inches (25 to 51 millimeters) per year (Bauer 1997). The decrease is probably resulting from the operational procedure that maintains the caverns at relatively high operating pressure, and the corresponding decrease in creep closure rate of the caverns with time (Bauer 1997). Because no new caverns would be constructed, the future subsidence rate would be expected to be smaller than 3 inches (76 millimeters) per year.

The local subsidence likely would lead to formation of ponds at the area over the caverns. Proper engineering design, monitoring, and controls such as draining paved areas would be used to prevent the formation of subsidence-induced ponds over the caverns. Thus, DOE expects that potential impact of subsidence at West Hackberry would be negligible.

Multiple-Use Impacts

The three caverns to be acquired by DOE at the West Hackberry site are close to each other and likely would coalesce during operation. The caverns are located in a line with 175 feet (53 meters) and 200 feet (61 meters) between the caverns. The coalescence would increase the rate of subsidence and could lead to cavity collapse. The known instances of salt cavern collapse (Bayou Choctaw, LA 1954; Grand Saline, TX 1976; Belle Isle, LA 1973; Eminence, MS 1973) occurred during brine solution mining, and they are believed to have resulted from uncontrolled or accidental leaching of the salt near the top of the dome rather than from structural failure of the cavern roof. Thickness of the cavern roof in each collapse was less than 300 feet (91 meters) (DOE 1978b, p. E-2). With the roof thickness greater than 1,500 feet (460 meters), the occurrence of collapse is very unlikely.

3.4.10 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that would occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. Some of the existing environments for the proposed new SPR storage site alternatives would remain undeveloped and it is possible that others would be developed for salt cavern storage or other oil and gas activities. For those sites that are developed for oil and gas activities, a small amount of localized subsidence is possible. Selection of the no-action alternative would eliminate some potential geological impacts such as small long term subsidence over cavern areas and the multiple use impacts unless the caverns or their surfaces were developed for some other purpose.

The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the Chacahoula storage site, and if the proposed site were developed by a commercial entity for oil and gas purposes some geological subsidence could continue as a result of those activities. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity, some geological subsidence could occur.

3.5 AIR QUALITY

This section analyzes the potential air quality impacts of the construction and operations and maintenance activities associated with the proposed action. It starts with a description of the basic methodology used for the analysis (see section 3.5.1) and then provides an overview of the common air quality impacts expected at all of the sites (see section 3.5.2). Sections 3.5.3 through 3.5.9 then describe the affected environment and anticipated impacts at each of the proposed sites in turn, focusing on those impacts of greatest potential concern identified in the common impacts discussion. Finally, the air quality impacts of the no-action alternative are discussed in section 3.5.10. The air quality appendix to this EIS (appendix A) provides greater detail on the specific methodology used to develop the emission estimates.

3.5.1 Methodology

DOE's analysis of air quality impacts for this EIS can be broken down into an analysis of construction impacts and operations and maintenance impacts. DOE also specifically examined greenhouse gas emissions—which are expected to be primarily from construction activities but may also come from operations and maintenance activities—to evaluate potential climate change impacts.

3.5.1.1 Construction Impacts

The analysis of construction impacts focuses on four main sources of direct emissions: site preparation (e.g., cut-and-fill operations); facility and road construction; cavern development; and pipeline construction. With the exception of cavern development activities, which are assumed to be 24-hour-per-day operations, construction activities are assumed to occur during 8-hour workdays, 5 days a week, 250 workdays per year. DOE estimates emissions associated with these four types of construction activities using the following methods:

- Fugitive **particulate matter** (PM) emissions from cut-and-fill operations are estimated based on the methodologies outlined in the Western Regional Air Partnership's Fugitive Dust Handbook (WRAP 2004). The methods in this Handbook are identical to EPA's AP–42 emission factor methodology except where WRAP developed more refined methods (EPA 2003a). Because these methodologies were developed for use in generally drier regions of the country, the analysis makes adjustments to account for standard dust suppression practices and added moisture associated with precipitation in the southeast, as described in more detail in appendix A.

- Air emissions from construction equipment powered by internal combustion engines are estimated using the emissions factor method from EPA's NONROAD model (EPA 2002, 2004a, 2004b).

- Air emissions from crew trucks needed in the construction of new or expanded sites are estimated using EPA's MOBILE6.2 model (EPA 2003b).

In addition to the direct emissions listed above, this EIS examines indirect emissions associated with the use of motor vehicles by employees to commute to the worksites.

The analysis focuses on five pollutants that are expected to be emitted in greatest quantities from such construction sources: carbon monoxide (CO), nitrogen oxides (NO_x), PM with a mean aerodynamic diameter of 2.5 micrometers or less ($PM_{2.5}$), PM with a mean aerodynamic diameter of 10 micrometers or less (PM_{10}), and non-methane hydrocarbons (NMHC). Because of increasingly stringent limits on both gasoline and diesel fuel sulfur content, sulfur dioxide (SO_2) was not included in the analysis, since these emissions from internal combustion engines are now negligible. Similarly, fuel no longer contains lead and DOE does not anticipate any lead emissions.

DOE predicts maximum annual emissions of these pollutants during the construction phase and compares those emissions to threshold triggers for new source review (NSR) requirements under the Clean Air Act (CAA). This comparison serves as a basis for evaluating whether the predicted emissions are likely to exceed the National Ambient Air Quality Standard (NAAQS) defined in EPA regulations (40 CFR Part 50), which are presented in table 3.5.1-1. Texas, Louisiana, and Mississippi are required to meet these standards.

Table 3.5.1-1: National Ambient Air Quality Standards

Pollutant	Primary Standard (To Protect Public Health)			Secondary Standard (To Protect Public Welfare)		
	Level	Averaging Time	Form of the Standard	Level	Averaging Time	Form
Ozone[a]	80 ppb	8-hour	3-year average of annual fourth highest daily maximum	Same as primary standard		
Particulate matter 10 microns or smaller (PM_{10})[b]	150 $\mu g/m^3$	24-hour	3-year average of the number of exceedences must be less than one	Same as primary standard		
	Revoked[3]	Annual	Not to be exceeded			
Particulate matter 2.5 microns or smaller ($PM_{2.5}$)[b]	35 $\mu g/m^3$	24-hour	3-year average of 24-hour average 98th percentile	Same as primary standard		
	15 $\mu g/m^3$	Annual	3-year spatial average of annual averages			
Carbon monoxide	35,000 ppb	1-hour	Not to be exceeded more than once per year	No secondary standard		
	9,000 ppb	8-hour	Not to be exceeded more than once per year			
Sulfur dioxide	140 ppb	24-hour	Not more than once per year	550 ppb	3-hour	Not more than once per year
	30 ppb	Annual	Not to be exceeded			
Nitrogen dioxide	53 ppb	Annual	Not to be exceeded	Same as primary standard		

Notes:

[a] As of 2005, the 1-hour standard for ozone had been phased out. Attainment of ozone standards now depends only on meeting the 8-hour standard.

[b] New standards for particulate matter were published in the Federal Register on October 17, 2006. The new standards lower the 24-hour $PM_{2.5}$ standard from 65 to 35 $\mu g/m^3$ and revoke the annual PM_{10} standard of 50 $\mu g/m^3$. This final rule is to be effective on December 18, 2006.

ppb = parts per billion; ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter

Source: 40 CFR Part 50

To further analyze potential impacts associated with $PM_{2.5}$ emissions, DOE also uses EPA's air quality screening model SCREEN3 (EPA 1995) to predict maximum ambient air concentrations of $PM_{2.5}$ resulting from the proposed construction activities. These predicted concentrations are then added to known background concentrations of $PM_{2.5}$ and the total resulting concentration is compared to the NAAQS. DOE focuses this analysis on $PM_{2.5}$ rather than PM_{10} because, as described in the affected environment sections for each site, baseline $PM_{2.5}$ concentrations are much closer to the NAAQS and incremental $PM_{2.5}$ emissions from the proposed action are a greater potential concern than PM_{10} emissions.

Finally, the CAA establishes geographic areas of attainment or nonattainment of the NAAQS for CO, PM, nitrogen dioxide (NO_2), and ozone based on the severity of each air pollutant. Therefore, the attainment or nonattainment status and severity are discussed separately in the affected environment sections for each of the proposed SPR storage sites and associated facilities. It is important to note that ozone is not directly emitted from sources; rather, it forms as a result of NMHC and NO_x from vehicle and industrial emissions reacting with sunlight in the atmosphere.

3.5.1.2 Operations and Maintenance Impacts

The analysis of operations and maintenance impacts focuses on three categories of emissions:

- CO, NO_x, $PM_{2.5}$, PM_{10}, and NMHC emissions from backup diesel generators that may be used for power sources in the event of electric power grid failures;
- Hydrogen sulfide emissions during drawdown; and
- NMHC emissions associated with well "workovers," fugitive emissions from brine ponds and storage tanks, as well as other maintenance activities.

Emissions from backup diesel generators are estimated and compared to threshold triggers for NSR and conformity review if located in nonattainment areas. Ambient air concentrations of hydrogen sulfide are estimated and analyzed for odor effects. Historical recorded emissions from well "workovers," brine ponds, and storage tanks and other maintenance activities at existing SPR sites are evaluated and compared to each state's permitted limits.

3.5.1.3 Greenhouse Gas Emissions and Climate Change Impacts

Over the long term, atmospheric greenhouse gases affect global temperatures, wind and rainfall patterns, and other aspects of the global climate system by altering the ability of the Earth to reflect and absorb solar radiation. Some gases have become more concentrated in the atmosphere as a direct result of human activities and are known to affect the global equilibrium by absorbing infrared radiation that would otherwise be emitted into space and converting it into heat. The most important of these greenhouse gases are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

The most significant source of greenhouse gas emissions for the SPR expansion are CO_2 emissions associated with combustion sources (construction equipment and motor vehicles) and CH_4 during cavern leaching. All combustion engines, including gasoline and diesel-fueled engines, emit large quantities of CO_2. Emissions of N_2O and CH_4 from gasoline and diesel engines are much smaller, so only CO_2 needs to be considered from these sources. Solution mining of salt from cavern development emits trapped CH_4 in addition to NMHC. The brine pumped from the caverns also contains some CO_2. However, CO_2 is soluble in water, and the concentrations of CO_2 in the brine are well below equilibrium concentrations found in sea water, so only the CH_4 emissions from cavern leaching are considered in this EIS.

For both off-road and on-road internal combustion engines, a mass balance method was used to estimate CO_2 emissions. This method is based on fuel consumption, assuming that all the carbon in the fuel that is not emitted directly as hydrocarbons is converted to CO_2. The method used to estimate CH_4 emissions from cavern leaching is fundamentally the same as that used to estimate NMHC emissions based on measurements of hydrocarbons in the brine solution (DOE 1981). Both the method for estimating CO_2 from fuel combustion and estimating CH_4 from cavern leaching are described in greater detail in the Air Quality Appendix to this EIS (see appendix A). Estimated emissions of CH_4 are converted to CO_2

equivalent global warming potentials by applying a factor of 23, as was used in the Intergovernmental Panel on Climate Change Third Assessment Report (IPCC 2001).

3.5.2 Impacts Common to Multiple Sites

Section 3.5.2.1 reviews the major types of emission sources and pollutants that would be associated with construction of all of the proposed sites and related infrastructure. Because the magnitude of these emissions is dependent on the nature and extent of the proposed construction activities, which vary substantially across the different sites, the construction impacts are evaluated in more detail on a site-specific basis in sections 3.5.3 through 3.5.9.

Sections 3.5.2.2 reviews the common types of emissions from the proposed operations and maintenance activities and section 3.5.2.3 reviews the common sources of greenhouse gas emissions and resulting climate change impacts. Because the nature and magnitude of these emissions are similar and can be evaluated together across the different sites, they are evaluated only in these common impact discussions and are not addressed in the site-specific sections that follow.

3.5.2.1 Construction Impacts

SPR site preparation, facility and road construction, cavern development, pipeline construction, and oil storage tank construction and use would generate air emissions. The greatest potential air quality impacts are expected to be associated with large-scale cut-and-fill operations, which emit fugitive PM. In addition, construction equipment is generally powered by internal combustion engines that emit additional air pollutants, including NO_x, PM, CO, CO_2, and NMHC.

Site preparation can be divided into four sequential phases: clearing and grubbing, rough grading, soil stabilization, and embankment placement and compaction. The emissions associated with these activities depend upon the facility size, existing vegetation, local terrain, and the extent to which affected areas are wetlands.

Facility construction also has four phases: foundation pouring, building construction, electrical installation, and pipe installation. Road construction includes laying road surfaces. These activities generate both fugitive dust and fuel combustion-related emissions. The emissions associated with these activities depend upon the existing infrastructure and size of the facility and road development.

Cavern development involves the use of diesel-powered boring drills working 24 hours per day. DOE expects all initial holes for new cavern development to be drilled during facility construction. Cavern development also involves dissolving the underground salt with fresh water and pumping out saturated brine, as described in Chapter 2. Because the salt is soluble in water but not in oil, oil is pumped into the cavern to protect the cavern ceiling and later to fill the cavern as it is formed. A small portion of the oil at the interface between the organic and aqueous phases mixes with the solution mining water and is pumped out with the brine during the cavern solution mining process. DOE assumes for this air quality analysis that oil that is mixed with the aqueous phase is pumped out and is released to the atmosphere as hydrocarbon vapors (including NMHC) from either the oil/brine separator or the brine ponds (DOE, 1981). For each new or expansion site, except for West Hackberry, NMHC emissions associated with cavern development are estimated based on the maximum expected increase in cavern capacity and the maximum brine production rate. The West Hackberry expansion would not involve any cavern development and would therefore not be expected to emit any NMHC.

New and expansion SPR sites could require extensive pipeline construction for oil, brine, and raw water transport. These pipes would range in diameter from 16 to 48 inches (0.4 to 1.2 meters) and would be buried. The miles of pipeline construction vary among each proposed site, as described in Chapter 2. Emissions-generating activities include both fugitive dust from the soil disturbance and fuel combustion from the off-road construction equipment. Because the majority of pipeline construction would be away from the storage sites themselves, pipeline construction can begin at the start of storage site preparation and can continue for up to three years, depending upon the site.

For several of the new site options (Bruinsburg, Richton, and Stratton Ridge), new above-ground oil storage tanks would also be installed and would potentially be active during the cavern solution mining process. Each of these facilities would have up to four 0.4 MMB storage tanks. Emissions of NMHC from these tanks would be associated with standing (rim seal, deck seams and fittings) storage losses and working (during movement of crude through tanks) losses.

All of these construction-related emissions and impacts are evaluated on a site-specific basis in sections 3.5.3 through 3.5.9. This approach allows for a full discussion of the different factors contributing to the emissions and impacts at each site.

3.5.2.2 Operations and Maintenance Impacts

The main operations- and maintenance-related emissions and impacts are summarized below; these include emissions from backup diesel generators, above-ground storage tank losses, brine pond losses, and frac tank emission losses associated with cavern "workovers." These emissions and impacts can be generalized across the proposed sites and do not warrant more detailed site-specific discussions in subsequent sections.

Backup Diesel Generator Emissions

Regional electric grids, rather than onsite internal combustion engines, will power most onsite equipment during operations and maintenance. Accordingly, routine operation of the new and expanded SPR sites is anticipated to have low air emissions.

In emergencies when the electric power grid fails, DOE may use backup diesel generators. Air emission permits are generally not required for emergency backup generators if used less than 500 hours per year, which is the expected maximum use from routine maintenance testing and emergency operations. Each of the new expansion or existing sites would be equipped with two standby diesel engine electrical generators: one for the main site rated at 1,200 horsepower (900 kilowatt) and the other for the RWI rated at 340 horsepower (250 kilowatt). Table 3.5.2-1 gives the combined emissions from a 1,200-horsepower diesel generator and a 340-horsepower diesel generator operating at the same time.

Table 3.5.2-1: Combined Emissions from a 1,200-Horsepower Diesel Generator and a 340-Horsepower Diesel Generator Operating 500 Hours per Year (tons per year)

CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
2.22	9.84	0.40	0.40	0.40

Notes:

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Source: EPA, 1996; Table 3.5-1 and Table 3.3-1

In addition, the Richton site may need to use three 2,000-horsepower (1,500-kilowatt) diesel-fired engines as pumping units at the midpoint (58 miles [93 kilometers]) of the oil distribution pipeline from Richton to Liberty Terminal during drawdown events. Table 3.5.2-2 gives the total estimated emission rate from three 2,000- horsepower diesel generators.

Table 3.5.2-2: Emissions from Three 2,000-Horsepower Diesel Generators Operating 500 Hours per Year (tons per year)

CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
8.25	36.00	1.05	1.05	0.96

Notes:

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Source: EPA, 1996; Table 3.5-1

These estimated maximum air emissions from backup diesel generators would be small, sporadic, and inconsequential in terms of air quality impacts. Considered by themselves, the estimated emissions are well below 250 tons per year (230 metric tons per year), the threshold trigger for NSR. They also are below conformity emission threshold levels of 100 tons per year for either NO_x or VOCs and, as a result, the provisions of the conformity rule would no longer apply. The section below on workover and other maintenance emissions addresses backup diesel generator emissions further by evaluating actual generator emissions from the Big Hill site together with other sources of emissions during operation and maintenance activities.

Hydrogen Sulfide Emissions

Crude oil can have significant sulfur content, so emissions of gaseous hydrogen sulfide during drawdown could pose a local odor nuisance or a health risk to sensitive individuals. The extent of these emissions would depend upon the gas-to-oil ratio, vapor phase of hydrogen sulfide fraction, sulfur content of the oil, drawdown rate, and local meteorological conditions.

To address this issue, DOE estimated ambient concentrations of hydrogen sulfide every 328 feet (100 meters) from release sources out to a distance of 5 miles (8 kilometers). The analysis relied on the results of a previous DOE study (Lee et al. 2000) and used the following assumptions:

- The maximum drawdown rate at each facility;
- All crude oil stored at the facility had a high sulfur content, 0.06 standard cubic feet of hydrogen sulfide per barrel;
- Stagnant air conditions (1.0 meters per second) and a mixing height of 0.25 miles (0.40 kilometers);
- Typical 400,000 barrel storage tank; and
- The potential occurrence of all atmospheric stability classes (Stability Class C was found to yield the highest estimated concentrations).

With these conservative assumptions, the estimated maximum ambient levels of hydrogen sulfide would vary by facility from 17 to 43 parts per million (1-hour average), depending upon each facility's maximum drawdown rate. DOE estimates the maximum concentration out to a distance of 0.12 miles (0.19 kilometers) from the source. These levels are high enough that people within that distance would be able to detect hydrogen sulfide odors (rotten egg smell) and would experience coughing and throat irritation when conducting moderate exercise in the area (OEHHA 2000, p. 6). The occurrence of these events, however, would be expected to be very rare as drawdown events are infrequent (only a few times in the past 20 years) and would need to be coupled with both the storage of high sulfur content crude oil (about half to two-thirds of the current crude oil storage) and the stagnant meteorological conditions assumed above.

DOE has a specific plan in place to minimize the impacts of hydrogen sulfide odors in the event of full drawdown. That plan is to inject a hydrogen scavenger (if needed, based on the oil's sulfur content) into the crude oil as it leaves the SPR, with the proper concentration to reduce the hydrogen sulfide to non-objectionable levels for worker exposures at the terminal receiving the oil. DOE has basic ordering agreements in place with several vendors to supply the large quantities of scavenger that might be required for a full drawdown. With these measures in place, DOE does not expect significant impacts associated with hydrogen sulfide emissions.

Other Operations and Maintenance Emissions

Historically, emissions from operations and maintenance of the SPR facilities include the following:

(1) VOCs evaporating from small quantities of oil in the brine ponds (as discussed above, the brine picks up small quantities of hydrocarbons when it comes into contact with oil during fill and drawdown activities);

(2) VOCs escaping from small leaks in pipe joints and pumping equipment (such as valves, flanges, and pump seals);

(3) CO, NO_x, PM, and VOC emitted from backup diesel generators and pumps used to supply diesel fuel to those generators, as discussed above;

(4) VOCs evaporating from various tanks and other equipment used to store or move oil or other fluids containing volatile compounds, such as "slop oil" tanks (used to store oil discharged as a result of equipment maintenance or contaminated stormwater), crude oil storage tanks, "sump" tanks (which accept crude oil that might be spilled during maintenance activities), diesel fuel storage tanks, gasoline storage tanks, other assorted equipment (such as an "air eliminator" and "solvent recycler"), and "frac" tanks (used to receive crude oil from a cavern that is being worked on to reduce cavern pressure); and

(5) CO, NO_x, PM, and VOCs emitted from vehicles used by workers commuting to and from the sites.

For the purpose of this EIS, historical emissions from the 161 MMB Big Hill facility can be used to estimate emissions from the proposed new or expanded SPR facilities. The current permit limits for emissions from operations and maintenance at Big Hill are shown in table 3.5.2-3. These include permit limits for backup diesel generators, which are well below the maximum estimated emissions presented above. Actual emissions have been below the total permitted levels shown in the bottom row of this table, so these values are conservative for the purpose of estimating emissions at other sites.

Although not the subject of a permit limit in Texas, there are also occasional frac tank emissions of VOCs, depending on the need for cavern maintenance activities. Recorded frac tank emissions of VOCs have been highly variable from year to year, since the same extent of cavern maintenance is not needed every year. In particular, VOC emissions from frac tanks at Big Hill were: 62.5 tons in 1998; 7 tons in 1999; 0.5 tons in 2000; 53.9 tons in 2001; 10.7 tons in 2002; 16.6 tons in 2003; and 17.4 tons in 2004.

Table 3.5.2-3: Permit Limits for Emissions from Operations and Maintenance of Current Big Hill Facility (tons per year)

Emission Source	CO	NO_x	$PM_{10}/PM_{2.5}$[a]	VOC
Brine pond	—	—	—	3.15
Fugitive emissions from piping	—	—	—	9.34
6-kilowatt generator	0.01	0.03	0.01	0.01
900-kilowatt generator	0.43	2	0.03	0.06
80-kilowatt generator	0.03	0.14	0.01	0.01
Diesel pump	0.1	0.45	0.03	0.04
Slop oil tank	—	—	—	0.18
Crude oil tank	—	—	—	1.37
Sump tank	—	—	—	0.06
Diesel fuel tanks (4)	—	—	—	0.04
Gasoline tank	—	—	—	0.24
Air eliminator	—	—	—	1.5
Solvent recycler	—	—	—	0.06
Total permit limit for all sources	0.57	2.62	0.08	16.1

[a] Permit limits are the same for PM_{10} and $PM_{2.5}$ emissions

Adding the recent maximum frac tank emissions of VOCs (62.5 tons per year) to the total permitted VOC emissions from other onsite sources reported in table 3.5.2-3 (16.1 tons per year) yields a maximum estimate of 78.6 tons per year of VOCs emitted from Big Hill operation and maintenance activities.

DOE expects that operation and maintenance emissions at the proposed expansion sites would be similar to those at Big Hill, but the emissions are likely to vary in proportion to the storage capacity of the different facilities. Therefore, for this EIS, DOE took the maximum Big Hill emissions discussed above and scaled them up or down to reflect the storage capacity of the site relative to the Big Hill storage capacity. To these scaled results, DOE then added estimated emissions associated with worker vehicles commuting to the sites. The estimated results are summarized in table 3.5.2-4.

Table 3.5.2-4: Estimated Maximum Emissions During the Operations and Maintenance at Proposed Expansion and New Sites (tons per year)

Proposed Sites	CO	NO_x	PM_{10}	$PM_{2.5}$	VOC
Expansion Sites					
Big Hill	12.0	2.3	0.075	0.075	47.7
Bayou Choctaw	7.1	0.92	0.031	0.031	6.8
West Hackberry	16.3	1.3	0.046	0.046	3.1
New Sites					
Richton	15.7	3.5	0.12	0.12	79.0
Chacahoula	12.8	3.4	0.11	0.11	79.3
Stratton Ridge	36.4	4.8	0.16	0.16	78.1
Bruinsburg	33.1	4.6	0.16	0.16	79.2

Source: Estimated as described in preceding text

The maximum estimated emissions in table 3.5.2-4 are well below 250 tons per year (230 metric tons per year), the threshold trigger for NSR. They also are below conformity emission threshold levels of 100 tons per year for either NO_x or VOC and, as a result, the provisions of the conformity rule would no longer apply. Based on this analysis, DOE expects the proposed operations and maintenance activities to have an insignificant impact on air quality. [1]

3.5.2.3 Greenhouse Gas Emissions and Climate Change Impacts

The emissions of greenhouse gases associated with construction and expansion of the SPR sites during maximum activity are shown for each site in table 3.5.2-5. Maximum total greenhouse gas emissions associated with the proposed action (0.22 million tons of CO_2 equivalents per year for the expansion alternative involving Bruinsburg and the three expansion sites) would be less than 0.004 percent of the annual total greenhouse gas emissions for the United States in 2000 (7,140 million tons of CO_2 equivalents per year). This amount may also be compared with the estimated green house gas emissions associated with the construction of three 11 MMB salt dome caverns for the proposed US Coast Guard Main pass Energy Hub to be located off the coast of Louisiana (US Coast Guard, 2006). That analysis showed that during the 27-month construction period the greenhouse gas annual emission rate would be 0.070 million tons of CO_2 equivalent. Thus, the greenhouse gas emissions under the proposed action for SPR expansion would be 3.1 times larger than the greenhouse gas emissions for the Main Pass Energy Hub. Once cavern development is complete, emissions would be limited to only indirect impacts associated with emissions from commuter vehicles (as high as 0.019 million tons of CO_2 equivalent per year, depending upon which combination of sites are developed), which would be about a third of the construction impacts. Therefore, the incremental emissions and climate change impacts of the proposed SPR site development are considered very small.

Table 3.5.2-5: Annual Average Emissions of Greenhouse Gases Associated with Site Construction and Expansion (million tons of CO_2 equivalents)

Site	Construction Impacts	Leaching Impacts	Indirect Impacts[a]	Total
Bruinsburg	0.071	0.065	0.011	0.147
Chacahoula	0.024	0.065	0.004	0.093
Richton	0.025	0.065	0.005	0.095
Stratton Ridge	0.024	0.065	0.011	0.100
Bayou Choctaw	0.005	0.008	0.002	0.015
Big Hill	0.031	0.039	0.004	0.054
West Hackberry	Negligible	N/A	0.002	0.002

[a] Indirect impacts would be associated with emissions from worker vehicles

N/A = not available

3.5.3 Bruinsburg Storage Site

3.5.3.1 Affected Environment

A **design value** is a pollutant concentration, based on ambient measurement, which describes the air quality status of a given area. Areas in which the design value exceeds the NAAQS may result in a nonattainment designation for the area.

Currently, all of Mississippi is in attainment for all criteria pollutants. The ozone monitors closest to the proposed Bruinsburg SPR storage site have 8-hour **design values** between 69 and 74 parts per billion and the nearest $PM_{2.5}$ monitors have 3-year annual average concentrations between 11.9 and 13.3 micrograms per cubic meter and a 24-hour average concentration

[1] If the emissions from the operation and maintenance (including the backup generators) are included in a permit, these emissions may be excluded from the general conformity applicability analysis.

between 27 and 30 micrograms per cubic meter (see table 3.5.3-1). These upper-end values correspond to 93 percent of the NAAQS for 8-hour ozone (80 parts per billion) and 89 percent of the NAAQS for annual $PM_{2.5}$ (15 micrograms per cubic meter). Other NAAQS, such as for 1-hour and 8-hour CO, 24-hour and annual PM_{10}, and 24-hour average for $PM_{2.5}$ (65 micrograms per cubic meter) are met by much greater margins. Thus, the pollutants of primary concern are 8-hour ozone and annual $PM_{2.5}$.

Table 3.5.3-1: Design Values for 8-Hour Ozone, Annual, and 24-Hour $PM_{2.5}$ at Monitoring Sites Near Bruinsburg Storage Site

Monitoring Site	County	Pollutant	2001–2003 Design Value	2002–2004 Design Value
Jackson	Hinds	8-hr ozone	73 ppb	69 ppb
Highway 22	Madison	8-hr ozone	74 ppb	73 ppb
Vicksburg	Warren	8-hr ozone	74 ppb	N/A
Northeast Jackson	Hinds	Annual $PM_{2.5}$	13.0 $\mu g/m^3$	12.9 $\mu g/m^3$
Downtown Jackson	Hinds	Annual $PM_{2.5}$	13.3 $\mu g/m^3$	13.1 $\mu g/m^3$
Vicksburg	Warren	Annual $PM_{2.5}$	12.2 $\mu g/m^3$	11.9 $\mu g/m^3$
Northeast Jackson	Hinds	24-hr $PM_{2.5}$	30 $\mu g/m^3$	30 $\mu g/m^3$
Downtown Jackson	Hinds	24-hr $PM_{2.5}$	29 $\mu g/m^3$	28 $\mu g/m^3$
Vicksburg	Warren	24-hr $PM_{2.5}$	30 $\mu g/m^3$	27 $\mu g/m^3$

Notes:

ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; N/A = not applicable; PM = particulate matter; hr = hour

Sources: MDEQ, 2003; MDEQ, 2004

3.5.3.2 Construction Impacts

As a proposed new SPR facility, about 270 acres (110 hectares) of the Bruinsburg site would need to be cleared and prepared. DOE estimates that this would require approximately 31 working days for clearing and grubbing, 10 working days for rough grading, 124 working days for soil stabilization with lime, and 57 working days for embankment compaction and stabilization. In addition, a marine terminal would be developed in Anchorage, LA, to support the Bruinsburg SPR site operation.

Constructing buildings and roads at the Bruinsburg site would require approximately 60 days for foundation pouring, 60 days for building construction, 250 days for electrical installation, 60 days for local pipe installation, and 60 days for road building.

Cavern solution mining would occur after other facility construction is complete and would result only in evaporative hydrocarbon emissions from oil extracted from the brine solution. Up to half of the 16 10-MMB-capacity caverns would be developed simultaneously, after which the other 8 would be developed.

In addition to the above onsite sources, emissions would be associated with pipeline ROW development and pipeline installation, as follows:

- A 14-mile (22-kilometer) brine disposal pipeline to injection wells located along the proposed Baton Rouge crude oil pipeline ROW along with a 15-mile (24-kilometer) maintenance road;
- A 39-mile (63-kilometer) crude oil pipeline connecting the facility to the Peetsville Pump Station in Lincoln County, MS;

- A 109-mile (176-kilometer) crude oil pipeline to connect the storage facility to the Anchorage, LA, Terminal area; and

- A 4.1-mile (6.6-kilometer) pipeline for RWI from the Mississippi River.

Pipeline construction would begin at the start of site preparation and continue for about 27 months using 2 pipeline construction crews.

Of the proposed new sites, Bruinsburg is unique in proposing underground injection as the method of brine disposal. DOE would space 60 brine disposal wells at approximately 1,000-foot (300-meter) distances along the brine disposal and crude oil pipelines ROW. Brine disposal wells would be drilled to a depth of 2,000 to 3,000 feet (600 to 900 meters) through rock into underlying porous media. DOE estimates that nine 500-horsepower drills similar to those used for storage cavern development could drill these wells in about 3 years.

DOE would clear an area of about 230 feet by 230 feet (70 meters by 70 meters) around each well. Overall, DOE would conduct clearing, grubbing, and rough grading activities similar to those for the SPR storage site for about 73 acres (30 hectares). The emissions would be about 59 percent of the emissions for the storage facility, based on the ratio of 73 acres to 120 acres (30 to 49 hectares). Despite the smaller area for the injection wells, the well construction schedule would be similar to the storage site schedule because of the increased effort needed for the dispersed location of the wells.

As noted above, an 11-mile (18-kilometer) aggregate surface access road would be built along the brine disposal pipeline. Emissions associated with construction of the access road are estimated by including an additional backhoe and two tractor trailers to the pipeline crew and doubling grader activity.

During the period when clearing, grubbing, and rough grading activities take place, DOE assumed that an average of 20 vehicles per day would travel the full length of the 11-mile (18 kilometer) gravel road and back. At other times, DOE assumed that an average of eight vehicles per day would travel the full length of the gravel road and back.

A summary of estimated direct air emissions and durations for different construction activities is given in table 3.5.3-2. Emissions are totals for all activities that last for less than one year. For activities lasting more than one year, such as pipeline construction and cavern development, emissions are given as maximum rates for those activities in any one year. The maximum annual emissions rate in the final row includes all the emissions during the 12-month period of greatest emissions. This is the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

Table 3.5.3-2: Maximum Direct Emissions during Construction of Proposed Bruinsburg Site (emissions are in total tons except those lasting > 1 year, which are in tons per year)

Activity	Days	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
Clearing and grubbing	54	18.52	0.38	31.25	3.59	3.26
Rough grading	10	0.07	0.26	2.47	0.26	0.02
Soil stabilization	124	4.62	2.63	9.38	1.23	0.83
Embankment compacting	57	5.60	0.63	15.71	1.75	0.96
Foundation pouring	60	0.75	1.56	0.14	0.14	0.10
Building construction	60	0.38	0.45	0.07	0.07	0.05
Electrical installation	250	0.39	0.83	0.09	0.09	0.09
Pipe installation	60	0.11	0.38	0.03	0.03	0.02

Table 3.5.3-2: Maximum Direct Emissions during Construction of Proposed Bruinsburg Site (emissions are in total tons except those lasting > 1 year, which are in tons per year)

Activity	Days	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
Road construction	60	0.30	0.57	3.58	0.42	0.05
Pipeline construction[a]	560	2.01	2.68	35.72	3.85	0.35
Cavern drilling	730	11.12	47.51	2.27	2.27	1.57
Solution mining[b]	425	0.00	0.00	0.00	0.00	23.9
Solution mining/fill[b]	359	0.00	0.00	0.00	0.00	93.8
Final fill	160	0.00	0.00	0.00	0.00	21.0
Brine disposal site prep[c]	43	6.87	0.28	21.84	4.73	1.13
Brine disposal well drilling[c]	1095	25.0	107	5.11	5.11	3.54
Gravel road travel[d]	N/A	0.48	0.10	24.86	5.27	0.00
Maximum annual emissions	—	72.10	162.04	123.82	13.69	98.82

Notes:

[a] The emissions associated with the pipeline construction are distributed over some 166 miles (267 kilometers)
[b] Based on simultaneous development of eight caverns; these activities would proceed sequentially
[c] The emissions associated with brine disposal wells and aggregate road travel are distributed over 11 miles (18 kilometer) of the proposed brine disposal pipeline
[d] After initial period of clearing, grubbing, and rough grading

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons; N/A = not available

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. The combined total annual emission rate includes all co-located sources of emissions that could occur in the same year and within the same airshed. Table 3.5.3-3 summarizes these emissions. CO emissions would be the largest, but since these emissions would be dispersed over miles of roadway, the effect is likely to be small.

Table 3.5.3-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Construction Activities at the Proposed Bruinsburg Site

Year	Workers	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
One	211	54.90	3.52	0.13	0.13	4.15
Two	323	84.05	5.24	0.20	0.20	6.35
Three	388	100.96	6.29	0.24	0.24	7.63
Four	137	35.65	2.22	0.08	0.08	2.70

Notes:

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Construction of the proposed Bruinsburg storage facility would be accompanied by an upgrade of the existing Placid Refinery dock to receive oil tankers. Because it is not necessary to either dredge a channel or construct a new dock at Anchorage, emissions associated with this construction are expected to be minor. Also, at the Anchorage location and at the Peetsville pumping station, four 0.4 MMB above-ground floating storage tanks would be constructed and operated during the solution mining activities. Application of EPA's TANKS 4.0 model finds that standing losses–those associated with a tank simply storing oil-from four well–maintained floating roof tanks of this size (400 MB) are much less than 1.1 tons (1 metric ton) of NMHC per year. Working losses-those associated with oil moving through a tank during active solution mining-are estimated at 11 tons (10 metric tons) of NMHC per year across all four tanks. These small emissions are not expected to exceed the NAAQS at this offsite location.

Tables 3.5.3-2 and 3.5.3-3 and the above-described storage tank emissions conservatively estimate the total impact from the construction of the Bruinsburg storage facility and associated infrastructure. In no case are emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for NSR under the CAA. The purpose of this review is to ensure that air quality is not significantly degraded from the addition of new sources of air pollution, and in areas meeting the NAAQS, NSR assures that new emissions do not significantly worsen air quality. Accordingly, sources that are below the NSR permit requirement triggers are unlikely to significantly worsen ozone air quality. This analysis indicates that emissions from construction of the new Bruinsburg storage facility are below the threshold triggers and are therefore unlikely to cause an exceedance of the ozone NAAQS.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA 1995) to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Bruinsburg facility. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1-hour concentration using EPA screening factors (EPA 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors (in this case the Vicksburg monitor) and the sums can be compared to the 24-hour and annual average NAAQS, which are 35 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.3-4 for the near fence-line concentration. This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

Table 3.5.3-4: Modeled SCREEN3 $PM_{2.5}$ Concentrations and Local Monitored Concentrations at the Proposed Bruinsburg Site

Averaging Period	Modeled Concentration ($\mu g/m^3$)	Monitored Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)
24-hour	5	30	35[a]
Annual	1.3	12.2	13.5

[a] These results are for the maximum (100th percentile) 24-hour $PM_{2.5}$ concentration while the NAAQS for $PM_{2.5}$ is for the 98th percentile so that no exceedance of the NAAQS is anticipated.

$\mu g/m^3$ = micrograms per cubic meter

3.5.4 Chacahoula Storage Site

3.5.4.1 Affected Environment

The proposed Chacahoula storage site is located in the Houma-Bayou Cane-Thibodaux **Metropolitan Statistical Area** (MSA), which is currently in attainment for all NAAQS, including 8-hour ozone, annual average $PM_{2.5}$ and PM_{10}, 24-hour average $PM_{2.5}$ and PM_{10}, and 1-hour and 8-hour CO.

Ozone design values for the 8-hour ozone standard at the Thibodaux monitoring station in Lafourche Parish were determined by averaging the fourth highest values for each 3-year period from the EPA AirData Web site (EPA 2004c), as shown in table 3.5.4-1. Similarly, annual and 24-hour $PM_{2.5}$ design values were also calculated using values from the EPA AirData Web site for neighboring Terrebonne Parish and also appear in table 3.5.4-1. The 8-hour ozone design value is below, but near the NAAQS of 80 parts per billion. The only other pollutant close to the NAAQS is the annual $PM_{2.5}$ concentration, which is at 70 percent of the standard. Other pollutants such as nitrogen dioxide, PM_{10}, and CO are met by much greater margins. Thus, the pollutants of primary concern in this EIS are ozone and $PM_{2.5}$.

Table 3.5.4-1: Design Values for 8-hour Ozone in Lafourche Parish and Annual and 24-Hour $PM_{2.5}$ in Terrebonne Parish

Site	Parish	Pollutant	2001–2003 Design Value	2002–2004 Design Value
Thibodeaux	Lafourche	8-hr ozone	79 ppb	77 ppb
Highway 24	Terrebonne	Annual $PM_{2.5}$	10.4 $\mu g/m^3$	10.0 $\mu g/m^3$
Highway 24	Terrebonne	24-hr $PM_{2.5}$	23 $\mu g/m^3$	23 $\mu g/m^3$

Notes:

ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; hr = hour

Source: EPA, 2004c

3.5.4.2 Construction Impacts

DOE modeled construction activities at Chacahoula based on the cost estimate for the Chacahoula site (DOE, 2004c), the cost estimate for the Stratton Ridge site (DOE 2004e), and Chapter 2 of the 1992 draft EIS for the expansion of the SPR (DOE 1992b).

As a proposed new facility, DOE expects that about 240 acres (96 hectares) of the Chacahoula site would be prepared for construction. However, since the site is largely underwater, grading, soil stabilization, and compacting would not be needed. Nonetheless, grubbing of large trees may be needed to improve the line of site for security purposes and filling would be required for pads and facility construction. The work would require approximately 60 days for foundation pouring, 60 days for building construction, 250 days for electrical installation, 60 days for local pipe installation, and 60 days for road building.

The storage caverns at Chacahoula would be developed following the same process as at Bruinsburg, up to eight at a time, as described in section 3.5.3.2, except that the maximum solution mining rate would be 1.2 MMBD. This maximum rate effects the time period for the solution mining and fill operations.

In addition to onsite emissions, emissions would be associated with the development of four pipelines:

- A 58-mile (93-kilometer) brine pipeline into the Gulf of Mexico (40 miles [65 kilometers] onshore, 18 miles [19 kilometers] offshore);
- A 54-mile (87-kilometer) crude oil pipeline to the LOOP terminal at Clovelly;
- A 21-mile (34-kilometer) crude oil pipeline to the St. James Terminal, LA; and
- A 13-mile (21-kilometer) RWI pipeline to the ICW.

Pipeline construction is expected to begin at the start of site preparation and continue for approximately 22 months using two pipeline construction crews working an average of 250 days per year.

Table 3.5.4-2 summarizes the estimated direct emissions and durations for each construction activity for the Chacahoula storage facility. The table gives total emissions for activities that last for less than one year. For activities lasting more than one year, such as pipeline construction and cavern development, emissions are given as maximum rates for activities in any one year. The maximum annual emission rates in the final row include all the emissions occurring during the 12-month period of greatest emissions. This is the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

Table 3.5.4-2: Maximum Direct Emissions during Construction of Proposed Chacahoula Site (total tons except emissions lasting > 1 year, which are in tons per year)

Activity	Days	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
Clearing	35	10.87	0.25	0.33	0.33	2.11
Rough grading	N/A	0.0	0.0	0.0	0.0	0.0
Soil stabilization	N/A	0.0	0.0	0.0	0.0	0.0
Embankment compacting	N/A	0.0	0.0	0.0	0.0	0.0
Foundation pouring	60	0.75	1.56	0.14	0.14	0.10
Building construction	60	0.38	0.45	0.07	0.07	0.05
Electrical installation	250	0.39	0.83	0.09	0.09	0.09
Pipe installation	60	0.11	0.38	0.03	0.03	0.02
Road construction	60	0.30	0.57	3.5	0.42	0.05
Pipeline construction[a]	460	1.67	1.85	35.17	3.79	0.28
Cavern drilling	730	11.12	47.51	2.27	2.27	1.57
Solution mining	510	0.00	0.00	0.00	0.00	23.9
Solution mining/fill	431	0.00	0.00	0.00	0.00	93.8
Final fill	160	0.00	0.00	0.00	0.00	21.0
Maximum annual emissions	—	25.23	52.51	41.60	7.14	94.08

Notes:

[a] The emissions associated with onshore pipeline construction are distributed over 125 miles (201 kilometers). Emissions from offshore construction are assumed to be negligible relative to the onshore pipeline.

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons; N/A = not available

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.4-3 summarizes these emissions. These emissions would be small and distributed over miles of roadway.

Tables 3.5.4-2 and 3.5.4-3 conservatively estimate the total emissions from the construction of the Chacahoula storage facility and associated infrastructure. The combined total annual emission rate includes all co-located sources of emissions that could occur in the same year and within the same airshed. In no case are emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for NSR under the CAA. Thus, the potential impact from the construction of the new Chacahoula storage facility on ozone air quality is unlikely to cause an exceedance of any of the NAAQS.

Table 3.5.4-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Construction Activities at Proposed Chacahoula Site

Year	Number of Workers	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
One	186	18.18	1.13	0.04	0.04	1.37
Two	298	29.13	1.82	0.07	0.07	2.20
Three	363	35.49	2.21	0.08	0.08	2.68
Four	112	10.95	0.68	0.03	0.03	0.83

Notes:

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA 1995) to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Chacahoula facility. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1-hour concentration using EPA screening factors (EPA 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors and the sums can be compared to the 24-hour and annual average NAAQS, which are 35 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.4-4 for the near fence-line concentration. This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

Table 3.5.4-4: Modeled $PM_{2.5}$ SCREEN3 Concentrations and Local Monitored Concentrations for the Proposed Chacahoula Site

Averaging Period	Modeled Concentration ($\mu g/m^3$)	Monitored Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)
24-hour	2	23	25
Annual	0.5	10.4	10.9

μg/m3 = micrograms per cubic meter

3.5.5 Richton Storage Site

3.5.5.1 Affected Environment

Design values for 8-hour ozone and annual and 24-hour average $PM_{2.5}$ at monitoring sites near the proposed Richton facility are given in table 3.5.5-1. Currently, all of Mississippi is in attainment for all criteria pollutants. In the vicinity of the proposed Richton site, the nearest ozone monitors have 8-hour design values between 73 and 77 parts per billion. The nearest $PM_{2.5}$ monitors have 3-year annual average concentrations between 13 and 14 micrograms per cubic meter. These upper-end values correspond to 96 percent of the NAAQS for 8-hour ozone (80 parts per billion) and 93 percent of the

NAAQS for annual $PM_{2.5}$ (15 micrograms per cubic meter). Other NAAQS for 1-hour and 8-hour CO, NO_2, 24-hour and annual average PM_{10}, and 24-hour average $PM_{2.5}$ (65 micrograms for cubic meter) are

Table 3.5.5-1: Design Values for 8-Hour Ozone, Annual, and 24-Hour $PM_{2.5}$ at Monitoring Sites Near Richton, MS

Monitoring Site	County	Pollutant	2001–2003 Design Value	2002–2004 Design Value
Stennis Air	Hancock	8-hr ozone	76 ppb	77 ppb
Saucier	Harrison	8-hr ozone	75 ppb	73 ppb
Vancleave	Jackson	8-hr ozone	73 ppb	75 ppb
Hattiesburg	Forrest	Annual $PM_{2.5}$	13.1 $\mu g/m^3$	13.3 $\mu g/m^3$
Laurel	Jones	Annual $PM_{2.5}$	14.3 $\mu g/m^3$	14.4 $\mu g/m^3$
Hattiesburg	Forrest	24-hr $PM_{2.5}$	29 $\mu g/m^3$	30 $\mu g/m^3$
Laurel	Jones	24-hr $PM_{2.5}$	32 $\mu g/m^3$	31 $\mu g/m^3$

Notes:

ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; hr = hour

Sources: MDEQ 2003; MDEQ 2004

met by much greater margins. Thus, the pollutants of primary concern in this EIS are ozone and annual $PM_{2.5}$.

3.5.5.2 Construction Impacts

For this EIS, DOE has estimated equipment needs and construction schedules based on the equipment and time schedule presented in the 1992 conceptual design of the Richton site (DOE 1992a), the cost estimate for the Stratton Ridge site (DOE 2004e), and Chapter 2 of the 1992 draft EIS for the expansion of the SPR (DOE 1992b).

As a proposed new SPR site, DOE estimates that about 240 acres (96 hectares) of the Richton site would need to be cleared and prepared. DOE estimates that this would require approximately 33 working days for clearing and grubbing, 10 working days for rough grading, 130 working days for soil stabilization with lime, and 60 working days for embankment compaction and stabilization. In addition, an oil terminal would be built in Pascagoula, MS and in Liberty, MS to support the Richton SPR site operation.

Building the new buildings and roads would require approximately 60 days for foundation pouring, 60 days for building construction, 250 days for electrical installation, 60 days for local pipe installation, and 60 days for road building.

Cavern solution mining would occur after other facility construction is complete and would result only in NMHC emissions from oil extracted from the brine solution. The caverns would be solution mined and filled in the same manner as described in section 3.5.3.2 for Bruinsburg, that is, eight at a time. The maximum solution mining rate is 1.2 MMBD.

In addition to the above onsite sources, emissions would be associated with the following pipeline ROW development and pipeline installation:

- A 100-mile (161-kilometer) pipeline for brine disposal to the Gulf of Mexico and crude oil distribution to the Pascagoula terminal and a parallel multi-purpose pipeline of 88 miles (142 kilometers) for raw water from the Gulf, brine disposal to the Gulf, and oil distribution. A greater width is used in estimating emissions from these parallel pipelines;

- A 116-mile (186-kilometer) crude oil pipeline also connecting the storage facility to the Capline Interstate Pipeline Injection Station at Liberty, MS;
- A mid-point pump station along the pipeline to Capline, which would use three 2,000-horsepower diesel fired engines pumping units; however, these pumps would only operate during drawdown conditions; and
- A 10-mile (16-kilometer) RWI pipeline from Leaf River.

Pipeline construction would begin at the start of site preparation and continue for nearly three years using three pipeline construction crews working an average of 250 days per year.

A summary of estimated direct air emissions and durations for different construction activities is given in table 3.5.5-2. This table estimates total emissions for activities that last for less than one year. For activities lasting more than one year, such as pipeline construction and cavern development, emissions are given as maximum rates for those activities in any one year. The maximum annual emissions rate in the final row of the table includes all the emissions during the 12-month period of greatest emissions. This is the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.5-3 summarizes these emissions. These emissions would be small and distributed over miles of roadway.

Tables 3.5.5-2 and 3.5.5-3 and the above-described storage tank emissions conservatively estimate the total impact from construction of the Richton storage facility and associated infrastructure. The combined total annual emission rate includes all co-located sources of emissions that could occur in the same year and within the same airshed. In no case are emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for NSR. Thus, the potential impact from the construction of the new Richton storage facility on air quality is unlikely to cause an exceedance of the NAAQS for ozone.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA 1995) to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Richton facility. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth-movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1-hour concentration using EPA screening factors (EPA 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors (in this case the nearest monitor is in Hattiesburg) and the sums can be compared to the 24-hour and annual average NAAQS, which are 65 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.5-4 for the near fence-line concentration. This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

Table 3.5.5-2: Maximum Direct Emissions during Construction of Proposed Richton Site (Emissions are in total tons except those lasting > 1 year, which are in tons per year)

Activity	Days	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
Clearing and grubbing	52	18.02	0.36	26.25	3.07	3.14
Rough grading	10	0.07	0.26	2.77	0.30	0.02
Soil stabilization	130	4.84	2.75	9.92	1.30	0.87
Embankment compacting	60	5.90	0.66	16.69	1.86	1.01
Foundation pouring	60	0.75	1.56	0.14	0.14	0.10
Building construction	60	0.38	0.45	0.07	0.07	0.05
Electrical installation	250	0.39	0.83	0.09	0.09	0.09
Pipe installation	60	0.11	0.38	0.03	0.03	0.02
Road construction	60	0.30	0.57	3.58	0.42	0.05
Pipeline construction[a]	700	2.50	2.78	53.58	5.77	0.42
Cavern drilling	730	11.12	47.51	2.27	2.27	1.57
Solution mining	425	0.00	0.00	0.00	0.00	23.9
Solution mining/fill	359	0.00	0.00	0.00	0.00	93.8
Final fill	160	0.00	0.00	0.00	0.00	21.0
Maximum annual emissions	—	42.65	54.77	111.52	14.61	94.22

Notes:

[a] Emissions associated with building the pipelines are distributed over their 302-mile (486-kilometer) length, but with 88 miles (9.6 kilometers) of crude oil pipeline collocated with the single purpose brine line

CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Table 3.5.5-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Construction Activities at Proposed Richton Site

Year	Workers	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
One	186	22.52	1.40	0.05	0.05	1.70
Two	298	36.09	2.25	0.09	0.09	2.73
Three	363	43.96	2.74	0.10	0.10	3.32
Four	112	13.56	0.85	0.03	0.03	1.03

Notes:

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Table 3.5.5-4: Modeled SCREEN3 $PM_{2.5}$ Concentrations and Locally Monitored Concentrations for Proposed Richton Site

Averaging Period	Modeled Concentration ($\mu g/m^3$)	Monitored Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)
24-hour	5.0	30	35.0[a]
Annual	1.2	13.3	14.5

[a] These results are for the maximum (100^{th} percentile) 24-hour $PM_{2.5}$ concentration while the NAAQS for $PM_{2.5}$ is for the 98^{th} percentile so that no exceedance of the NAAQS is anticipated.

μg/m3 = micrograms per cubic meter

3.5.6 Stratton Ridge Storage Site

3.5.6.1 Affected Environment

The proposed Stratton Ridge site is located in Brazoria County in the Houston MSA. According to the U.S. EPA Green Book (EPA 2005), this is currently a nonattainment area for 8-hour ozone (moderate), but in attainment for all other NAAQS, including annual average $PM_{2.5}$, 24-hour average $PM_{2.5}$, PM_{10}, and CO.

During the period of 2001-2004, two monitors in Brazoria County monitored ozone and one monitored $PM_{2.5}$. Eight-hour ozone design values for these two monitors were determined by averaging the fourth highest values for each 3-year period from the EPA AirData Web site and are shown in table 3.5.6-1. Annual and 24-hour average $PM_{2.5}$ design values for the Clute monitor were also calculated using data from the AirData Web site and also appear in table 3.5.6-1. Both monitoring sites show that the 8-hour NAAQS for ozone (80 ppb) is exceeded.

Table 3.5.6-1: Design Values for 8-hour Ozone and Annual and 24-Hour $PM_{2.5}$ in Brazoria County

Site	Pollutant	2001–2003 Design Value	2002–2004 Design Value
Clute	8-hr O_3	87 ppb	N/A
Manvel	8-hr O_3	92 ppb	97 ppb
Clute	Annual $PM_{2.5}$	9.5 μg/m^3	N/A
Clute	24-hr $PM_{2.5}$	21 μg/m^3	N/A

Notes:

ppb = parts per billion; μg/m^3 = micrograms per cubic meter; hr = hour; N/A = not applicable; $PM_{2.5}$ = particulate matter 2.5 microns or smaller

Source: EPA 2004c

3.5.6.2 Construction Impacts

DOE has projected the construction activities for the Stratton Ridge storage facility based on the equipment and time schedule documented in the cost estimate for the Stratton Ridge site (DOE, 2004e) and Chapter 2 of the 1992 draft EIS for the expansion of the SPR (DOE 1992b, pages 2-17 through 2-19 and pages 2-23 through 2-26).

As a proposed new SPR site, DOE expects that about 270 acres (110 hectares) of the Stratton Ridge site would need to be cleared and prepared. This would require approximately 22 working days for clearing and grubbing, 7 working days for rough grading, 87 working days for soil stabilization with lime, and 40 working days for embankment compaction and stabilization.

Constructing the new buildings and roads would require approximately 60 days for foundation pouring, 60 days for building construction, 250 days for electrical installation, 60 days for local pipe installation, and 60 days for road building.

Cavern solution mining and filling would follow the plan for Bruinsburg, as described in section 3.5.2.2, that is, eight at a time. The maximum solution mining rate is 1.2 MMBD.

In addition to the above onsite emissions, offsite emissions would be associated with pipeline development. A 37-mile (60-kilometer) pipeline would be required for oil distribution to Texas City, TX, and additional 3 miles (4.8 kilometers) to connect the tank farm to the BP refinery. In addition, 6.2 miles (10 kilometers) of RWI pipeline and 10 miles (16 kilometers) of brine disposal pipeline would be needed. The RWI pipeline would be constructed in the same ROW as the land portion of the brine pipeline. Pipeline construction would begin at the start of site preparation and continue for about 18 months using one pipeline construction crew.

A summary of all estimated direct emissions and durations for different construction activities is given in table 3.5.6-2. The table provides total emissions for activities that last for less than one year. For activities lasting more than one year, such as pipeline construction and cavern development, emissions are given as maximum rates for those activities in any one year. The maximum annual emissions rate in the final row of the table includes all the emissions (both onsite and offsite) during the 12-month period of greatest emissions. This would be for the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

Table 3.5.6-2: Maximum Direct Emissions during Construction of Stratton Ridge Site (emissions are in total tons except those lasting > 1 year, which are in tons per year)

Activity	Days	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
Clearing and grubbing	47	15.84	0.33	30.73	3.48	2.84
Rough grading	7	0.05	0.18	1.86	0.20	0.01
Soil stabilization	87	3.24	1.84	6.74	0.88	0.58
Embankment compacting	40	3.93	0.44	10.66	1.19	0.68
Foundation pouring	60	0.75	1.56	0.14	0.14	0.10
Building construction	60	0.38	0.45	0.07	0.07	0.05
Electrical installation	250	0.39	0.83	0.09	0.09	0.09
Pipe installation	60	0.11	0.38	0.03	0.03	0.02
Road construction	60	0.30	0.57	3.63	0.42	0.05
Pipeline construction[a]	380	0.83	0.93	18.14	1.95	0.14
Cavern drilling	730	11.12	47.51	2.27	2.27	1.57
Cavern solution mining	425	0.00	0.00	0.00	0.00	23.9
Solution mining/fill	359	0.00	0.00	0.00	0.00	93.8
Final fill	160	0.00	0.00	0.00	0.00	21.0
Maximum annual emissions	—	35.18	51.60	70.42	10.00	93.94

Notes:

[a] The emissions associated with pipeline construction are distributed over some 56 miles (90 kilometers) of pipelines

CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.6-3 summarizes these emissions. These emissions would be small and distributed over miles of roadway.

If one of the Stratton Ridge alternatives is selected, DOE would also build four 0.4 MMB above-ground floating roof storage tanks at Texas City, TX. These tanks could potentially be operated during the solution mining activities to supply crude oil for cavern development. Application of EPA's TANKS 4.0 model finds that standing losses—those associated with a tank simply storing oil—from four

Table 3.5.6-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Construction Activities at Proposed Stratton Ridge Site

Year	Workers	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
One	186	53.34	3.32	0.13	0.13	4.03
Two	298	85.45	5.33	0.20	0.20	6.46
Three	363	104.09	6.49	0.25	0.25	7.87
Four	112	32.12	2.00	0.08	0.08	2.43

Notes:

CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

well-maintained floating roof tanks of this size (400 MB) are much less than 1.1 tons (1.0 metric ton) of NMHC per year. Working losses of NMHC—those associated with oil moving through a tank during active solution mining activities—are estimated at 11 tons (9.5 metric tons) per year across all four above-ground storage tanks. In any given year, there may be both standing and working losses, and to be conservative, the total emissions from the tanks can be estimated to be the sum of these two emissions, or less than 12.1 tons (11 metric tons).

Tables 3.5.6-2 and 3.5.6-3 and the above-described storage tank emissions conservatively estimate the total impact from the construction of the Stratton Ridge storage facility and associated infrastructure. The combined total annual emission rate includes all co-located sources of emissions that could occur in the same year and within the same airshed. In no case are emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for NSR. Thus, the potential impact from the construction of the new Stratton Ridge storage facility on air quality is unlikely to cause an exceedance of the NAAQS for ozone.

Section 176(c) of the Clean Air Act Amendments of 1990 (CAAA) requires that Federal actions conform to the State Implementation Plan for locations that lie within a nonattainment area. The conformity rule establishes the conformity criteria that a nonattainment area must comply with to demonstrate that the proposed action will conform to the State Implementation Plan for achieving attainment of the NAAQS. EPA has delegated implementation of the CAA to the State of Texas, which in turn relies on the Texas Commission on Environmental Quality to administer and enforce the CAA requirements. The state regulation for implementation of the General Conformity Rule is found in the Texas Administrative Code, Title 30, Part 1, Chapter 101, Subchapter A, Section 101.30. As described in section 3.5.6.1, Stratton Ridge is located in an area with a designation of moderate ozone nonattainment. Thus, this site must comply with the provisions of the conformity rule for ozone precursor emissions of NOx, and VOC. However, if the proposed action's total of direct and indirect emissions are below specified emission levels (40 CFR 93.153(b)), which for a moderate ozone nonattainment area are less than 100 tons (91 metric tons) per year for either NO_x or VOC, the provisions of the conformity rule no longer apply.

For NO_x, DOE estimates that Stratton Ridge construction activities would result in maximum direct emissions of 51.60 tons per year (see table 3.5.6-2) and maximum indirect emissions of 6.49 tons per year (see table 3.5.6-3). That sums to a maximum NOx emission of 58.09 tons per year, which is less than the 100-ton per year threshold for the conformity rule to continue to apply.

To compare VOC emissions to the conformity rule threshold, the above estimates of direct NMHC emissions need to be adjusted to account for the ethane component (this is not an issue for indirect emissions because ethane is not a significant component of gasoline or diesel combustion emissions). VOC emissions exclude both methane and ethane, since they have very little ozone forming potential. Direct NMHC emissions, however, include emissions of ethane. SPR solution mining measurements have shown that ethane ranges from 6 percent to 39 percent of the total NMHC emissions (DOE 1981). Applying the mean fraction of 20 percent to the direct NMHC emissions estimated above, the total maximum VOC emissions can be estimated as follows:

- A maximum of 93.94 tons per year of direct NMHC emissions from construction (see table 3.5.6-2) minus 20 percent equals 75.15 tons per year of VOC emissions; plus
- A maximum of 7.87 tons per year of indirect NMHC emissions from worker commutes (see table 3.5.6-3), which equates to 7.87 tons per year of VOC emissions; plus
- A maximum of 12.1 tons per year of direct NMHC emissions from tank losses (see above text) minus 20 percent equals 9.7 tons per year of VOC emissions; equals
- A total maximum of 92.72 tons per year of VOC emissions from all construction activities.

This estimated maximum VOC emissions put the proposed action below the conformity rule threshold of 100 tons per year. As a result, the provisions of the conformity rule would no longer apply.

The conformity rule also has a provision that requires a conformity analysis be performed if the emissions of concern are above 10 percent of the area's total emissions (40 CFR 93.153(i)). This type of action would be considered a "regionally significant action" subject to full conformity analysis if the emissions exceed the 10 percent threshold. The State Implementation Plan totals for Brazoria County are approximately 16,000 tons per year for VOC and 54,000 tons (49,000 metric tons) per year for NO_x (EPA 2004c). The estimated maximum VOC emissions of less than 100 tons (91 metric tons) per year is considerably less than 10 percent of the respective regional emissions. Therefore, the provisions of the conformity rule would no longer apply to the proposed action at Stratton Ridge, and the potential air quality impact from the SPR expansion at Stratton Ridge would be unlikely to cause an exceedance of the NAAQS for ozone.

DOE recognizes that the preliminary conformity review conducted for this EIS estimates maximum VOC emissions that, at 92.72 tons per year, are close to the 100 tons-per-year threshold that triggers a full conformity determination in the affected nonattainment area. In the event that one of the Stratton Ridge alternatives is selected, a comprehensive additional conformity review would be conducted taking into account any other sources, factors, or activities that may have not been considered in this EIS to determine if the current estimate is sufficiently conservative and could be exceeded. If necessary, a full conformity determination to demonstrate compliance with the State Implementation Plan would also be undertaken at that time. In the event that the result of this conformity determination is such that conformity could not be demonstrated, the proposed action at Stratton Ridge would be terminated and an alternative site selected.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA 1995) to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Stratton Ridge facility. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth-movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1-hour concentration using EPA screening factors (EPA 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors and the sums can be compared to the 24-hour and annual average NAAQS, which are 65 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.6-4 for the near fence-line concentration.

Table 3.5.6-4: Modeled SCREEN3 $PM_{2.5}$ Concentrations and Local Monitored Concentrations for Proposed Stratton Ridge Site

Averaging Period	Modeled Concentration (μg/m³)	Monitored Concentration (μg/m³)	Total Concentration (μg/m³)
24-hour	5.0	21	26.0
Annual	1.1	9.5	10.6

μg/m3 = micrograms per cubic meter

This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

3.5.7 Bayou Choctaw Expansion Site

3.5.7.1 Affected Environment

The Bayou Choctaw site is located in Iberville Parish in the Baton Rouge MSA. According to the U.S. EPA Green Book (EPA, 2005), the Baton Rouge MSA is currently a nonattainment area for 8-hour ozone. The Area is in attainment for all other NAAQS, including $PM_{2.5}$, PM_{10}, and CO.

There are no ozone monitors in Iberville Parish, but neighboring Ascension and West Baton Rouge Parishes have one monitor each. Eight-hour ozone design values for these two monitors were determined by averaging the fourth highest values for each 3-year period from the EPA AirData Web site and are shown in table 3.5.7-1. There are two $PM_{2.5}$ monitors in Iberville Parish and annual and 24-hour average $PM_{2.5}$ design values were calculated and appear in table 3.5.7-1.

Table 3.5.7-1: Design Values for 8-hour Ozone and Annual and 24-Hour $PM_{2.5}$ Near Bayou Choctaw

Site	Parish	Pollutant	2001–2003 Design Value	2002–2004 Design Value
King Road	Ascension	8-hr ozone	77 ppb	80 ppb
Port Allen	W. Baton Rouge	8-hr ozone	84 ppb	84 ppb
Iberville	Iberville	Annual $PM_{2.5}$	10.8 μg/m³	10.2 μg/m³
St. Gabriel	Iberville	Annual $PM_{2.5}$	12.4 μg/m³	12.3 μg/m³
Iberville	Iberville	24-hour $PM_{2.5}$	25 μg/m³	25 μg/m³
St. Gabriel	Iberville	24-hour $PM_{2.5}$	28 μg/m³	28 μg/m³

Notes:

ppb = parts per billion; μg/m³ = micrograms per cubic meter; $PM_{2.5}$ = particulate matter 2.5 microns or smaller.

Source: EPA 2004c

3.5.7.2 Construction Impacts

To expand the Bayou Choctaw site, DOE would develop up to two new 10-MMB caverns and purchase one 10-MMB cavern from Petrologistics Olefins. Because the facility is located in wetlands, clearing and grubbing activities would not be needed, except for a small effort to integrate the site into the existing facility and for security. No new buildings are planned, and only some new firewater pipelines are planned for the expansion. Thus, cavern drilling would be the primary onsite construction activity that would generate air emissions. Offsite, DOE would construct a new 3,000-foot (914-meter) brine disposal pipeline and six new brine injection wells.

Emissions associated with preparing the new caverns were conservatively estimated at 20 percent of the emissions for developing a new 160 MMB capacity site such as Richton. These emissions would be associated with constructing well pads, electrical systems, new accesses roads, and upgrades to existing access roads. Emissions estimates for developing the two new caverns are based on a maximum solution mining rate of 110 MMBD. This rate is much lower than the rate at the other SPR proposed new sites or expansions, resulting in longer time to develop the Bayou Choctaw caverns.

A summary of estimated direct emissions and durations for different construction activities is given in table 3.5.7-2. The table provides total emissions for activities that last for less than one year. For activities lasting more than one year, such as pipeline construction and cavern development, emissions are given as maximum rates for those activities in any one year. The maximum annual emissions rate in the final row of the table includes all the emissions during the 12-month period of greatest emissions. This would be for the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

Table 3.5.7-2: Maximum Direct Emissions from Expansion of Existing Bayou Choctaw Site (Emissions are in total tons except those lasting > 1 year, which are in tons per year)

Activity	Days	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
Electrical installation	50	0.08	0.17	0.02	0.02	0.02
Pipe installation	12	0.02	0.08	0.01	0.01	0.00
Road construction	12	0.06	0.11	1.02	0.01	0.01
Pipeline construction[a]	2.0	0.01	0.01	0.13	0.014	0.001
Brine disposal site preparation	4	0.69	0.03	2.18	0.47	0.11
Brine disposal well drilling	110	2.50	10.7	0.51	0.51	0.35
Cavern drilling	365	5.56	23.75	1.14	1.14	0.79
Cavern solution mining	1160	0.00	0.00	0.00	0.00	2.19
Solution mining/fill	980	0.00	0.00	0.00	0.00	8.60
Final fill	40	0.00	0.00	0.00	0.00	1.31
Maximum annual emissions	—	8.92	34.85	5.00	2.37	9.06

Notes:

[a] The emissions associated with pipeline construction are distributed over 3,000 feet (914 meters) of offsite brine disposal pipeline

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.7-3 summarizes these emissions. The emissions would be small and distributed over miles of roadway.

Tables 3.5.7-2 and 3.5.7-3 conservatively estimate the total impact from the construction of the Bayou Choctaw storage facility and associated infrastructure. The combined total annual emission rate includes all co-located sources of emissions that could occur in the same year and within the same airshed. In no case are the combined emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for NSR. Thus, the potential impact from the construction

Table 3.5.7-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Expansion of Bayou Choctaw Site

Year	Workers	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
One	198	13.81	0.86	0.03	0.03	1.04
Two	198	13.81	0.86	0.03	0.03	1.04
Three	198	13.81	0.86	0.03	0.03	1.04
Four	198	13.81	0.86	0.03	0.03	1.04

Notes:

CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

of the expanded Bayou Choctaw storage facility on air quality is unlikely to exceed the NAAQS for ozone.

Section 176(c) of the CAAA requires that Federal actions conform to the State Implementation Plan for locations that lie within a nonattainment area. The conformity rule establishes the conformity criteria that a nonattainment area must comply with in order to demonstrate that the proposed action will conform to the State Implementation Plan for achieving attainment of the NAAQS. EPA has delegated implementation of the CAA to the State of Louisiana, which in turn relies on the Louisiana Department of Environmental Quality (LDEQ) to administer and enforce the CAA requirements. The state regulation for implementation of the General Conformity Rule is found in the Louisiana Administrative Code (LAC), Part III, Chapter 14, Subchapter A, 1401-1415. As described in section 3.5.7.1, Bayou Choctaw is located in a marginal ozone nonattainment area. Thus, this site must comply with the provisions of the conformity rule for ozone precursor emissions, such as NOx and VOC. However, if the proposed action's total of direct and indirect emissions are below specified emission levels (40 CFR 93.153(b)), which for a marginal ozone nonattainment area are less than 100 tons (91 metric tons) per year for either NO_x or VOC, the provisions of the conformity rule no longer apply.

For NO_x, DOE estimates that Bayou Choctaw construction activities would result in maximum direct emissions of 34.85 tons per year (see table 3.5.7-2) and maximum indirect emissions of 0.86 tons per year (see table 3.5.7-3). That totals a maximum NOx emission of 35.71 tons per year, which is less than the 100-ton per year threshold for the conformity rule to continue to apply.

To compare VOC emissions to the conformity rule threshold, the above estimates of direct NMHC emissions need to be adjusted to account for the ethane component, as described above in section 3.5.6.2 for Stratton Ridge. Going through the same process outlined in that section, the total maximum VOC emissions from Bayou Choctaw construction can be estimated as follows:

- A maximum of 9.06 tons per year of direct NMHC emissions from construction (see table 3.5.7-2) minus 20 percent equals 7.25 tons per year of VOC emissions; plus

- A maximum of 1.04 tons per year of indirect NMHC emissions from worker commutes (see table 3.5.7-3), which equates to 1.04 tons per year of VOC emissions; equals

- A total maximum of 8.29 tons per year of VOC emissions from all construction activities.

This estimated maximum VOC emission puts the proposed action below the conformity rule threshold of 100 tons per year. As a result, the provisions of the conformity rule would no longer apply.

The conformity rule also has a provision that requires that a conformity analysis be performed if the emissions of concern are above 10 percent of the area's total emissions (40CFR 93.153(i)). This type of action would be considered a "regionally significant action" subject to full conformity analysis if the emissions exceed the 10 percent threshold. The State Implementation Plan totals for Iberville Parish are approximately 6,700 tons (6,100 metric tons) per year for VOC and 39,000 tons (35,000 metric tons) per year for NO_x (USEPA 2004c). The maximum of less than 8.29 tons (7.54 metric tons) per year for VOCs and 35.71 tons (32.51 metric tons) per year for NO_x is considerably less than 10 percent of the respective regional emissions. Thus the proposed action does not need to carry out a conformity determination and the potential impact from the expansion of the existing Bayou Choctaw storage facility on air quality is therefore unlikely to exceed the NAAQS.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA, 1995), to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Bayou Choctaw facility. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1 hour concentration using EPA screening factors (EPA, 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors and the sums can be compared to the 24-hour and annual average NAAQS, which are 35 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.7-4 for the near fence-line concentration. This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

Table 3.5.7-4: Modeled SCREEN3 $PM_{2.5}$ Concentrations and Local Monitored Concentrations for Proposed Bayou Choctaw Expansion

Averaging Period	Modeled Concentration ($\mu g/m^3$)	Monitored Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)
24-hour	0.8	28	28.8
Annual	0.19	12.4	12.6

μg/m3 = micrograms per cubic meter

3.5.8 Big Hill Expansion Site

3.5.8.1 Affected Environment

The Big Hill site is located in Jefferson County in the Beaumont-Port Arthur MSA. According to the U.S. EPA Green Book (EPA 2005), the Beaumont-Port Arthur MSA is currently a nonattainment area for 8-hour ozone. The area is in attainment for all other NAAQS, including $PM_{2.5}$, PM_{10}, and CO.

For the period of 2001-2004, five monitors in Jefferson County had complete ozone data. Eight-hour ozone design values for these monitors are determined by calculating the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone. These values are available on EPA's AirData Web site and are shown in table 3.5.8-1 along with annual and 24-hour average $PM_{2.5}$ design values for two $PM_{2.5}$ monitors.

Table 3.5.8-1: Design Values for 8-hour Ozone, Annual, and 24-Hour $PM_{2.5}$ in Jefferson County

Site	Pollutant	2001–2003 Design Value	2002–2004 Design Value
Beaumont	8-hr ozone	78 ppb	79 ppb
Port Arthur (53rd St)	8-hr ozone	79 ppb	78 ppb
Port Arthur (90th St)	8-hr ozone	86 ppb	84 ppb
Hamshire Street	8-hr ozone	76 ppb	77 ppb
Sabine Pass	8-hr ozone	91 ppb	93 ppb
Port Arthur	Annual $PM_{2.5}$	11.1 $\mu g/m^3$	11.1 $\mu g/m^3$
Hamshire Street	Annual $PM_{2.5}$	10.5 $\mu g/m^3$	10.6 $\mu g/m^3$
Port Arthur	24-hr $PM_{2.5}$	28 $\mu g/m^3$	27 $\mu g/m^3$
Hamshire Street	24-hr $PM_{2.5}$	29 $\mu g/m^3$	26 $\mu g/m^3$

Notes:

ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; hr = hour; $PM_{2.5}$ = particulate matter 2.5 microns or smaller

Source: EPA 2004c

3.5.8.2 Construction Impacts

DOE has used conservative assumptions to estimate the emissions related to expanding the existing Big Hill storage facility. The amount of new land needed at Big Hill would be 147 acres (60 hectares), which would have about 65 acres (26 hectares) of land clearing and grubbing. The facility capacity may be increased up to 96 MMB. In addition, 23 miles (37 kilometers) of oil distribution pipeline would have to be added to implement the increased drawdown rate. Approximately 1.3 miles (2.1 kilometers) of existing brine disposal pipeline would also need to be upgraded. DOE emissions are expected to be negligible from this pipeline upgrade activity. Cavern development and solution mining are assumed to occur in two equal phases of 48 MMB.

A summary of estimated direct emissions and durations for different construction activities at Big Hill is given in table 3.5.8-2. Total emissions are provided for activities that last for less than 1 year. For activities lasting more than 1 year, such as cavern development, emissions are given as maximum rates for those activities in any 1 year. The maximum annual emissions rate in the final row of the table includes all the emissions during the 12-month period of greatest emissions. This is the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

Table 3.5.8-2: Maximum Direct Emissions from Expansion of Big Hill Site (emissions are in total tons except those lasting > 1 year, which are in tons per year)

Activity	Days	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
Clearing and grubbing	54	17.73	0.38	38.60	4.32	3.25
Rough grading	5	0.03	0.13	1.29	0.14	0.01
Soil stabilization	65	2.42	1.38	5.05	0.66	0.43
Embankment compacting	30	2.95	0.33	7.77	0.87	0.51
Foundation pouring	30	0.38	0.78	0.07	0.07	0.05
Building construction	30	0.19	0.23	0.04	0.04	0.03
Electrical installation	125	0.20	0.42	0.04	0.04	0.05
Pipe installation	30	0.05	0.19	0.02	0.02	0.01

Table 3.5.8-2: Maximum Direct Emissions from Expansion of Big Hill Site (emissions are in total tons except those lasting > 1 year, which are in tons per year)

Activity	Days	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
Road construction	30	0.15	0.29	1.82	0.21	0.02
Pipeline construction[a]	210	0.70	0.78	9.98	1.07	0.12
Cavern drilling	365	11.12	47.51	2.27	2.27	1.57
Cavern solution mining	255	0.00	0.00	0.00	0.00	16.7
Solution mining/fill	216	0.00	0.00	0.00	0.00	55.4
Final fill	96	0.00	0.00	0.00	0.00	7.60
Maximum annual emissions	—	35.63	51.76	65.09	9.46	57.67

Notes:

[a] The emissions associated with building the pipeline are distributed over its 23-mile (37-kilometer) length

CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Source: EPA 2004c

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.8-3 summarizes these emissions. The emissions would be small and distributed over miles of roadway.

Tables 3.5.8-2 and 3.5.8-3 conservatively estimate the total impact from the construction of the Big Hill storage facility expansion and associated infrastructure. The combined total annual emission rate includes all co-located sources of emissions that could occur in the same year and within the same airshed. In no case are emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for NSR. Thus, the potential impact from the construction of the expanded Big Hill storage facility on air quality is unlikely to cause an exceedance of the NAAQS for ozone.

Section 176(c) of the CAAA requires that Federal actions conform to the State Implementation Plan for locations that lie within a nonattainment area. The conformity rule establishes the conformity criteria that a nonattainment area must comply with in order to demonstrate that the proposed action will conform to the State Implementation Plan for achieving attainment of the NAAQS. EPA has delegated implementation of the CAA to the State of Texas, which in turn relies on the Texas Commission on Environmental Quality to administer and enforce the CAA requirements. The state regulation for implementation of the General Conformity Rule is found in the Texas Administrative Code, Title 30, Part 1, Chapter 101, Subchapter A, Section 101.30. As described in section 3.5.7.1, Big Hill is located in a marginal ozone nonattainment area. Thus, this site must comply with the provisions of the conformity rule for ozone precursor emissions, such as NOx and VOC. However, if the proposed action’s total of direct and indirect emissions are below specified emission levels (40 CFR 93.153(b)), which for a marginal ozone nonattainment area are less than 100 tons (91 metric tons) per year for either NO_x or VOC, the provisions of the conformity rule no longer apply.

For NO_x, DOE estimates that Big Hill construction activities would result in maximum direct emissions of 51.76 tons per year (see table 3.5.8-2) and maximum indirect emissions of 1.44 tons per year (see table 3.5.8-3). That totals a maximum NOx emission of 53.2 tons per year, which is less than the 100-ton per year threshold for the conformity rule to continue to apply.

Table 3.5.8-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Expansion of Big Hill Site

Year	Workers	CO	NO_x	PM_{10}	$PM_{2.5}$	NMHC
One	198	23.14	1.44	0.05	0.05	1.75
Two	198	23.14	1.44	0.05	0.05	1.75
Three	198	23.14	1.44	0.05	0.05	1.75
Four	198	23.14	1.44	0.05	0.05	1.75

Notes:

CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Source: EPA 2004c

Table 3.5.8-4: Modeled SCREEN3 Concentrations and Locally Monitored Concentrations for Proposed Big Hill Expansion

Averaging Period	Modeled Concentration ($\mu g/m^3$)	Monitored Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)
24-hour	5	29	34
Annual	1.2	11.1	12.3

μg/m3 = micrograms per cubic meter

To compare VOC emissions to the conformity rule threshold, the above estimates of direct NMHC emissions need to be adjusted to account for the ethane component, as described above in section 3.5.6.2 for Stratton Ridge. Going through the same process outlined in that section, the total maximum VOC emissions from Big Hill construction can be estimated as follows:

- A maximum of 57.67 tons per year of direct NMHC emissions from construction (see table 3.5.8-2) minus 20 percent equals 46.14 tons per year of VOC emissions; plus
- A maximum of 1.75 tons per year of indirect NMHC emissions from worker commutes (see table 3.5.8-3), which equates to 1.75 tons per year of VOC emissions; equals
- A total maximum of 47.89 tons per year of VOC emissions from all construction activities.

This estimated maximum VOC emission puts the proposed action below the conformity rule threshold of 100 tons per year. As a result, the provisions of the conformity rule would no longer apply.

The conformity rule also has a provision that requires that a conformity analysis be performed if the emissions of concern are above 10 percent of the area's total emissions (40 CFR 93.153(i)). This type of action would be considered a "regionally significant action" subject to full conformity analysis if the emissions exceed the 10 percent threshold. The State Implementation Plan totals for Jefferson County are approximately 25,000 tons per year for VOC and 69,000 tons per year for NO_x (USEPA, 2004c). The maximum of 47.89 tons per year of VOC emissions and 53.2 tons per year of NO_x emissions are considerably less than 10 percent of the respective regional emissions. Thus, the provisions of the conformity rule would no longer apply to the proposed action, and the potential impact from the expansion of the existing Big Hill storage facility on air quality is unlikely to cause an exceedance of the ozone NAAQS.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA, 1995) to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Big Hill expansion. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1-hour concentration using EPA screening factors (EPA, 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors and the sums can be compared to the 24-hour and annual average NAAQS, which are 35 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.8-4 for the near fence-line concentration. This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

3.5.9 West Hackberry Expansion Storage Site and Associated Infrastructure

3.5.9.1 Affected Environment

The West Hackberry facility is located in Cameron Parish in the Lake Charles MSA. U.S. EPA's Green Book currently lists the Lake Charles MSA as being in attainment for all NAAQS, but the 8-hour ozone measurements are near the 80 ppb NAAQS. All other NAAQS, including $PM_{2.5}$, PM_{10}, and 1-hour and 8-hour CO standards are met.

For the period of 2001–2004, three nearest monitors are in Calcasieu Parish and have complete ozone data. Eight-hour ozone design values for these three monitors were obtained from EPA's AirData Web site (2006), which selects the fourth highest values for each 3-year period. Results are shown in table 3.5.9-1 along with annual and 24-hour average $PM_{2.5}$ design values for two $PM_{2.5}$ monitors.

Table 3.5.9-1: Design Values for 8-Hour Ozone, Annual, and 24-Hour $PM_{2.5}$ in Calcasieu Parish

Site	Pollutant	2001–2003 Design Value	2002–2004 Design Value
Carlyss	8-hr ozone	79 ppb	80 ppb
Westlake	8-hr ozone	73 ppb	70 ppb
Vinton	8-hr ozone	79 ppb	76 ppb
Vinton	Annual $PM_{2.5}$	10.0 $\mu g/m^3$	9.7 $\mu g/m^3$
Lake Charles	Annual $PM_{2.5}$	11.3 $\mu g/m^3$	10.8 $\mu g/m^3$
Vinton	24-hr $PM_{2.5}$	24 $\mu g/m^3$	22 $\mu g/m^3$
Lake Charles	24-hr $PM_{2.5}$	31 $\mu g/m^3$	29 $\mu g/m^3$

Notes:

ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; hr = hour; $PM_{2.5}$ = particulate matter 2.5 microns or smaller

Source: EPA 2004c

3.5.9.2 Construction Impacts

To expand the West Hackberry site, DOE would purchase three existing 5-MMB caverns adjacent to the existing SPR facility. No site preparation, building construction, solution mining, drilling, or offsite pipeline construction would be required for the expansion. At most, only minor onsite construction activities would occur. Because full construction (not including cavern development) at other sites is unlikely to cause air quality impacts, the impacts from construction at West Hackberry can be considered negligible.

3.5.10 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained, and hence any additional environmental impacts from air pollutant emissions would not occur. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the proposed Chacahoula storage site could be developed by a commercial entity for oil and gas purposes. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity.

No additional air pollutant emissions would occur in the study areas as a result of the selection of the No-Action alternative.

3.6 WATER RESOURCES

This section assesses potential impacts on water resources associated with the proposed new and expansion SPR sites and their associated infrastructure. These resources include both surface and groundwater. For this section, floodplains are considered surface water resources, but wetlands and aquatic organisms are not. Those are addressed in Section 3.7 Biological Resources.

Section 3.6.1 Methodology describes the approach used to evaluate existing conditions and potential impacts associated with the proposed new and expansion SPR sites. Section 3.6.2 discusses the general impacts associated with construction and operations and maintenance at many or all of the SPR storage sites and associated infrastructure. Potential impacts DOE has judged to be minor across all alternatives in this section are not evaluated further. Sites with unique features and the potential for unique impacts are discussed in site-specific sections. Section 3.6.2 references the best management practices presented in Chapter 2 and indicates how those practices would reduce potential impacts.

Sections 3.6.3 through 3.6.10 address each proposed new and expansion site and the no action alternative separately, describing existing water resources that could be affected by the proposed action and potential impacts that warrant site-specific discussion.

3.6.1 Methodology

3.6.1.1 Surface Water

DOE identified and characterized the existing conditions of surface water bodies in all potentially affected areas. Sources of information consulted by DOE include the following: 305(b) reports, 303(d) lists of impaired waters, Louisiana’s Title 33 Environmental Regulatory Code, various documents and information from the U.S. Geological Survey’s (USGS) Water Resources of the United States Web site (USGS 2006a), EPA’s Surf Your Watershed (EPA 2006i) and EnviroMapper (EPA 2006b) databases, and various state agency representatives. DOE identified surface water bodies that could be affected by a proposed SPR because they would:

- Serve as raw water source;
- Be crossed by pipelines, roads, and other utilities;
- Receive brine discharge; or
- Lay in or are directly downgradient of construction and storage sites.

These water bodies generally were characterized by size; relative flow rates; locations; salinity; known uses; and special designations such as scenic rivers, public water supplies, and impaired waters. DOE identified only the major surface water bodies associated with the proposed alternatives. After a preferred alternative is selected, DOE would conduct a delineation of waters of the United States and navigable waterways and secure a jurisdictional determination from USACE and U.S. Coast Guard.

After identifying potentially affected water resources, DOE assessed the proposed activities associated with the construction and operations and maintenance of each proposed site and the potential effect and degree of risk each activity might have on water resources. DOE considered the characteristics of the affected water resources, in particular the capacity of these water resources to assimilate impacts.

To assess the potential impacts resulting from brine disposal in the Gulf of Mexico, DOE conducted a detailed modeling analysis based on empirical (field) data collected from the brine diffuser at Big Hill, Bryan Mound, and the former brine diffuser at West Hackberry. The analysis was then applied to each proposed new and expansion site to evaluate potential impacts. This analysis was able to project the likely increase in salinity levels in the water column, vertical and horizontal extent of the brine plume, and salinity concentration contours as a function of distance from the brine disposal site. The predictions for potential impacts are for a reasonably conservative set of circumstances that are likely to overestimate the extent of the brine plume in most cases.

The report summarizing these modeling results is included in appendix C of this EIS.

DOE also evaluated the extent of proposed new construction in floodplains and whether the proposed alternatives would comply with Executive Order 11988, Floodplain Management. Sections 3.6.2 through 3.6.9 address this information for each site. DOE prepared a detailed Floodplain Assessment and Finding (appendix B) in accordance with Executive Order 11988.

The floodplain calculations summarized in this EIS and the floodplain assessment include all floodplain areas (100-year and 500-year) located within each expansion site, ancillary facilities (tank farms), and all associated ROWs (brine/water lines, oil lines, power lines, and access roads).

The Gulf Coast area of all the proposed sites—except Richton and Bruinsburg—is subject to the effects of hurricanes and associated tidal surges. Hurricanes Katrina and Rita (fall, 2005) demonstrated these effects. The evaluation of water resources in this EIS is based on surface water data gathered before Hurricanes Katrina and Rita struck and field visit observations made after the hurricanes' impacts were rendered. Although the sites (except Richton and Bruinsburg) likely were affected by the tidal surge and an influx of increased salinity, field observations indicate that surface water channel geometries from before the hurricanes remained intact and flood waters receded. The impacts of the hurricanes on salinity and other water quality parameters are not fully understood, and such an analysis is beyond the scope of this report.

Table 3.6.1-1 lists potential impacts evaluated for different components of the proposed actions that are discussed in this section.

Table 3.6.1-1: Types of Surface Water Impacts Analyzed

Source of Construction or Operations and Maintenance Impact	Potential Surface Water Impacts Analyzed
Construction of pipeline, road, utility, and RWI intake structure across and in surface water bodies	Increase in suspended sediments; Change of streambed morphology (causes **headcutting**); Change in flow and salinity regimes caused by berming and channeling
Raw water withdrawal from surface water bodies	Reduction of surface water flow rates, volume, and levels
Brine disposal in the Gulf of Mexico	Increased salinity
Introduction of potential for oil spills	Contamination of water with oil and oil-degradation products
Introduction of potential for brine spills	Increased salinity of receiving water
Introduction of potential spills and routine use of other materials such as fuels, maintenance fluids, and pesticides onsite, with possible runoff to surface waters or infiltration to groundwaters[a]	Contamination of receiving water[a]
Construction in floodplains	Loss of hydraulic flood storage and effect on base flood elevation
Location of RWI and brine diffuser structure	Impeded navigation
Construction in upland areas	Runoff resulting in siltation and sedimentation in surface water bodies

Table 3.6.1-1: Types of Surface Water Impacts Analyzed

Source of Construction or Operations and Maintenance Impact	Potential Surface Water Impacts Analyzed
Introduction of wastewater treatment plant discharges and spills	Contamination of receiving water
Non-point source surface water runoff	Contamination of receiving water
Provision of potable, sanitary, and cleaning water to site	Strain on source water resources

[a] Analysis presented in section 3.2

3.6.1.2 Groundwater

DOE characterized potentially affected groundwater resources by defining the depths, characteristics, uses, and designations of aquifers below and adjacent to the proposed sites. DOE specifically characterized groundwater use by identifying public and private wells listed in available public records, along with available information on delineated groundwater management districts and sole-source aquifers. Information sources consulted by DOE included the following: GIS layers obtained from the state environmental agencies showing SWPAs; USGS and EPA Web sites containing information on target aquifers; EPA's Sole Source Aquifer Database; and state agency representatives and Web sites. The information gathered is provided in sections 3.6.2 through 3.6.9 for each site.

DOE then evaluated potential sources and scenarios that could affect the identified groundwater resources. The probability of impacts was evaluated for the types of impact sources, the nature of potentially affected aquifers, and the uses of aquifers. From there, DOE evaluated the significance of the potential impact based on the regional and local context and intensity. Table 3.6.1-2 lists the different potential groundwater impacts evaluated, most of which are common to most or all of the sites, and most have the potential for only minor impacts on groundwater or they pose a low risk for groundwater impacts. These potential impacts are discussed in the following sections.

Table 3.6.1-2: Types of Groundwater Impacts Analyzed

Source of Construction or Operations and Maintenance Impact	Potential Groundwater Impacts Analyzed
Brine discharges from pipelines (surface) or leakage through the brine wells set in the cavern (subsurface)	Increased salinity of groundwater
Disposal of brine via injection into deep aquifers	Increased salinity of groundwater quality in injection zones and overlying aquifers
Leakage from oil storage caverns (subsurface)	Contamination of groundwater with oil
Leakage from oil pipelines (surface)	Contamination of groundwater with oil
Accidental discharge of fuel, maintenance fluids, pesticides, and herbicides (surface) [a]	Contamination of groundwater[a]

[a] Analysis presented in section 3.2

3.6.2 Impacts Common to Multiple Sites

The following sections describe and evaluate the types of potential impacts to water resources that are generally common to all of the proposed sites. In sections 3.6.2 through 3.6.9, DOE evaluates further the significance of potential impacts for particular sites. In addition, because underground injection of brine is proposed only at Bruinsburg, Bayou Choctaw, and West Hackberry, those potential impacts are not included in this general discussion, but rather are addressed in the site-specific sections.

3.6.2.1 Surface Water Common Impacts

3.6.2.1.1 Impacts of Raw Water Withdrawal from Surface Water

The proposed facilities would withdraw water from surface water bodies for use in cavern solution mining during the construction period. Cavern solution mining would continue for up to 5 years at each site where new caverns would be developed. As part of continuing operations, raw water would be withdrawn for displacement of oil in the caverns during oil drawdown. The potential impacts of raw water withdrawal on surface water bodies are specific to the characteristics of each water body, particularly the channel geometry, water levels, and flow rates at and near the RWI point.

Two of the proposed new sites and two expansion sites (Chacahoula, Stratton Ridge, Big Hill, and West Hackberry, respectively) would withdraw raw water from the ICW. The ICW channel geometry is similar for the proposed RWI points at the four sites. USACE maintains the ICW at 12-feet (3.7 meters) deep at mean low tide, and 130-feet (38-meters) wide at channel bottom (USACE 2005a). Previous modeling of the potential impacts of SPR RWI from the ICW (e.g., for the Big Hill site, DOE 1981, appendix B) indicates that changes to water depth caused by the RWI would be several hundredths of a foot (less than 1.5 centimeters). Water depth change would be greatest at the intake point, decreasing with distance from the intake point. This change in water depth is small compared to daily tidal depth fluctuations of 1.0 foot (30 centimeters) or more in many parts of the ICW. Changes to flow velocities associated with RWI would be several hundredths of a foot per second (several hundredths of a kilometer per hour)—again insignificant in comparison to baseline flow rates. Impacts on water salinity would be highly specific to the affected water body. In the case of the proposed Big Hill site, water salinities at all modeled locations would be expected to change by less than 1 part per thousand because of RWI, compared to natural salinity fluctuations of 1 to 10 parts per thousand (DOE 1981, appendix B). The cited Big Hill modeling effort assumed a water withdrawal rate of 1.4 MMBD, which is significantly higher than the rate proposed at any of the SPR expansion facilities other than Big Hill. Thus, impacts predicted for water withdrawal at Big Hill would be greater than could be expected at any of the proposed expansion sites that would withdraw water from the ICW.

DOE would secure from USACE the necessary permits for the RWI structures and withdrawal (Section 404 permit) and a water quality certificate or Section 401 permit from the state. DOE would comply with any withdrawal limitations or minimum in-stream flow conditions imposed by these agencies.

The three remaining proposed sites (Bruinsburg, Richton, and Bayou Choctaw) would withdraw raw water from surface water bodies other than the ICW. The potential impacts associated with raw water withdrawal at these sites are discussed in the site-specific sections to provide more details.

> Mitigation: No mitigation measures are identified for the sites that would withdraw water from the ICW. For those sites that would withdraw water from other surface water bodies, possible mitigation measures are identified in the Richton site-specific section only.

3.6.2.1.2 Impacts of Brine Disposal in the Gulf of Mexico

Brine from the leaching of the salt caverns or from filling caverns with oil would be discharged into the Gulf of Mexico from all sites except Bruinsburg, Bayou Choctaw, and West Hackberry, where brine would be injected into deep subsurface aquifers via injection wells. Brine would be generated during the cavern development process, which would be expected to last for 4 to 5 years. After that, brine would be generated during cavern filling events or drawdown. The primary surface water impact associated with brine disposal in the Gulf of Mexico would be elevated salinity levels in the water column near the diffuser site.

DOE estimated potential salinity impacts to water from the brine diffuser discharge using a model based on empirical data from operating and formerly operating SPR diffusers. Model results are included in appendix C and are discussed below and in the site-specific sections.

All the proposed brine diffuser locations would be in waters of similar depths (about 30 to 50 feet [9 to 15 meters]) along the coastline. The depth of the diffuser and its placement just above the bottom sediments would ensure that the diffuser does not affect navigation. The bottom of the Gulf of Mexico slopes gently seaward at all the proposed locations except for Chacahoula. The diffuser for Chacahoula is situated near the base of Ship Shoal, where the bottom rises steeply about 10 feet (3.1 meters) onto the shoal. This situation will be discussed in the Chacahoula site-specific section. Salinities in coastal Gulf of Mexico fluctuate, primarily because of varying inputs of fresh water from the Mississippi River. Salinity data relevant to the brine discharge sites are discussed below.

Brine is denser than seawater. After it is discharged through the diffusers, it would mix due to the high velocity of discharge, and the resultant diluted brine would sink to the bottom of the water column; therefore, the bottom current velocity is an important determinant of the dissemination and resultant extent of the brine plume. Based on a review of available oceanographic data, a bottom current velocity of 9 centimeters per second (212 inches per minute) was selected as representative of typical conditions (see appendix C). Table 3.6.2-1 summarizes brine diffusion modeling results for typical conditions. In general, modeling results indicate that the maximum increase in salinity under typical conditions would be 4.3 parts per thousand, which could extend a maximum of 0.8 nautical miles (0.92 mile [1.5 kilometers]) from the diffuser location. Salinity increases of up to 1 part per thousand could extend as far as 1.9 nautical miles (2.2 miles [3.5 kilometers]) from the diffuser under such conditions.

Table 3.6.2-1: Estimated Extent of Brine Plumes Caused by Brine Disposal in the Gulf of Mexico

Site[a]	Projected Distance of Salinity Increases in the Gulf of Mexico
New Sites	
Chacahoula, LA	See site-specific discussion, section 3.6.4
Richton, MS	Increase of 1 ppt salinity out to 1.7 nautical miles from the diffuser Increase of 4 ppt salinity out to 0.70 nautical miles from the diffuser
Stratton Ridge, TX	Increase of 1 ppt salinity out to 1.8 nautical miles from the diffuser Increase of 4 ppt salinity out to 0.80 nautical miles from the diffuser
Expansion Sites	
Big Hill, TX	Increase of 1 ppt salinity out to 1.9 nautical miles from the diffuser Increase of 4 ppt salinity out to 0.80 nautical miles from the diffuser

Notes:

[a] Bruinsburg, Bayou Choctaw, and West Hackberry would dispose of brine by underground injection, not Gulf discharge

[b] ppt = parts per thousand

Nautical mile = 1.15 miles and 1.85 kilometers

Because the brine diffusers for each of the SPR sites would be located at similar water depths along the Gulf of Mexico coastline, data collected from active and formerly active SPR brine discharge locations are considered to be representative of baseline conditions at the other proposed brine discharge sites. Based on seasonal bottom current data from the Big Hill diffuser site, the lowest current velocities (which result in higher salinity plumes) occur in late spring and summer (appendix C, tables C.3-1 and C.3-2). Salinities measured at the Clovelly LOOP brine diffuser stations did not indicate a seasonal trend in salinity concentrations of receiving waters (35 to 36 parts per thousand in June; 28 to 30 parts per thousand in August; and 31 to 32 parts per thousand in November) (Barry A. Vittor & Associates 2002, p. v). The maximum increase in salinity of 4.3 parts per thousand indicated by the model would typically be within normal seasonal variability. It is unclear if low current velocities and high ambient bottom salinities would occur at the same time of the year, which could result in 4.3 parts per thousand salinity above the normal maximum salinity. The potential impacts of increased salinity on biota are evaluated in section 3.7 where biological resources are discussed.

DOE evaluated uncertainties associated with the modeling results and determined that they are unlikely to substantially affect the model outcome or impact analysis. Bottom current velocity and the rate of brine discharge are important determinants on how much salinity concentrations would increase in surrounding water, and both of these factors are realistically accounted for in the model. DOE would not discharge below the rate used in the model (30 feet [9.2 meters] per second). Thus, model results reflect the minimum allowable discharge rate. Discharge rates exceeding 30 feet per second would more readily disperse the brine into the water column and reduce the size of the brine plume. The model was run for the two most prevalent bottom current directions, which are primarily parallel to the shoreline (long-shore currents). Although field data indicate that currents in all directions do occur in this area, net transport would be roughly longshore. The modeling results shown in appendix C present the results when the currents remain constant. This presentation does not show the impacts during transient conditions, such as reversing currents that could increase salinities but would reduce the extent of the plume estimated by the model. The effect of a hurricane, which brings large volumes of water to the shoreline, would be to further dilute the brine plume, and would not result in higher salinities than those forecasted by the model.

NPDES permits would be required for any discharges to surface waters, including the Gulf of Mexico. The permitting process would require that the CORMIX model be used to analyze the potential impacts of the discharge on surrounding waters before a permit is issued. Since this would be done before operation of the brine diffuser, the potential impacts to Gulf of Mexico waters would be analyzed further than that presented in this EIS as a further precaution against adverse impacts to surface waters and biota. In addition, a Section 404/401 permit and possibly a Section 10 permit would be obtained from USACE and the state for the construction of the diffuser and brine diffuser pipeline. As with permits for existing SPR sites, the permits for the new and expansion sites would require that effluent meet certain requirements protective of water quality and biota, and they would also mandate an ongoing monitoring and reporting program to document that the discharge would meet those requirements. Monitoring program results from the Bryan Mound and Big Hill operating SPR brine discharge locations in the Gulf of Mexico are reported in Annual Environmental Reports issued by DOE and in the Discharge Monitoring Reports provided to the state under the NPDES permit. Review of the most current report available (2003) indicates that discharge water quality is consistently within permit requirements (DOE 2004f).

> Mitigation: Because of its unique location in proximity to a shoal area (Ship Shoal), the Chacahoula brine diffuser site and associated brine discharge are discussed in the site-specific section. Mitigation measures specific to that site are identified in that section.

3.6.2.1.3 Impacts Associated with Constructing Pipelines Across Surface Water Bodies

Development of the SPR expansion sites would entail construction of new offsite pipelines associated with all sites except the West Hackberry site, which would use existing pipelines. The new pipelines would cross a variety of water bodies, including intermittent, small, moderate-sized, and larger streams and rivers, and manmade canals including the ICW. These water bodies range from fresh to brackish to saline, with increasing salinity and tidal influence closer to the coastline.

The potential impacts to surface water bodies associated with the construction of pipeline crossings would depend on the construction methods used. Two methods are proposed for crossing streams and rivers: open cut and directional drilling. These methods are described in section 2.3.9; the potential impacts associated with these methods are summarized below.

Directional Drilling: This method would have the least impact on surface water bodies because it involves boring and placing the pipeline underneath the channel. This approach would not entail significant disturbance of water body banks, the water column, or streambeds or bottoms of water bodies. There would be a potential for some bank erosion and delivery of sediment to water bodies in cases where drilling equipment is setup close to water bodies. This would be controlled and effectively reduced through best management practices required by the Erosion and Sediment Control Plan, the Section 404/401 permit, the Section 10 permit, and the NPDES stormwater permit for construction activities. The best management practices would include erosion and runoff control measures, and construction of barriers to sediment movement. Any impacts to surface waters would be small in scale, of short duration, and localized near the drill equipment location.

Open Cut: This method could potentially result in the following conditions:

- A temporary increase in turbidity in the water column resulting from disturbance of bottom sediments and the introduction of sediment in runoff;

- A temporary increase in suspended nutrients and organic matter resulting from disturbance of bottom sediments and the introduction of sediment in runoff; also could lead indirectly to reduced dissolved oxygen levels in the water column;

- Deposition of sediment in water bodies, which could disrupt habitat, lead to reduced channel depth, and cause other changes in stream processes;

- Headcutting, a process of streambed degradation triggered by a disturbance of loose streambed substrate; could lead to the collapse of stream banks, loss of streamside vegetation, and widening of streams; and

- Saltwater intrusion or disruption of salinity regimes where pipeline installation between surface water bodies could open new channels for flow.

Open cut installation of pipelines across surface water bodies could lead to impacts related to resuspension of bottom sediments and organic matter in the water column, which would be of short duration and occur during actual construction activity and extending for a short time after construction activity ended. In water bodies that have no or low current, these impacts would be localized near the construction sites, and would be relatively intense for brief periods. In water bodies with stronger currents, impacts would extend for some distance down current. In such systems, impacts in the water column would be less intense because of flushing and dilution action. DOE would implement construction best management practices to minimize the impacts of open cut pipeline construction through surface water bodies. Some of these best management practices would be required by several regulatory and permit requirements. Specifically, all work would be done in accordance with DOE-prepared Soil Erosion and Sediment Control Plans; Erosion Control, Revegetation and Maintenance Plan; Erosion and Sediment Control permits; NPDES stormwater permit for construction activities; Section 10 permit; and USACE Section 404 permit and 40l Water Quality Certification from the state.

Best management practices could include site-specific runoff controls, installation of geotextiles, use of silt curtains and temporary coffer dams and other methods that minimize suspension of bottom sediments, all of which would be required as part of the state and Federal permits. Such plans would minimize sediment suspension and siltation and channel-filling impacts. As a result of these measures, little or no sediment would be introduced to water bodies from adjacent land areas. In addition, associated secondary impacts such as reduction in stream depth and changes in other stream processes would not be expected to occur.

Headcutting would be a potential impact following pipeline installation in streams with significant current that have streambeds composed of sandy or unconsolidated substrate. Streams in the coastal regions of Mississippi and Louisiana are particularly vulnerable to headcutting following disturbance of streambeds. As headcuts move progressively upstream, they can result in alteration of streambed grade, collapse of stream banks, loss of streamside vegetation, and widening and lateral movement of stream beds. Progressing headcuts cause re-entrainment of sediment and turbidity in the downstream water column. DOE would minimize the potential for headcutting by restoring streambeds to natural contours, stabilizing and revegetating the slope after installation of pipeline crossings, and minimizing or avoiding to the extent possible any permanent alteration in streambed grade at pipeline crossings. Strict compliance with the Erosion and Sediment Control Plan, NPDES stormwater permit for construction activity, and the Section 404/401 permit would reduce the potential for headcutting.

Transport of water from higher salinity to lower salinity regimes could occur where trenches are excavated to install pipelines between surface water bodies. To minimize saltwater intrusion along a pipeline, DOE would install clay plugs at periodic intervals in pipeline trenches during construction. After pipeline installation, DOE would backfill pipeline trenches with sufficient native topsoil to restore surface topography and vegetation and prevent water channeling.

> <u>Mitigation</u>: In addition to the above best management practices, DOE would consider several site-specific mitigation measures to prevent or minimize headcutting and the associated impacts to stream morphology and water quality. Although current plans call for the application of directional drilling only for larger streams (i.e., those wider than 100 feet [31 meters]) and for streams parallel and adjacent to other structures requiring directional drilling—such as highways, railroads, and other pipelines, DOE also would consider the use of directional drilling for installation of pipeline under other streams that are particularly vulnerable to headcutting. This would include unstable streams in the Mississippi and Louisiana coastal zones that have experienced headcutting, streams with moderate to strong currents, and streambeds composed of sand or unconsolidated substrate. DOE would also consider instituting a monitoring program for streams where the open cut method would be used to ascertain if headcutting has started. If headcutting were to occur in these streams, DOE would consider application of remedial measures such as streambed grade stabilization structures.

3.6.2.1.4 Impacts from Erosion and Runoff from Construction Activities

Some construction would take place in upland areas at the storage sites (e.g., Richton and Bruinsburg), at the crude oil storage tank facilities and crude oil terminals, and for some segments of the pipelines, access roads and transmission line ROWs. If there is a downslope water body, construction activities could produce runoff to the surface water that could degrade water quality. As described in Chapter 2, best management practices, such as the use of geotextiles, hay bales, and riprap to impede runoff, would help minimize erosion and prevent sediment runoff in these areas. These measures would effectively control sediment transport offsite, largely preventing sedimentation in any adjoining water bodies. Particular attention would be given to spoils storage areas, where sediment could run off and affect nearby surface waters. Because of the best management practices and sediment and erosion controls that would be implemented, sediment releases to surface waters would be expected to be minimal to none.

Any release of sediment to local water bodies would be expected to occur during heavy precipitation when flushing and assimilative capacity in these water bodies would be at a maximum. The potential impacts of sedimentation to surface water bodies include increased turbidity in the water column; increased suspended nutrients and organic matter in the water column leading indirectly to a reduction in dissolved oxygen levels; and deposition of sediment on water body beds, which could disrupt habitat, cause reduced channel depth, and cause other changes in stream processes. As described above, because the amount of sediment reaching water bodies is projected to be very low or none, any appreciable impacts within surface water bodies would be minor, localized and short-term.

3.6.2.1.5 Impacts of Oil Spills to Surface Water

Oil spills associated with the proposed SPR facilities could occur at storage facilities, along oil pipeline routes, and at oil transfer terminals. Oil released through oil spills could enter any of the water bodies identified in the site-specific sections, which would be near SPR expansion sites or oil transfer terminals, or crossed by oil pipelines. These water bodies include intermittent, small, moderate-sized, and larger streams and rivers, manmade canals (including the ICW), tidal rivers, estuaries, and the Gulf of Mexico.

If oil spills were to occur, measures outlined in facility Emergency Response Procedures would help minimize the impacts to surface waters. Each existing SPR site complies with Federal Spill, Prevention, Control, and Countermeasures (SPCC) regulations, and with applicable Louisiana, Mississippi and Texas SPCC regulations. This includes development of and compliance with plans to prevent and contain petroleum and hazardous substance spills. SPR sites maintain spill plans in accordance with Title 40 CFR 112 and corresponding state regulations (DOE 2004f). The proposed new and expansion sites would comply with these same regulations, and would maintain appropriate spill prevention and response plans.

Section 2.3 identifies the control measures that would be used to minimize the likelihood of oil spills, and the likelihood that these spills would reach surface waters. These measures include the construction of containment systems to prevent release of oil to surface waters. For example, a dike would be built surrounding the wellhead area at each cavern to contain and control spills that might result from a manifold failure or blowout, and surrounding crude oil storage tanks as well to contain any oil leaked from these tanks. Pipelines would be protected by corrosion-control coating and monitored with pressure gauges and volume meters to rapidly detect any leaks, and systems would be in place to rapidly stop the flow of oil to any leak points.

Spill prevention and response measures that would be implemented include quickly-deployed spill control systems such as booms and absorbent materials. DOE also would contract with an emergency response company that could respond to a spill with additional equipment and response personnel beyond those available to DOE.

These various measures described above would greatly reduce the probability of oil spills, as well as the magnitude of potential consequences.

Section 3.2.1.1 presents the historical rate of oil spills from all components of oil handling facilities associated with SPR sites (the storage sites themselves, oil transport vessels, pipelines, and terminal facilities). Section 3.2.2.1 also quantifies the risk associated with oil spills at each proposed SPR site and associated infrastructure. Based on the historic performance of SPR facilities, DOE projects that a small number of oil spills would occur at each of the proposed new and expansion sites. Section 3.2.2.1 (table 3.2.1.1-1) provides a projection of the likely number of reportable oil spills that could occur at each site during initial fill operations. During any drawdown and refill operations in later years, the overall potential for spills would be proportional to the amount of oil drawn down and replaced. A total drawdown and total refilling of the site would be an extreme case for a single year's activity, and therefore, the values in table 3.2.1.1-1 represent a reasonable upper bound of the number of oil spills anticipated during any year of SPR storage-site operation.

Most of these spills would be expected at the storage sites, with a smaller number of spills at the associated terminals. Because of the spill prevention and response measures described earlier, and based on historic performance statistics, most of the oil spills would be of low volume. The probability of higher-volume spills is very low.

If spilled oil were to reach surface water bodies, impacts on surface water resources would vary, depending on the amount of oil introduced to the water body and the characteristics of the water body. These potential impacts are described in section 3.2.2.1 and include the coating of vegetation and existing features that contact the water surface in the area of the oil slick; the release of volatile and sometimes toxic oil components to the atmosphere; the breakdown and dissolution of oil components, some of which may be toxic, into the water column (particularly in the case where oil dispersant chemicals are used); and the deposition of oil emulsions, partially oxidized oil tar globules, and other dense oil constituents on the water body bottom. Oil components deposited on the water body bottom and left adhering to vegetation could remain in the environment for extended periods (months or years), and continue to break down gradually and release low levels of oil constituents to the water column and sediments.

Elevated concentrations of oil constituents occurring in the water column and on the water surface immediately after a spill would decrease over time because of dispersion, dilution, and degradation. The rate of concentration decline would depend on the size and flushing rate of the water body affected, as discussed below.

Low-Energy Water Bodies

Impacts of oil spills would be pronounced in smaller, low-energy water bodies, such as ponds or slow-moving creeks through marshlands, where little dispersion or dilution could take place, and the effects of any uncontained oil would be concentrated in a small area. In a marshy area with high levels of turbidity and organics in the water column, the oil would adhere to some of these particulates, which would increase the residence time of the contamination. However, these types of water bodies also have high levels of microbes that may aid in degradation of the spilled petroleum compounds.

Higher Energy Water Bodies

Oil released to streams and rivers with strong flow or tidal flushing, or into larger open bodies of water such as the Gulf of Mexico, would disperse more rapidly, resulting in milder impacts over a wider area. River currents would spread contamination downstream, resulting in decreasing concentrations. Over open water, wind would also facilitate mixing and dispersion.

Although the consequences of a very high-volume spill could be substantial, the probability of such a spill is very low, as demonstrated by the quantitative analysis discussed above and in section 3.2. The consequences to water resources of the more likely low-volume spills would be expected to be minimal. The overall risk to water resources associated with oil spills from the proposed SPR sites and infrastructure would be low.

> Mitigation: In addition to control measures, best management practices, and emergency response preparations described earlier, DOE would give preference to oil-spill response measures that remove oil from the environment, and would avoid the use of chemical dispersants. Dispersants would be considered only in cases where their use would clearly result in reduced environmental impacts.

3.6.2.1.6 Impacts of Brine Spills to Surface Water

Accidental brine discharge could potentially occur along the brine pipelines, at the brine ponds located at the salt cavern sites, and at brine pumping facilities at SPR sites. Analysis of the causes of brine spills during the 22-year history of SPR operation (see section 3.2.2.1) indicates that spills typically were caused by corrosion or erosion of piping, equipment failure, operator error, and overtopping of brine ponds during periods of heavy precipitation. Brine released through brine spills could enter any of the surface water bodies identified in the following site-specific sections, which would be near brine-pumping facilities or brine ponds onsite, or would be crossed by brine pipelines. These water bodies include intermittent, small, moderate-sized, and larger streams and rivers, manmade canals (including the ICW), tidal rivers, estuaries, and the Gulf of Mexico.

Section 2.3.3 presents the control measures that would be used to minimize the likelihood of brine spills and the likelihood that these spills would reach surface waters. Measures to prevent leaks from brine ponds would include high-density polyethylene liners or concrete, underdrain systems to detect leakage, regular inspection and maintenance programs, and sufficient freeboard in ponds to prevent overflow. Brine pipelines would be concrete-lined to limit erosion and corrosion and would be pressure-tested to check integrity. Brine would be treated with ammonium bisulfite, which scavenges dissolved oxygen and reduces pipeline corrosion. Engineering controls and monitoring would allow rapid detection of leaks, and systems would be installed to quickly stop the pumping of brine if a leak occurred. These measures would reduce the likelihood of occurrence and limit the volume of brine spills.

Section 3.2.1.2 presents data for historical brine spills from the existing SPR sites, including the number of reportable spills per year and the total volume of brine spills per year. Section 3.2.1.2 also analyzes the risk of brine spills associated with each proposed SPR site.

As discussed in section 3.2.2.1, the immediate effect a brine spill would have on surface water would be an increase in chloride concentration in the receiving water body. Because the chloride concentration in brine is 10 to 100 times higher than in natural waters, brine spills would result in significantly elevated chloride concentrations in the receiving water body. This, in turn, could possibly exceed acute toxicity limits for some aquatic wildlife species.

Impacts to Low-Energy Water Bodies

In low-energy water bodies, such as ponds and creeks that wind through marshlands, dilution of the brine spill would occur mainly through diffusion into surrounding waters and mixing by any tidal influx into the area. In marshland with poor water circulation, chloride concentrations returned to normal within 4 months at one spill site (Boeing Petroleum Services, Inc. 1990b)

Impacts to Higher Energy Water Bodies

In higher energy water bodies, such as rivers and areas subject to strong tidal influence near the coast, the brine would be diluted by incoming tides and spread out by outgoing tides. It would also be spread downstream and diluted by river currents. Elevated chloride concentrations would likely be localized in a surface water body near the point of brine entry. Chloride concentrations would decrease with distance from the point of brine entry to the water body, and over time, because of natural flushing and dispersion. Monitoring at the sites of past brine spills has demonstrated that even relatively high volumes of spilled brine have had little or no impact on large and well-flushed water bodies (e.g., the ICW). In moderately flushed marshland and ponds, chloride concentrations in surface waters and sediments return to normal (before the spill) levels within 2 months (Boeing Petroleum Services, Inc. 1990b).

Although a high-volume brine spill could result in moderate consequences to surface water resources, the probability of such a spill is very low. The consequences to water resources of the more likely low-volume spills would be expected to be minimal. The overall risk to water resources associated with brine spills from the proposed SPR sites and infrastructure would be low.

3.6.2.1.7 Impacts on Floodplains

A substantial portion of the proposed storage sites and associated infrastructure would be located in floodplains. The Bruinsburg, Chacahoula, Stratton Ridge, Bayou Choctaw, and Big Hill sites would be entirely or partially within floodplains, therefore their selection as preferred site(s) would entail new construction in a floodplain. The affected floodplain areas include both 100-year and 500-year floodplains, and in the case of the Chacahoula site, include wetland areas that are normally inundated. Appendix B Floodplains and Wetlands Assessment provides the total area of floodplains that would be affected by the candidate alternatives, which includes the SPR site, pipelines, and power lines. This appendix also provides maps of the proposed SPR developments in relation to floodplains.

The amount of onsite construction in floodplain areas would vary from site to site, and would include developing 1 to 16 wellheads and pads; installing pumps and onsite pipelines; and constructing buildings, access roads, and related infrastructure. At the proposed Bruinsburg, Chacahoula, Stratton Ridge, Bayou Choctaw, and Big Hill sites, some filling as well may be required around cavern well pads, onsite facilities and buildings, and access roads.

The Bruinsburg, Chacahoula, Richton, Stratton Ridge, and Big Hill sites would all entail construction of offsite RWI structures, brine disposal facilities, crude oil and water distribution pipelines, or a combination. Access roads would also need to be located entirely or partially in floodplains.

A comprehensive description of how each candidate site would affect floodplains, and maps indicating the location of the proposed new and expansion sites and associated infrastructure with respect to floodplains, are provided in appendix B. The following sections address individual SPR expansion sites and summarize key information regarding the potentially affected floodplains at each of the proposed new and expansion sites. The site-specific sections also include an estimate of the area of floodplains that would be affected at each site.

DOE regulations (10 CFR Part 1022) require assessment of the potential impacts of the proposed action on natural and beneficial floodplain values in accordance with Executive Order 11988 on Floodplain Management. These include potential impacts on the capacity of the floodplain to provide flood attenuation; preservation of diversity and stability of wildlife species and habitats; cultural resource values (e.g., archeological and historic sites); cultivated resource values (e.g., agriculture, aquaculture, forestry); aesthetic values (e.g., natural beauty); and other values related to the public interest. The potential impacts of the proposed SPR expansion on each of these aspects of floodplain value are assessed in this EIS. Section 3.7 assesses in detail the potential impacts of the proposed actions on wildlife and habitats, including within the floodplain areas that would be affected by the proposed developments. The potential impacts of SPR expansion on floodplains are also described in detail in appendix B.

Federal regulations also require assessment of the potential impacts of the proposed floodplain action on lives and property (10 CFR Part 1022). The key issue for lives and property is whether the proposed action would impact the ability of the affected floodplain area to assimilate or store flood waters, or if the proposed action would exacerbate risks to lives and property during flooding.

The impacts on the affected floodplains associated with the proposed SPR sites would be lessened because most of the proposed infrastructure would be built below ground level. The main impacts on flood storage and flooding attenuation would result from construction of some above-ground structures and placement of fill at new cavern facilities at Bruinsburg, Chacahoula, Stratton Ridge, Bayou Choctaw, and Big Hill. The development of onsite facilities and wellheads and the development of RWI facilities would involve fill of small areas of floodplain. However, these fill areas would be insignificant in comparison to the total areas of the floodplains where they would be located. The Big Hill and proposed Bruinsburg, Chacahoula, and Stratton Ridge sites are all located in floodplains that each extend over hundreds of acres (hectares), parts of the Neches-Trinity Coastal Basin, Louisiana Western Gulf Coastal Plain Province, and the San Jacinto-Brazos Coastal Basin, respectively. The Bayou Choctaw site is also located in a very extensive floodplain area. However, fill areas developed as part of the proposed action at these sites would have an insignificant impact on the flood storage capacity or hydraulic function of the related floodplains.

Construction of pipelines through floodplains would have only short-term, localized effect. Pipelines would be buried below grade, and the land would be returned to its original grade. Thus, pipeline construction is expected to have little or no impact on hydraulic function in the affected floodplains. Pump stations and the pump house for the RWI would be flood-proofed and built at an elevation above the base flood elevation (where practicable).

Although some impacts to floodplains cannot be avoided (e.g., removal of vegetation during site or pipeline construction), such impacts would be mitigated through the use of appropriate engineering designs and good operating procedures. DOE would lessen impacts to floodplains to the extent possible throughout construction of the new or expansion SPR sites. Control measures that DOE would use can be divided into three categories: (1) impact avoidance; (2) impact minimization, meaning the use of low-impact methods or containment measures; and (3) restoration, which includes replanting, rehabilitation, and other post-construction mitigation. These control measures and DOE's Floodplain Finding as required by Executive Order 11988 are described in appendix B.

DOE would comply fully with applicable local and state guidelines and regulations regarding floodplain construction, and would be further regulated by permits that must be obtained for any construction in a floodplain. In general, DOE would be required to evaluate the potential impact of placing fill or structures in a 100-year floodplain and demonstrate that the proposed fill/structures would not increase the base flood elevation. For any floodplains that are also wetlands, DOE would obtain permits from USACE and the state as required under Section 10 of the Rivers and Harbor Act and Section 404 of the CWA for any regulated action involving excavation or filling in wetland, inland waters, or navigable waters. USACE would take protection of floodplains into consideration in issuing these permits. For floodplain areas that are not also wetlands, local permits would be required. Both USACE and local permits would also require best management practices and facility designs that would protect the long-term floodplains function for hydraulic control in the drainage area.

Based on these constraints, DOE expects that overall impacts to floodplain hydraulic function, and therefore to lives and property, would not be significant.

Appendix B addresses whether a practicable alternative to SPR development in a floodplain exists. From the standpoint of individual storage sites, practicable alternatives do not exist because SPR facility locations are dictated by the location and configuration of the salt domes where storage capacity would be developed.

On a programmatic basis, alternatives to development of storage sites in a floodplain exist to the extent that SPR storage capacity could be developed practically in salt domes located outside of floodplains; however, the proposed project depends extensively on water for cavern leaching. It also must be near the Gulf of Mexico or satisfactory deep subterranean formations that can accept brine discharge from the cavern leaching process. The linear nature of the proposed pipelines and the dispersed locations of salt domes, brine discharge capacity, and raw water sources means that some floodplain would be crossed by pipelines, access roads, and other infrastructure regardless of where the storage sites were located; therefore, floodplain impacts could not be avoided altogether. DOE is further constrained in site selection for the storage sites because of statutory requirements that DOE limits its consideration to sites that already have been studied, or to sites proposed by the Gulf Coast states.

In view of these practical and statutory constraints, DOE considers that a practicable alternative to development in floodplain areas does not exist. Further, the minimal impact that SPR development is expected to have on floodplain values would not justify moving SPR development to nonfloodplain sites that have other significant practical and cost disadvantages. Even with the development of SPR sites in floodplain areas, the overall project would still meet the requirement to avoid "adverse effects and incompatible development within floodplain," as required under 10 CFR Part 1022 and Executive Order 11988.

3.6.2.1.8 Impacts to Navigation

Virtually all of the pipelines and power lines at all proposed sites would traverse surface waters. The affected areas would include many surface water bodies that are primarily low-energy, small, channels through the marshes. These smaller waterways are used mainly for hunting and fishing with canoes, kayaks, and airboats being the primary form of vessel used on these surface water bodies. A few moderate-sized water bodies, listed in the site-specific sections, also would be crossed by SPR infrastructure. In addition, the ICW, which is maintained by USACE and used for commercial transportation, would be crossed by pipelines. At all such pipeline crossings, impacts to navigation would be limited to the construction phase because all pipelines would be buried and would not impair navigation during operations and maintenance. Where directional drilling is used, impacts to navigation even during construction would be negligible. A Section 10 permit (under the Rivers and Harbors Act) and Section 404/401 permits (under the CWA) would be required for pipeline construction through navigable waterways. The permit conditions would include best management practices to minimize impacts to navigation during construction. For these reasons, the proposed pipeline crossings and permanent structures in the navigable waterways would be expected to have negligible impacts on navigation.

At the three proposed expansion sites (Big Hill, West Hackberry, and Bayou Choctaw), the proposed action would make use of existing raw water systems with no incremental effect on navigation. Pumps in the Big Hill RWI would be upgraded with no incremental effect on navigation.

New RWI structures would be placed in the ICW for the proposed Chacahoula and Stratton Ridge sites, in the Leaf River and Gulf of Mexico at Pascagoula for the Richton site, and in the Mississippi River for the Bruinsburg site. These new intakes would include a structure to house the pumps and submerged screened intake pipes. The structures would be designed to minimize impacts to navigation and, except for the Pascagoula RWI, would be built into the waterway bank to avoid impacts to navigation. A typical RWI would be placed along the shoreline with an area dredged from the shoreline that would contain the pumps and the submerged screen intake pipes. This would not impede boat traffic. The Pascagoula RWI would be built on an existing deck, which would be refurbished. As with pipelines, Section 10 and Section 404/401 permits would be required for any construction in navigable waterways, and would include best management practices to avoid impacts to navigation.

The proposed Big Hill site would use existing brine discharge structures, while the Chacahoula, Richton, and Stratton Ridge sites would require new brine discharge structures. All of these discharge structures are or would be located in the Gulf of Mexico, which is heavily used for commercial and recreational boating. The pipelines would be buried and the brine-diffuser structures would be located in water at least 30-feet (9-meters) deep, which would not interfere with marine traffic. The diffuser structures would be constructed so as to protect shrimp nets from being entangled. Again, DOE would secure Section 404/401 and Section 10 permits, which require avoidance of impacts to navigation. The permit conditions for both the intake and brine discharge structure would require placement of all permanent structures at a depth below the draw of normal boat traffic and might require markers to warn boaters of the submerged structure.

The following is a list of some specific measures that DOE would undertake to prevent impacts to navigation:

- Design and build new RWI structures not to intrude into navigation channels;
- Install navigational hazard markers at the intake and discharge sites; and
- Install the pump house for the RWI outside the channel where the RWI structures would be located on navigable waters.

3.6.2.1.9 Impacts From On-Site Wastewater Treatment Plant Discharge

DOE would install and operate an onsite wastewater treatment facility to treat sanitary waste at each of the proposed sites. NPDES permits, as well as applicable state and local permits, would be in place for each of these facilities. The permits would require that treated effluent water meet water quality criteria protective of the surface-water receiving bodies. Monitoring results indicate that the wastewater treatment facilities at existing SPR sites consistently meet their specific discharge requirements (DOE 2004f).

Although DOE would comply fully with discharge requirements, the potential would remain for treated sanitary waste discharge to have some impact on receiving water bodies during normal operation and in spills or upset conditions. Typical impacts associated with routine sanitary wastewater treatment plant discharge include a small elevation of nutrient levels, biochemical oxygen demand, and reduced dissolved oxygen levels in the water column of receiving waters. These impacts would be localized near waste discharge points. Beyond the mixing zones for these discharges, impacts would not be expected. Any water quality impacts would be within acceptable limits as established by NPDES permits. During spills or upset conditions, untreated wastewater could be released to surface waters, resulting in a one-time, short-lived elevation in nutrient levels, microbes, and biochemical oxygen demand in the receiving water body. The duration and severity of impact would depend on the size of the spill and size and flushing action of the receiving water body. However, the onsite wastewater treatment plants would be relatively small in size, precluding the possibility of very large-volume spills of untreated wastes. Historical operating data (DOE 2004f) indicate that the likelihood of such an occurrence would be very low.

3.6.2.1.10 Impacts From Nonpoint Source Surface Water Discharge

Nonpoint source surface-water discharges potentially could occur at the SPR sites during both construction and operations and maintenance periods in the form of contaminated runoff. Runoff from the sites potentially could contain traces of materials spilled or used in small quantities onsite including oil, brine, fuels, cleaning materials, solvents, pesticides, vehicle maintenance fluids, or other materials. Runoff also could contain sediment from disturbed ground surfaces. DOE would practice good housekeeping and management practices to minimize the occurrence and size of any spills, to clean up spilled materials, and to minimize runoff contamination by cleaners or pesticides. Control measures would be taken to prevent sediment in runoff, as described earlier in the discussion of erosion and sedimentation impacts. National or state Pollutant Discharge and Elimination System permits and Stormwater Pollution Prevention Plans, as well as other applicable state and local permits, would be required for all facilities. These permits would include requirements for monitoring and reporting of certain chemicals and water-quality parameters in overland discharge from the sites to adjacent receiving waters. Monitoring results indicate that existing SPR sites consistently meet discharge requirements (DOE 2004f).

Although DOE would comply fully with permit requirements, the potential would remain for contaminants contained in nonpoint source discharges to have some minor impact on receiving water bodies. The potential impacts of oil, brine, chemicals, and sediment releases to surface water bodies have been described in earlier sections and section 3.2.2. The same types of impacts could occur as a result of the release of these same constituents in nonpoint source discharges. The level of impact associated with nonpoint source discharges would be low because the above constituents, if present in runoff, would be present at very low concentrations.

3.6.2.1.11 Impacts Associated with Potable and Miscellaneous Water Use

Small amounts of water for drinking and sanitary purposes would be used at each proposed site. The proposed expansion sites at Bayou Choctaw, West Hackberry, and Big Hill would use the water sources currently used at those sites. Bayou Choctaw pumps and treats groundwater, West Hackberry obtains water from the larger Hackberry public water system, and Big Hill purchases treated (chlorinated) surface water from local suppliers (DOE 2004f). Considering the minimal amount of potable and sanitary water required at the sites, the potential impacts of water used at the proposed expansion and new sites would be negligible.

3.6.2.2 Groundwater Common Impacts

The following paragraphs summarize the general groundwater impacts common to all sites. These do not include potential groundwater impacts associated with the underground injection of brine, which are unique to the Bruinsburg, Bayou Choctaw, and West Hackberry sites and are evaluated in those site-specific sections below.

3.6.2.2.1 Impacts of Brine Releases to Groundwater

Section 3.2.2.1 and section 3.6.2.1.5 discuss the risk of brine spills associated with the proposed SPR sites. A larger-volume brine spill could have consequences for groundwater resources, including groundwater **salinization**; however, the probability of such a large-volume spill is very low. Low-volume spills would be unlikely to reach groundwater. The overall risk to groundwater associated with brine spills is low.

Brine also could be released to groundwater via leaks from brine ponds. Measures to prevent leaking from brine ponds would include high-density polyethylene liners, underdrain systems to detect leakage, and sufficient freeboard to preclude overflow. These controls would guard against an uncontrolled, long-term discharge of brine to groundwater from the brine ponds. The brine ponds at the West Hackberry SPR facility did result in contamination of groundwater (DOE 2004f). At West Hackberry, the brine pond was removed and the brine-impacted groundwater was pumped from the aquifer. Also, brine leaks from pipelines at the Bayou Choctaw and Big Hill operating SPR sites have been reported (DOE 2004f). Groundwater monitoring programs at these sites indicate that the impacts to groundwater were localized.

The characteristics (such as salinity) and current and potential uses of groundwater, along with the geologic characteristics of each site as it relates to potential impacts from any brine discharges, are discussed in the site-specific sections.

3.6.2.2.2 Impacts from Oil Storage Cavern Leakage

Three mechanisms could lead to leakage of brine or oil from a salt cavern: (1) flow paths of sufficient permeability in the salt or associated natural seepage pathways such as faults and joints; (2) flow through hydraulic fractures generated in the walls of the cavern; or (3) leakage along the salt-cement interface in the cased well bore. The following paragraphs summarize the three mechanisms and collectively conclude that it is unlikely for brine or oil to leak from a salt cavern.

Rock salt is essentially impermeable (with a permeability about 10^{-21} to 10^{-19} meters squared). DOE would conduct a detailed geophysical survey for each proposed new site to ensure that the new SPR caverns would not intersect any natural seepage pathways and that the impermeability of the surrounding material meets design requirements; and thus, the leakage of brine or oil through the salt itself or associated natural seepage pathways would be unlikely.

Fractures may develop in the roof or crest of salt caverns if the cavern roof undergoes sufficient downward deflection or sag at the midpoint. With sufficient thickness of roof salt, these fractures would not extend through the whole roof salt and reach the caprock. The remaining unfractured roof salt and the caprock would prevent leakage of brine or oil from a salt cavern.

With the borehole and casing sealed properly following standard practices, the leakage brine or oil from a salt cavern along the salt-cement interface in the cased well-bore would be unlikely. Wells would be double-cased and grouted to prevent contamination of strata above the caverns. After installation, a nitrogen well-leak test, occurring over a period of five days, would be performed. This test is designed to detect small leaks in the well walls and wellhead. For additional protection, a dike would surround the wellhead area at each cavern. If any spills occur due to a manifold failure or blowout, drains on either side of the dike would contain the spill.

To protect against cavern leakage, the cavern would be pressure-tested before oil is injected. The test sensitivity level is leakage of up to 100 barrels of oil per year. DOE anticipates that the cavern integrity would surpass this limit. In addition, the caverns would be thousands of feet below sea level, and the rock aquifers at this depth would contain saline water that would be unusable as a potable source. The saline water of the rock aquifers likely would not affect shallow groundwater aquifers or surface waters.

3.6.2.2.3 Impacts to Groundwater Due to Raw Water Withdrawal from Surface Waters

Withdrawal of raw water from surface water during drought periods could result in a cumulative impact to nearby groundwater table levels. The incremental impacts from each site would be negligible, given that typically recharge flows from ground water toward the surface waters at all of the proposed new and expansion sites. Recharge of the aquifer from surface waters would only occur during short periods of high water following extended periods of heavy precipitation. Withdrawal from a surface water during periods of low water could result in an increase in hydraulic gradient and flow from the aquifer to the surface water. However, the impact to the groundwater table would be very small at Richton and Bruinsburg. Because the other sites withdraw water from the Intracoastal Waterway, which is tidally influenced, there would be no impact on the groundwater table. Also, raw water withdrawals would be permitted by the applicable state, and DOE would adhere to any monitoring requirements or withdrawal restrictions.

3.6.3 Bruinsburg Storage Site

Development and operation of the proposed Bruinsburg site would involve the following activities:

- Construction and operation of 16 storage caverns and associated facilities, including a wastewater treatment plant;
- Construction and operation of a pipeline, RWI structure on the Mississippi River, and power line running along the raw water pipeline from the main site substation to the RWI:
- Construction and operation of a brine disposal pipeline to 60 offsite brine disposal wells spaced along the brine and crude oil pipeline ROW and a road along the brine pipeline for construction and maintenance activities associated with brine wells;
- Construction and operation of two crude oil pipelines—one to the Peetsville pump station and the other to the Anchorage bulk storage terminal;
- Construction and operation of two new tank farms—one at Anchorage and the other at Peetsville, each consisting of four 0.4 MMB capacity oil storage tanks;
- Addition of site support facilities including construction of a 7-foot (2.2-meter) security fence, clearing of a 300-foot (91-meter) security buffer beyond the security fence, and refurbishment of access roads to the site and RWI structure.

The following sections describe the potential effects on water resources and potential impacts at the Bruinsburg storage site and associated infrastructure. The common impacts described in section 3.6.2 also apply to the Bruinsburg site.

3.6.3.1 Bruinsburg Surface Water

3.6.3.1.1 Bruinsburg Surface Water: Affected Environment

The Bruinsburg site is located at an elevation of approximately 82 feet (25 meters) above sea level (measured at the USGS site, ID 072900650) 3 miles (4.8 kilometers) east of the Mississippi River. It is also located in the South Independent Streams Basin, which covers approximately $2.8x10^6$ acres ($1.1x10^6$ hectares). The major waterways located in this basin include Bayou Pierre, Coles Creek, Buffalo River, and Homochitto River. The land in the basin is gently rolling to hilly terrain, and it is categorized as 73 percent forested and 23 percent agricultural land. Elevations in the basin range from approximately 10 to 550 feet (3.1 to 170 meters) above sea level. Agriculture and silviculture (the agriculture of trees) are the predominant uses of the basin. The proposed SPR site area is also agricultural.

3.6.3.1.2 Bruinsburg Surface Water: Construction Impacts

The common impacts to surface water discussed in section 3.6.2.1 are applicable to the proposed Bruinsburg site. The potential raw water withdrawal impacts of this site are discussed in the following paragraphs. Brine from the Bruinsburg site would be disposed of through deep injection wells, creating no impacts to the Gulf of Mexico associated with this site.

Table 3.6.3-1 and figure 3.6.3-1 list the site location and some of the nearby surface water bodies and show specific surface water bodies that could be affected by this proposed site.

Table 3.6.3-1: Potentially Impacted Surface Waters, Bruinsburg

Water Body Name and Relevant Segment	Description	State Designations,[a,b] Uses, and Impaired Segments
Cavern Site		
Bayou Pierre	River through agricultural area; tributary to the Mississippi River; perennial	• Recreation • Habitat-critical for the Bayou darter, which, because of silt and sedimentation, is a threatened species in Bayou Pierre • Impaired for aquatic life support and primary and secondary recreational contact
RWI from Mississippi River		
Mississippi River	Major drainage river	• Recreation • Major commercial river
Coles Creek	Upland creek; perennial	• Impaired use for aquatic life support and secondary recreational contact • Impairments are biological, nutrient, low DO, pesticides, sedimentation and siltation, salinity, pathogens
Crude Oil Pipelines to Anchorage		
Located in Mississippi		•
Coles Creek	Upland creek; perennial	• Impaired use for aquatic life support and secondary recreational contact • Impairments are biological, nutrient, low DO, pesticides, sedimentation and siltation, salinity, pathogens
Blueskin Creek	Upland stream; intermittent	N/A
Fairchilds Creek	Upland creek; perennial	• Impaired use for aquatic life support • Impaired use for nutrients, low DO, siltation, and pesticides
Sandy Bayou	Upland stream; intermittent	N/A
Dunbar Bayou	Upland stream; intermittent	N/A
Perkins Creek	Upland creek; intermittent	N/A
Second Creek	Upland creek; perennial	• Impaired use for aquatic life support • Impaired for biological, low DO, salinity, siltation, and pesticides
St. Catherine Creek	Upland creek; perennial	• Impaired use for aquatic life support and primary and secondary recreational contact • Impaired for salinity and chlorides and suspended solids
Callahan Branch	Upland creek; intermittent	N/A
Town Creek	Upland creek; intermittent	• Aquatic life support and secondary recreational contact • Impaired use for aquatic life support • Impaired for nutrients, low DO, pathogens, biological impairment, sedimentation/siltation, suspended solids, pesticides, turbidity, and other habitat alteration.
Hurricane Creek	Upland stream; intermittent	• Aquatic life support • Impaired use for nutrients, low DO, biological impairment, sedimentation/siltation, pesticides, pH, and flow alteration
Homochitto River	Upland river; tributary to Mississippi River; perennial	• Recreation • Impaired use for aquatic life support and secondary recreational contact • Impaired for nutrients, low DO sediment and siltation, pathogens, and pesticides
Dry Fork	Upland stream; perennial	N/A
Browns Creek	Upland stream; perennial	• Aquatic life support and secondary recreational contact. • Evaluated for nutrients, low DO, siltation, pathogens, and pesticides

Table 3.6.3-1: Potentially Impacted Surface Waters, Bruinsburg

Water Body Name and Relevant Segment	Description	State Designations,[a,b] Uses, and Impaired Segments
Buffalo River	Upland river; tributary to Mississippi River; perennial; 2004 average streamflow varies between 70 ft/sec^3 (March) to less than 2,000 ft/sec^3 (September)	• Impaired use for aquatic life support • Impaired for biological, low DO, salinity, and pesticides
Located in Louisiana		
Middle Fork Thompson Creek	Upland stream; perennial	• Impaired use for aquatic life support; • Cause of impairment unknown
Thompson Creek	Upland river; tributary to Mississippi River; perennial	• Impaired use for aquatic life support • Impaired for nutrients, biological, low DO, and salinity
White Bayou	Upland stream; intermittent	N/A
Bayou Baton Rouge	Upland stream; intermittent	N/A
Monte Sano Bayou	Upland stream; perennial	N/A
Mississippi River	Major river	• Aquatic life support, primary and secondary recreational contact, and public water supply
Crude Oil Pipelines to Peetsville		
James Creek	Upland creek; perennial	• Impaired use for aquatic life support and secondary recreational contact • Impaired for nutrients, low DO, pesticides, pathogens, biological impairment, unknown toxicity, flow alteration, suspended solids, and sediment/siltation
Widows Creek	Upland creek; intermittent	N/A
Willis Creek	Upland creek; perennial	• Impaired use for aquatic life support • Impaired for nutrients, low DO, pesticides, and sediment/siltation
Clarks Creek	Upland creek; perennial	N/A
Hughes Creek	Upland creek; perennial	• Impaired use for aquatic life support • Impaired for nutrients, low DO, other habitat alterations, and sediment/siltation
Whetstone Creek	Upland creek; intermittent	N/A
Bakers Creek	Upland creek; perennial	• Impaired use for aquatic life support and secondary recreational contact • Impaired for nutrients, low DO, pathogens, biological impairment, and other habitat alteration
Caney Branch	Upland stream; perennial	N/A
Crow Creek	Upland creek; intermittent	N/A
Johnson Creek	Upland creek; perennial	• Impaired use for aquatic life support • Impaired for nutrients, low DO, pesticides, sediment/siltation
Foster Creek	Upland creek; perennial	• Impaired use for aquatic life support • Impaired for sediment/siltation
Homochitto River	Upland river; perennial	• Recreation • Impaired use for aquatic life support and secondary recreational contact • Impairment caused by sedimentation/siltation, pathogens, nutrients, low level pesticides
Cedar Creek	Upland creek; perennial	• Impaired use for aquatic life support • Impaired for pesticides

Table 3.6.3-1: Potentially Impacted Surface Waters, Bruinsburg

Water Body Name and Relevant Segment	Description	State Designations,[a,b] Uses, and Impaired Segments
Dry Creek	Upland creek; intermittent	• Impaired use for aquatic life support and secondary recreational contact • Impaired for nutrients, pesticides, sediment/siltation, and pathogens

Notes:

[a] All of the waters in MDEQ's basin approach are classified as Fish and Wildlife. Basin waters carrying other classifications are noted accordingly (MDEQ 2006a).

[b] Louisiana State designations are defined as:

Primary Recreation: "any recreational or other water use in which there is prolonged and intimate body contact with the water involving considerable risk of absorbing waterborne constituents through the skin or of ingesting constituents from water in quantities sufficient to pose a significant health hazard."

Secondary Recreation: "any recreational or other water use in which body contact with the water is either incidental or accidental, and in which the probability of ingesting appreciable quantities of water is minimal."

Fish and Wildlife Propagation: "the use of water for aquatic habitat, food, resting, reproduction, cover, and/or travel corridors for any indigenous wildlife and aquatic life species associated with the aquatic environment. This use also includes the maintenance of water quality at a level that prevents damage to indigenous wildlife and aquatic life species associated with the aquatic environment and contamination of aquatic biota consumed by humans."

Drinking Water Supply: "refers to the use of water for human consumption and general household use."

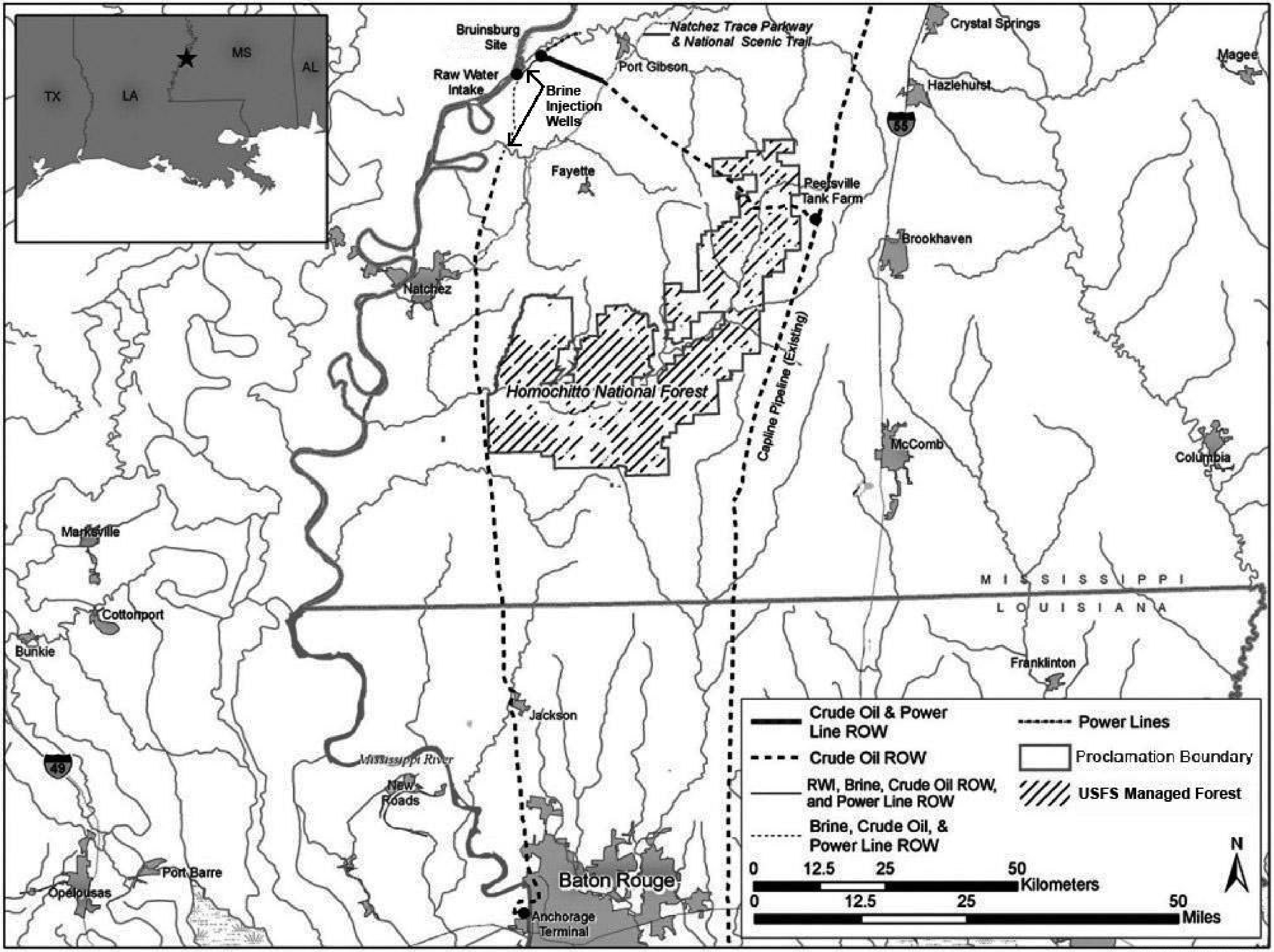
Oyster Propagation: "the use of water to maintain biological systems that support economically important species of oysters, clams, mussels, or other mollusks so that their productivity is preserved and the health of human consumers of these species is protected."

Agriculture: "the use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption."

Outstanding Natural Resource Waters: "include water bodies designated for preservation, protection, reclamation, or enhancement of wilderness, aesthetic qualities, and ecological regimes, such as those designated under the Louisiana Natural and Scenic Rivers System or those designated by the department as waters of ecological significance. Characteristics of outstanding natural resource waters include, but are not limited to, highly diverse or unique in stream and/or riparian habitat, high species diversity, balanced trophic structure, unique species, or similar qualities."

Source: LDEQ 2005

Figure 3.6.3-1: Regional Surface Water Map for Bruinsburg Site



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The proposed SPR facility site at Bruinsburg would be located less than 1 mile east of Bayou Pierre. Bayou Pierre discharges to the Mississippi River 3 miles downstream of the proposed site. Bayou Pierre, the primary local drainage, would not be impacted directly by the proposed facility or the pipelines or RWI structure.

The proposed RWI pipeline to the Mississippi River would cross no water bodies. The brine disposal pipeline would cross only one upland creek, Coles Creek. The crude oil pipeline to Anchorage would cross several streams, including several that discharge downstream into the Mississippi River to the west. Most of these streams are identified by Mississippi or Louisiana as having impaired quality because of sedimentation, low dissolved oxygen, pesticides, and elevated nutrients, all of which are characteristic of agricultural runoff (MDEQ 2006b). The crude oil pipeline to Peetsville would also cross several upland water bodies, including the Homochitto River—a tributary of the Mississippi River—and Clark's Creek, which discharges to the Homochitto River. Directional drilling would minimize impacts during construction activities, and it also would be implemented for some of the larger water bodies including the Homochitto River.

The extent of 100-year and 500-year floodplains in the project area were determined based on the Federal Emergency Management Agency's flood insurance rate maps covering the project area. The potential impacts to floodplains are discussed at length in section 3.6.2.1.7. The proposed Bruinsburg site is located in a predominantly undeveloped area that has numerous floodplains associated with the Mississippi River and Bayou Pierre, and tributaries listed in table 3.6.3-1. The pipelines associated with the proposed Bruinsburg project, also cross through the floodplains of the listed surface waters. Table 3.6.3-2 lists the total area of floodplains affected by the proposed project. In addition, floodplains along pipeline routes would be temporarily disturbed during construction, but would be brought up to original grade after construction.

Table 3.6.3-2: Total Area of Floodplains Affected by Bruinsburg Storage Site

Floodplain	Area (acres)[a]	Area (hectares)[a]
100-year	270	110
500-year	22	9
Total	**292**	**119**

[a] Numbers have been rounded to two significant figures

The Bruinsburg site would withdraw water from the Mississippi River at a point 3.5 miles (5.7 kilometers) southwest of the proposed SPR site. At the proposed withdrawal point, the Mississippi River is approximately 0.50-miles (0.80-kilometers) wide, and it has an annual average flow rate of approximately 2.7×10^5 cubic feet per second (7.5×10^3 cubic meters per second) (Data for Vicksburg, MS) (Riverweb 2004f). Six NPDES discharge permits have been issued in the Bruinsburg RWI area (EPA 2006c); at least one of these discharges is to the Mississippi River upstream of the RWI (the receiving waters for the remaining permits are not listed). Information about the volume of this discharge is unavailable. These discharges would not affect the proposed RWI because the water would not be used for potable water.

Raw water withdrawal from the Mississippi River for the Bruinsburg site would be 1.2 MMBD (78 cubic feet per second [2.2 cubic meters per second]) during drawdown, and 1.2 MMBD (78 cubic feet per second [2.2 cubic meters per second]) during solution mining. These measurements represent a small fraction (less than 0.003 percent) of the average river flow. The RWI would be expected to have no appreciable effect on water levels, downstream water flow, water availability for other users, dilution and assimilation capacity of the river for pollutants, or water quality.

If one of the proposed Bruinsburg alternatives is selected, DOE would apply for a Permit to Withdraw for Beneficial Uses from the Public Waters of Mississippi and coordinate with the Mississippi Office of Land and Water Resources to ensure that Minimum Instream Flows would be maintained during the period of withdrawal. This RWI also would be coordinated and permitted by USACE through the Section 404 process.

3.6.3.1.3 Bruinsburg Surface Water: Operations and Maintenance Impacts

Section 3.6.2.1 discusses potential surface water impacts related to operations and maintenance at all sites. The potential impacts related to raw water withdrawal are also applicable to the operations and maintenance phase.

3.6.3.2 Bruinsburg Groundwater

3.6.3.2.1 Bruinsburg Groundwater: Affected Environment

The proposed Bruinsburg site is located over a shallow aquifer, the Southern Hills Aquifer; and a deep aquifer, the Mississippi Embayment Aquifer System (MEAS). The Southern Hills Aquifer system extends from near Vicksburg, MS at its northernmost point to Baton Rouge, LA at its southern extent, and is bounded on the east and west by the Pearl and Mississippi rivers (EPA 2006g, 2004h; USGS 2002b). This system consists of four aquifer units, including a Shallow **Alluvial** (Pleistocene) aquifer and Pliocene, Miocene, and Oligocene units (LAGS 2000)[1].

The different units of the Southern Hills Aquifer system originate in outcroppings that run in roughly east-west bands across southern Mississippi. The aquifers dip downward towards the coastline and the Mississippi River Valley. Groundwater flow in the aquifer system is generally to the south, i.e., down-dip or downgradient.

The Southern Hills Aquifer system is an important groundwater resource in the region. It is designated by EPA as a sole source aquifer and is the primary groundwater resource aquifer for southwestern Mississippi and southeastern Louisiana. It is the only source of drinking water for more than 50 percent of the residents in a large area of southeastern Louisiana (EPA 2006f, 2004g, 2004h). The Shallow Alluvial aquifer and the Miocene unit of the Southern Hills Aquifer system serve as water resources for much of southern Mississippi and southeastern Louisiana (MDEQ 2004b; USGS 1981; USGS 2005a; Walley 2006). Thus, Bruinsburg is located in the origination area or recharge zone of the Southern Hills Aquifer system, and is upgradient of the great majority of the system. In the vicinity of the Bruinsburg site, the bottom of the Southern Hills aquifer system is approximately 800 feet (244 meters) below grade (USGS 1982). Most of the Miocene outcropping area is covered by an overlying confining layer of loess, up to 90 feet (27 meters) thick. This overlying confining layer greatly reduces vertical recharge to the Miocene unit (MDEQ 2004b).

[1] Some references (USGS 2005b) refer to five aquifer units, including a lower Pliocene to upper Miocene unit. The aquifer units or permeable zones within the Southern Hills Aquifer system and the larger Coastal Lowlands Aquifer system (of which the Southern Hills system is a part) are heterogeneous and discontinuous across the system. The system is generally devoid of widespread confining units, and permeable zones are distinguished by their different hydraulic conductivities rather than their separation by confining units. Stratigraphic comparisons and identification of permeable zones across the entire system are difficult, and in some areas arbitrary (USGS 2005b). Due to the absence of confining layers these permeable zones or aquifer units are extensively interconnected and effectively form a single large aquifer system.

Examples of the uses of the Southern Hills Aquifer downgradient of the Bruinsburg site include the designated source water protection area (SPWA) and municipal supply wells in Russo, MS, located approximately 10 miles downgradient from Bruinsburg. Other major pumping centers in Mississippi relying on the Miocene unit include Natchez, Brookhaven, Hazlehurst, Colombia, McComb, Moss Point, Picayune, Ellisville, Hattiesburg, Laurel, Biloxi, Gulfport, and Pascagoula (MDEQ 2004b), at distances of 30 to 190 miles (48 to 310 kilometers) downgradient of Bruinsburg. Smaller wells exist throughout the area of Mississippi downgradient of Bruinsburg.

In Louisiana, the area of Baton Rouge (approximately 100 miles (160 kilometers) downgradient of Bruinsburg) withdrew 131 million gallons (0.50 million cubic meters) per day from the Southern Hills Aquifer system in 2000. This withdrawal was largely from the Pliocene unit, but also to a lesser extent from other units in the system (USGS 2002b; USGS 2005a). Other major pumping centers relying on the Southern Hills Aquifer system include St. Franksville, Amite, Franklinton, Bogalusa, Hammond, Covington, Denham Springs, and Slidell, LA (USGS 2002b), at distances of 80 to 145 (130 to 230 kilometers) miles downgradient from Bruinsburg. Hundreds of smaller wells tap the Southern Hills Aquifer system in Louisiana. Many of these wells are located along the border with Mississippi, within roughly 60 miles (97 kilometers) of Bruinsburg (USGS 2002b).

Total withdrawal from the Southern Hills Aquifer system in 2000 was 290 million gallons per day (1.1 million cubic meters per day), of which 49 percent was used for public water supply, 39 percent was used for industrial uses, and the remainder was used for power generation, rural domestic use, and other uses (USGS 2002b).

In the Bruinsburg area, the Southern Hills Aquifer system is underlain by a thick confining layer known as the Vicksburg-Jackson confining unit, or locally as the Yazoo Clay layer. Below this confining layer is a second major aquifer system, the MEAS. Bruinsburg is located over the southernmost, downgradient, down-dipping section of the MEAS, which is a large system extending from southeastern Arkansas eastward into northeastern Mississippi and southern Tennessee, and southward into central Louisiana and just south of the southern Mississippi border, into southeastern Louisiana.

The MEAS comprises six aquifer units with outcropping zones extending in arch-shaped bands across northern Louisiana, southeastern Arkansas, northeastern Mississippi, and southern Tennessee (USGS 2005a). Thus, the MEAS is at or near the surface in areas significantly northeast, north, and northwest (and upgradient) of Bruinsburg. The MEAS aquifer units increase in thickness, and the lower units increase in depth below grade, with distance to the south, and as they approach the central axis of the aquifer system along the Mississippi river corridor (USGS 2005a). Groundwater flow in the MEAS is driven by gravity in the downgradient direction; i.e., towards the central axis of the MEAS along the Mississippi River, and to the south (USGS 2005a).

In southern Mississippi and central Louisiana, an extensive, thick, clay confining unit (Vicksburg-Jackson confining unit) separates the MEAS from the overlying potable water aquifers of the Southern Hills Aquifer system (USGS 2005a). In the vicinity of the Bruinsburg site, this thick clay confining layer is 300- to 500-feet (91- to 150-meters) thick (Taylor 2005; USGS 2005a). This confining layer precludes movement of water between the upper Southern Hills Aquifer system and the lower MEAS.

Of particular interest within the MEAS is the Middle Claiborne unit, which is composed largely of the Sparta Sands aquifer, and is generally referred to as the Sparta aquifer. The Sparta aquifer is an important source of water in its northern sections (i.e., in southeastern Arkansas, northern Louisiana, northeastern Mississippi, and southern Tennessee), where this aquifer is relatively near the surface and contains fresh water. In 2000, water was withdrawn from the Sparta aquifer in Louisiana at the rate of 68 million gallons (257 thousand cubic meters) per day (USGS 2002b). This water was used for public water supply (55 percent), industry (40 percent), and other uses (5 percent) (USGS 2002b). Significant amounts of water are withdrawn from the Sparta/Central Claiborne Aquifer in the cities of Stuttgart, Pine Bluff, El Dorado, and Magnolia, Arkansas; Ruston, Jonesboro, Monroe, and Bastrop, Louisiana; and Yazoo City and Jackson, Mississippi. Large withdrawals are also made in the Memphis, Tennessee area (USGS 2005a).

All of these Sparta withdrawal areas are upgradient (from 35 to over 240 miles [56 to 390 kilometers]) of the Bruinsburg site. The freshwater limit (1,000 parts per million dissolved solids concentration isopleth) of the Sparta aquifer extends in an arch upgradient of Bruinsburg, roughly 60 miles (97 kilometers) to the northwest, 50 miles (81 kilometers) to the north, and 35 miles (56 kilometers) to the northeast. The 10,000 parts per million dissolved solids concentration isopleth extends in an arch upgradient of Bruinsburg, approximately 45 miles (72 kilometers) to the northwest, 40 miles (64 kilometers) to the north, and 20 (32 kilometers) miles to the northeast (USGS 2005a). Thus, the usable portions of the aquifer are many miles upgradient of the Bruinsburg site.

The MEAS aquifer units increase in dissolved solids content in the downgradient direction, and with depth below grade. These units contain fresh water in the northern areas where they are relatively near the surface, but become saline downgradient. Bruinsburg is located in the downgradient portion of the MEAS. The top of the Sparta aquifer is 1,900 feet (580 meters) below grade at this point. The dissolved solids concentration within the aquifer at this point is over 10,000 parts per million (USGS 2005a).

3.6.3.2.2 Bruinsburg Groundwater: Construction Impacts

All of the general groundwater-related impacts discussed in section 3.6.2.2 are applicable to the proposed Bruinsburg site. However, impacts to the Miocene aquifer unit from surface or near-surface discharges at Bruinsburg would not be likely because of the presence of the thick overlying, low permeability layer of loess. This confining layer would act as a barrier to infiltration of spilled contaminants to the underlying Miocene aquifer.

The crude oil pipeline to Peetsville would cross through one SWPA in the town of Russum, MS, where there are three public supply wells. The crude oil pipeline to Anchorage would pass through three SWPAs in the towns of Washington and Fenwick, MS. Potential impacts to groundwater resources in these SWPAs are unlikely, considering the low probability of an uncontrolled spill from pipelines within the SWPA that would subsequently penetrate to groundwater.

Brine from the Bruinsburg site would be disposed of through deep well injection. The proposed brine injection rate would require a complex of 60 injection wells spaced 1,000 feet (300 meters) apart, resulting in an 11-mile (18-kilometer) injection corridor or injection field, which would begin approximately 3 miles (5 kilometers) from the storage site.

Based on review of well log information, DOE has identified two formations in the MEAS beneath Bruinsburg, the Sparta and Wilcox units, as potentially suitable disposal formations for injected brine. At the northern end of the proposed injection area, the top of the Sparta unit is at approximately 1,900 feet (580 meters) below grade, and the unit is approximately 750 to 1,000 feet (230 to 300 meters) thick. The top of the Wilcox unit is approximately 3,300 feet (1,000 meters) below grade, and this unit is approximately 3,700 feet (1,100 meters) thick.

The total disposal capacity of these formations, and the pressure buildup likely to occur as a result of brine injection, are not known at this time. If DOE were to select this alternative, the total disposal capacity and pressure build up would be determined during the development of the detailed design.

Based on review of currently available well logs, DOE has concluded that the Sparta formation alone may not have adequate capacity to handle the proposed brine injection volumes and rates, necessitating development of injection wells in both the Sparta and Wilcox formations. Considering the likely heterogeneity of the proposed injection formations over the length of the disposal corridor, additional testing would be required to assess the capacity of these formations for receiving injected brine at the proposed rates, as well as to provide confidence that brine injection would not adversely affect the quality of either the overlying water supply aquifer or the upgradient freshwater portions of the formations that would receive the brine.

The proposed injection area would be located at least 35 miles (56 kilometers) downgradient of the freshwater portions and withdrawal areas of the Sparta and Wilcox units, and both of these aquifers have dissolved solids concentrations greater than 10,000 parts per million at the proposed brine disposal area (USGS 2005a). Brine injected into these aquifers at Bruinsburg would travel further downgradient with the general direction of groundwater flow, and also by gravity along the bedding that dips towards the south. Thus, the injected brine would be carried into increasingly saline portions of the aquifers, and away from the freshwater portions of the aquifers that constitute current or potential sources of fresh water. Permitting for the proposed brine-disposal system would be subject to the requirements of the Underground Injection Control (UIC) Program regulations, including the prohibition on injection into formations that contain waters of 10,000 parts per million total dissolved solids or less (40 CFR Parts 144-146). Permitting would require a determination that injection would not adversely impact freshwater portions of the injection formations.

The Yazoo Clay formation, approximately 300- to 500-feet (91- to 152-meters) thick, separates the Sparta aquifer (the uppermost of the two proposed injection aquifers) from the overlying potable water aquifers of the Southern Hills Aquifer system. Quantitative performance data are not available for the Yazoo Clay layer. However, this layer is characterized as very low permeability (Taylor 2005) and could therefore be expected to serve as an effective barrier to the migration of brine upward into the potable Southern Hills Aquifer system.

Brine would be injected into a portion of the aquifer with dissolved solid concentrations in excess of 10,000 parts per million and would travel into an increasingly saline portion of the aquifer. As a result of this, and the presence of the Yazoo Clay formation serving as a barrier to upward migration, there would be no impact on potable portions of the Sparta or Wilcox aquifers from brine disposal at Bruinsburg.

There is a low potential that injected brine potentially could discharge to the shallow water source aquifer through leaks in the brine disposal wells. Moreover, these wells would be sealed, and pressure tested to assure that leakage would not occur. DOE would also implement a shallow groundwater monitoring program at the site to ensure protection of groundwater quality. Also, permitting of the brine disposal facility would be subject to UIC Program regulations, which specifically prohibit the over pressuring of injection zones to the point that the injected brine could rise into overlying aquifers (40 CFR Parts 144-146).

3.6.3.2.3 Bruinsburg Groundwater: Operations and Maintenance Impacts

Potential impacts from operation and maintenance activities would be similar to those discussed above for construction. The brine disposal wells also would be used during drawdown events.

3.6.4 Chacahoula Storage Site

The proposed new Chacahoula SPR project would include the following activities:

- Construction and operation of storage caverns, well pads, and associated facilities including a wastewater treatment plant, a security fence and buffer, and access roads to the site and RWI structure;
- Construction and operation of an RWI structure on the ICW and an RWI pipeline;
- Construction and operation of a brine disposal pipeline and brine diffuser discharge system in the Gulf of Mexico; and
- Construction and operation of two crude oil pipelines, a pipeline to the existing St. James terminal on the Mississippi River and a pipeline to LOOP's Clovelly Terminal in Galliano.

The following sections describe the potentially affected water resources and potential impacts specific to the Chacahoula storage site and associated infrastructure. The common impacts described in section 3.6.2 also apply to the proposed Chacahoula site.

3.6.4.1 Chacahoula Surface Water

3.6.4.1.1 Chacahoula Surface Water: Affected Environment

The Chacahoula site is located in the Louisiana portion of the Western Gulf Coastal Plain Province. This low-lying area is composed of the Mississippi River floodplain, coastal marshes, and a series of terraces and low hills. The site would be located at an elevation of 6 to 7 feet (1.8 to 2.1 meters) above sea level in a permanently inundated swamp, in the Terrebonne sub-basin of the Mississippi River Drainage Basin. Local drainage at the Chacahoula site is to Bubbling Bayou to the south and a canal that runs north-south, just east of the site. The proposed SPR site and the proposed pipeline routes would be located primarily in marshlands and would cross numerous small and some larger water bodies. However, the proposed oil pipeline running north to the oil terminal adjacent to the Mississippi River would cross some land at slightly higher elevation.

3.6.4.1.2 Chacahoula Surface Water: Construction Impacts

The common impacts to surface water discussed in section 3.6.2.1 are applicable to the proposed Chacahoula site. The particular surface water bodies that would be crossed or potentially impacted by this alternative are listed below in table 3.6.4-1. A map showing the location of most of these waters is presented in figure 3.6.4-1.

Surface water in the region is typically used for recreational boating and fishing. For example, Bayou Black is used for recreational boating and commercial boat tours; Bay Junop is used for recreation and fishing; and the ICW is used for recreational boating and fishing. The ICW also has considerable commercial activity, as barges haul petroleum, petroleum products, foodstuffs, building materials, manufactured goods, and other materials up and down that water body. To support this commercial traffic, USACE maintains navigable depths in the ICW through dredging and locks.

Some of the water bodies are recognized by the EPA and Louisiana as having "impaired" water quality. For example, Bayou Black is listed as impaired based on low dissolved oxygen concentrations; Lost Lake is listed as impaired based on high organic content and low dissolved oxygen levels; and Bayou

Table 3.6.4-1: Potentially Impacted Surface Waters, Chacahoula

Water Body Name (and Relevant Segment)	Description	State Designations,[a] Uses, and Impaired Segments
Cavern Site		
Bubbling Bayou	Channel through marsh; perennial	• Primary contact recreation, secondary contact recreation, and fish and wildlife propagation
Canals running along western and eastern sides of site	Canal/ditch	N/A
Exit Row Raw Water Intake and Brine P/L		
Bayou Black	Channel through marsh; perennial	• Uses: recreational boating, boat tours, aquatic life • Impaired by low DO
RWI Pipeline to ICW		
Canal running along eastern edge of site	Canal/ditch	N/A
Tributary to Bubbling Bayou 0.5 miles from site	Small stream	N/A
Shell Canal	Canal; Perennial	N/A
Bubbling Bayou	Channel through marsh	• Primary and secondary contact recreation and fish and wildlife propagation
Bayou Black	River through developed agricultural and oil fields	• Substantial surface water body used for recreational boating and commercial boat tours. Bayou Black is listed as "impaired," based on dissolved oxygen concentrations
Bayou de Cade	Canal through marsh; perennial	N/A
Bayou Cocodrie	Channel through marsh; perennial	• Agriculture, primary and secondary contact recreation, fish and wildlife propagation, outstanding natural resource waters, and limited aquatic life and wildlife use
Several unnamed canals	Small canals through marsh	N/A
Intracoastal Waterway	Major commercial and recreational waterway; USACE maintains navigable depths in the water way through dredging and locks; perennial	• The ICW is used for both recreational boating and for commerce • Primary and secondary contact recreation and fish and wildlife propagation • The ICW has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods • The USACE maintains navigable depths in the water way through dredging and locks
Brine Disposal Pipeline		
Bayou Penchant	River (major drainage) through marsh; 30-mile long river with peak stream flows of up to 13,000 cfs	• 30-mile long river with peak stream flows of up to 13,000 cfs • Classified as "impaired" by EPA based on turbidity, oil and grease concentrations, and total organic solids concentrations • The Penchant Basin is currently the focus of a USGS ecological restoration program
Bayou Cocodrie	Channel through marsh; perennial	• Agriculture, primary and secondary contact recreation, fish and wildlife propagation, outstanding natural resource waters, and limited aquatic life and wildlife use

Table 3.6.4-1: Potentially Impacted Surface Waters, Chacahoula

Water Body Name (and Relevant Segment)	Description	State Designations,[a] Uses, and Impaired Segments
Coulee Michel	Stream; perennial	N/A
Bay Junop	Coastal bay	• Recreation and fishing
Intracoastal Waterway	Major commercial and recreational waterway; USACE maintains navigable depths in the water way through dredging and locks; perennial	• The ICW is used for both recreational boating and for commerce • Primary and secondary contact recreation and propagation of fish and wildlife • The ICW has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods • The USACE maintains navigable depths in the water way through dredging and locks
St. James Crude Oil Pipeline		
St. James Parish Canal	N/A	N/A
Mississippi River	Upland channel, perennial	• Primary/secondary contact recreation, propagation of fish and wildlife, and drinking water supply
Baker Canal	N/A	N/A
Citamon Bayou	Channel through marsh; perennial	Primary and secondary contact recreation, agriculture, propagation of fish and wildlife
Cutgrass Coulee	N/A	N/A
Bayou Verrett	Channel through marsh; perennial	Primary and secondary contact recreation, agriculture, propagation of fish and wildlife
Clovelly Crude Oil Pipeline		
Petit Bois Bayou	Channel through marsh; perennial	N/A
Intracoastal Waterway	Major commercial and recreational waterway; USACE maintains navigable depths in the water way through dredging and locks; perennial	• The ICW is used for both recreational boating and for commerce • Primary and secondary contact recreation and propagation of fish and wildlife • The ICW has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods • The USACE maintains navigable depths in the water way through dredging and locks
Bayou Terrebone	Upland channel; perennial	• Primary and secondary contact recreation, propagation of fish and wildlife; oyster propagation
Bayou LaFourche	Channel through marsh; perennial	• Primary and secondary contact recreation, propagation of fish and wildlife; domestic raw water supply
Petit Chackbay Bayou	Channel through marsh; perennial	N/A

Table 3.6.4-1: Potentially Impacted Surface Waters, Chacahoula

Water Body Name (and Relevant Segment)	Description	State Designations,[a] Uses, and Impaired Segments
Company Canal	Canal; ditch	• Agriculture, fish and wildlife propagation, drinking water, primary and secondary contact recreation
Canal Tisamond Foret	Canal; ditch	N/A

Notes:

[a] State designations are defined as follows:

Primary Contact Recreation: "any recreational or other water use in which there is prolonged and intimate body contact with the water involving considerable risk of absorbing waterborne constituents through the skin or of ingesting constituents from water in quantities sufficient to pose a significant health hazard."

Secondary Contact Recreation: "any recreational or other water use in which body contact with the water is either incidental or accidental, and in which the probability of ingesting appreciable quantities of water is minimal."

Fish and Wildlife Propagation: "the use of water for aquatic habitat, food, resting, reproduction, cover, and/or travel corridors for any indigenous wildlife and aquatic life species associated with the aquatic environment. This use also includes the maintenance of water quality at a level that prevents damage to indigenous wildlife and aquatic life species associated with the aquatic environment and contamination of aquatic biota consumed by humans."

Drinking Water Supply: "refers to the use of water for human consumption and general household use."

Oyster Propagation: "the use of water to maintain biological systems that support economically important species of oysters, clams, mussels, or other mollusks so that their productivity is preserved and the health of human consumers of these species is protected."

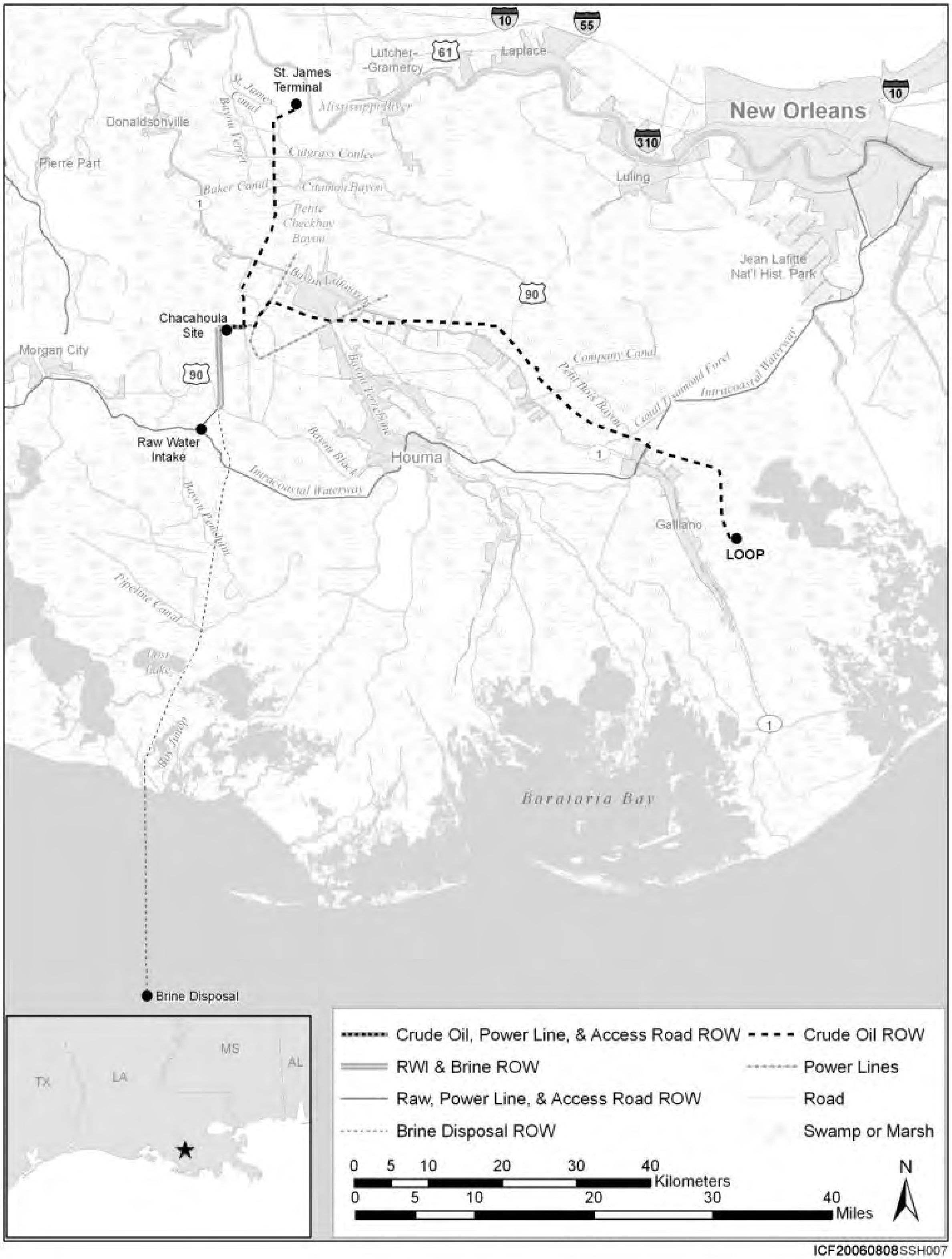
Agriculture: "the use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption."

Outstanding Natural Resource Waters: "include water bodies designated for preservation, protection, reclamation, or enhancement of wilderness, aesthetic qualities, and ecological regimes, such as those designated under the Louisiana Natural and Scenic Rivers System or those designated by the department as waters of ecological significance. Characteristics of outstanding natural resource waters include, but are not limited to, highly diverse or unique in stream and/or riparian habitat, high species diversity, balanced trophic structure, unique species, or similar qualities."

cfs = cubic feet per second; N/A = not available; 1 mile = 1.609 kilometers

Source: LDEQ 2005

Figure 3.6.4-1: Regional Surface Water Map for Chacahoula Site



Terrebonne is listed as impaired based on a variety of contaminants and the presence of invasive, noxious plant species. Bayou Penchant is also classified as impaired based on turbidity, oil and grease concentrations, and total organic solids concentrations. The Penchant Basin is currently the focus of a USGS ecological restoration program. Similarly, Bay Junop is the subject of an ongoing ecological restoration program, including an oyster restoration project supported by EPA.

The RWI pipeline would run to the south through mostly undeveloped marsh land, and would cross one substantial water body, Bayou Black, before reaching the ICW. The brine disposal pipeline would run along the same route, but then would continue south to the Gulf of Mexico through mostly undeveloped marshland, crossing several substantial water bodies. The crude oil pipeline to St. James Terminal on the Mississippi River to the north would cross several creeks and run primarily through marshlands. The crude oil pipeline to Clovelly would cross upland rivers and streams, and then streams through costal marsh as it approaches the Clovelly LOOP. The majority of the potentially affected surface water for the Chacahoula site would be fresh water, except where the brine pipeline and the Clovelly crude oil pipeline approach the coastline.

Directional drilling would be used to minimize the impacts of crossing water bodies at some of the larger rivers, including Bayou Penchant, Bayou Lafourche, Bayou Terrebonne, and the ICW.

The Chacahoula site would withdraw raw water from the ICW. The potential surface water impacts are addressed in section 3.6.2.1.1, and would be expected to be insignificant.

The extent of 100-year and 500-year floodplains in the project area were determined based on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate maps covering the project area. The potential impacts to floodplains are discussed in section 3.6.2.1.7 and in appendix B. Table 3.6.4-2 provides a summary of the floodplains located within the proposed project area.

Table 3.6.4-2: Total Area of Floodplains Affected by Chacahoula Storage Site

Floodplain	Area (acres)[a]	Area (hectares)[a]
100-year	140	55
500-year	N/A	N/A
Total[b]	**140**	**55**

Notes:

[a] Numbers have been rounded to two significant figures
[b] Numbers may not equal total due to rounding

With respect to floodplains, the Chacahoula site, terminal, and RWI structure would result in a disturbance of approximately 140 acres (55 hectares) of the 100-year floodplain. All onsite construction for the storage area, therefore, would occur within a floodplain. To minimize wetland and floodplain impacts, just the areas of the onsite facilities, access road, and around the cavern pads would be filled, the remainder of the site would remain at current grade. Offsite construction in floodplain would include temporary disturbances during pipeline construction.

The floodplain in which the Chacahoula site is located extends over thousands of acres, and is part of the Louisiana Western Gulf Coastal Plain Province.

3.6.4.1.3 Chacahoula Surface Water: Operations and Maintenance Impacts

The potential effects of discharging brine through diffusers into the Gulf of Mexico are discussed in Section 3.6.2.1.2. Potential impacts were modeled based on monitoring data at operating SPR brine diffuser sites in the Gulf of Mexico, and the impacts from the Chacahoula discharge would be very localized. As discussed in section 3.6.2.1.2 above, the proposed location of the brine diffuser is at the base of a 10-foot (3-meter) escarpment called Ship Shoal. As for the other proposed sites, potential salinity impacts of the Chacahoula brine discharge on the Gulf of Mexico were estimated based on an empirical model. However, the empirical plume model does not show effects of bottom topography, such as Ship Shoal. At Chacahoula, the brine plume movement is restricted by the upward sloping sea bottom to the north (shoreward), west, and south (Ship Shoal). Flow along the bottom to the east is possible, as the water bottom slopes downward to the east along Ship Shoal. The bathymetry (which is the ocean bottom equivalent to land's topography) at the Chacahoula diffuser would likely result in pooling of approximately 2 feet (0.6 meters) of above-ambient salinity water near the bottom.

> Mitigation: A preconstruction survey could be undertaken to evaluate the possibility of avoiding Ship Shoal. If required, a more detailed model could define potential impacts to water quality and biological resources.

3.6.4.2 Chacahoula Groundwater

3.6.4.2.1 Chacahoula Groundwater: Affected Environment

In the Chacahoula salt dome area, the subsurface water system is the Mississippi River Alluvial Aquifer, which is principally comprised of interconnected fresh-water-bearing sands and gravels, overlain by a 100-foot (30-meter) confining layer of clay and silt to form an artesian aquifer system (Arthur 2001). This aquifer is the most heavily pumped in Mississippi, and 98 percent of the groundwater pumped is used for agriculture.

The aquifer depth ranges from approximately 800 feet (244 meters) below ground surface near Bayou Choctaw to roughly 1,400 feet (427 meters) near the Chacahoula dome. Depth to the base of fresh water is approximately 250 feet (76 meters) below ground surface at the site. The depth to salt in the site area is approximately 1,100 feet (335 meters) below ground surface, and the top of the caprock is at a depth of about 875 feet (267 meters) at its highest point (DOE 1978b). The cavern system would be hundreds of feet below the base of the fresh water aquifer.

> An **aquifer** is a body of rock or soil that is capable of transmitting groundwater and yielding usable quantities of water to wells or springs.

According to the Louisiana Department of Transportation and Development water well registry, several groundwater wells are located in the vicinity of the Chacahoula site (LADOTD 2005). The identified wells are primarily screened (i.e., draw water from) within an interval that is between 150 and 200 feet (46 and 61 meters) below the ground surface, and consist almost exclusively of oil rig supply and industrial-use wells. Depth to groundwater at these wells is generally less than 10 feet (3 meters) below the ground surface, with reported well yields up to 3.34 cubic feet per second (0.0946 cubic meters per second). The general groundwater flow direction at the Chacahoula site is expected to be to the south. These wells are screened hundreds of feet above the proposed storage depth. Also, they are protected from surface and near surface discharges by the upper low-permeability layer.

Water use in Lafourche Parish, where the Chacahoula site is located, is dominated by surface water sources, and groundwater use represents an average of about 2 percent of the total water usage, and is primarily associated with industrial and livestock usage. Groundwater is not used for public water supplies in Lafourche Parish (Whelan 2006; EPA 2006a).

3.6.4.2.2 Chacahoula Groundwater: Construction Impacts

All of the general groundwater-related impacts discussed in section 3.6.2.2 are applicable to the proposed Chacahoula site. However, the likelihood of impacts to groundwater at Chacahoula would be further minimized because of the presence of a 100-foot (30-meter) clay confining layer above the aquifer layer at the site (DOE 1978b). This clay layer would impede any infiltration of spills to the aquifer. This alternative would not use groundwater or discharge through underground injection wells to the groundwater. There would be no significant impact to groundwater.

3.6.4.2.3 Chacahoula Groundwater: Operations and Maintenance Impacts

The evaluation of potential impacts from construction of the proposed Chacahoula project above would also apply to the operations and maintenance impacts.

3.6.5 Richton Storage Site

Construction and operation of the proposed SPR site at Richton would involve the following activities:

- Construction and operation of 16 storage caverns with a combined capacity of 160 MMB and associated facilities including a wastewater treatment plant and access road;
- Construction and operation of RWI structures on the Leaf River and the Gulf of Mexico at Pascagoula;
- Installation of a utility line from the substation at the Leaf River RWI to the new power lines providing electricity to the storage site and construction of a new, wide, gravel access road along the pipeline ROW from Old Augusta Road to the RWI;
- Construction and operation of two multi-purpose pipelines to Pascagoula and brine diffuser discharge system in the Gulf of Mexico;
- Construction of a bulk oil storage marine terminal at Pascagoula, which would include modifications to barge dock, storage tanks, utilities, and associated support facilities; and
- Construction and operation of pipeline to Liberty and bulk storage terminal in Liberty, which would include construction of storage tanks, utilities, associated support facilities, and a mid-station pump station along the crude oil pipeline to Liberty.

The following sections describe the potentially affected water resources and potential impacts specific to the Richton storage site and associated infrastructure. The common impacts described in section 3.6.2 also apply to the Richton site, unless otherwise noted.

3.6.5.1 Richton Surface Water

3.6.5.1.1 Richton Surface Water: Affected Environment

The Richton site would be located within the Thompson's Creek drainage sub-basin of the Leaf River drainage basin and within the Mississippi portion of the Gulf Coastal Plain Province. The cavern site is in an uplands area, at about 250 feet (76 meters) above sea level elevation, and the majority of surface waters affected would be uplands and fresh water systems. Water may become increasing brackish in the coastal, marshy areas as the brine disposal pipeline approaches the Gulf of Mexico.

3.6.5.1.2 Richton Surface Water: Construction Impacts

The common impacts described in section 3.6.2.1 are applicable to the Richton site. Primary surface water bodies that could potentially be affected by development of the Richton site are listed in table 3.6.5-1 and shown in figures 3.6.5-1 and 3.6.5-2.

Since the Richton SPR site and most of the pipelines would be located outside the coastal area, any of the impacts to surface water would impact fresh water systems, rather than brackish systems. The majority of the water bodies that would be crossed by pipelines are listed by the State as impaired due to runoff issues, including sediment/siltation, low-oxygen levels and elevated nutrient levels.

DOE would use directional drilling techniques to minimize impacts of laying pipeline across rivers at some of the larger rivers. Some of the rivers where this method could be employed include Thompson Creek, Chickasawhay River, Bogue Homo, Leaf River, Pearl River, and Bogue Chitto River.

The potential effects of discharging brine through diffusers into the Gulf of Mexico are discussed in section 3.6.2.1.2. Potential impacts were modeled on monitoring data at operating SPR brine diffuser sites in the Gulf of Mexico, and the impacts from Richton discharge would be very localized. The plume of increased salinity would extend into the Pascagoula Ship Channel. Under typical conditions, the resultant salinity would only be elevated by 1 part per thousand in the channel. Under low current velocity conditions, salinity could be elevated by 4 parts per thousand in the ship channel. It is possible that elevated salinity water could accumulate at the bottom of the dredged channel under certain conditions.

Raw water demand for the Richton site would be about 1.2 MMBD (78 cubic feet per second [50 million gallons per day] or 2.2 cubic meters per second). The RWI structure for Richton would be located along the north bank of the Leaf River approximately 450 feet (140 meters) downstream of the confluence with the Bogue Homo, and approximately 4 miles (6.4 kilometers) east of New Augusta. The RWI point is well upstream of the fall line, and the water is fresh. Another RWI would be located at Pascagoula in the Gulf of Mexico.

During cavern creation, drawdown, or maintenance, withdrawal from the Leaf River would be used during normal and high flow conditions in the Leaf River. Under low flow conditions in the Leaf River, the withdrawal would be supplemented by a secondary source(s) including a RWI from the Gulf of Mexico at Pascagoula. The RWI at Pascagoula would be designed to handle about 0.5 MMBD of the proposed 1.2 MMBD total volume. During construction or maintenance, when flows in the Leaf River reach the Minimum Instream Flow that is designated by the regulatory agencies to protect special status species, withdrawal from the Leaf River would be reduced or terminated until the Minimum Instream Flow in the Leaf River is reached. During this period, DOE would withdraw from the Gulf of Mexico. If necessary, other possible supplemental sources could be considered in consultation with the regulatory agencies including possible groundwater sources, existing surface water withdrawals from other surface water bodies, and a possible onsite off-stream reservoir. If low flow conditions exist in the Leaf River during emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico and/or from other supplemental sources identified during the consultation process, and, as necessary to reach the proposed Richton oil distribution rate of 1.0 MMBD, from the Leaf River.

Table 3.6.5-1: Potentially Affected Surface Waters, Richton

Water Body Name (and Relevant Segment)	Description	State Designations,[a] Uses, and Impaired Segments
Cavern Site		
Drains to Harper Branch to west	Upland channel; perennial	N/A
Fox Branch to north	Upland channel; perennial	N/A
Pine Branch to south	Upland channel; perennial	N/A
RWI (south to the Leaf River)		
Leaf River (pipeline crosses river and RWI in river)	Upland channel; perennial; New Augusta (closest gauge to site) $7Q_{10}$ is 497 cfs and downstream at Mclain $7Q_{10}$ is 598 cfs	N/A
Bogue Homo	Upland channel; perennial	N/A
Merritt Springs Branch	Upland channel; perennial	N/A
Mill Creek	Upland channel; perennial	• Impaired use for aquatic life support • Types of impairment: biological impairment, nutrients, low DO/organic enrichment, pesticides, salinity, and sedimentation/siltation
Crude Oil Pipeline to Liberty		
Lotts Creek	Upland stream; perennial	N/A
Bogue Homo	Upland channel; perennial	N/A
Gardner Creek	Upland channel; perennial	N/A
Collins Creek	Upland channel; intermittent	• Impaired use for aquatic life support • Types of impairment: nutrients, low DO, pesticides, and sediment/siltation
Silver Creek	Upland channel; perennial	• Impaired use for aquatic life support and secondary recreational contact • Types of impairment: biological impairment, pathogens, nutrients, low DO, pesticides, and sediment/siltation
Upper Little Creek	Upland channel; perennial	• Impaired use for aquatic life support and secondary recreational contact • Types of impairment: biological impairment, nutrients, low DO, pesticides, pathogens, and sediment/siltation
Gully Creek	Upland channel; perennial	N/A
Boggy Prong	Channel through marsh; Intermittent	N/A
Graves Creek	Upland channel; perennial	N/A
Tallahala Creek	Upland channel; perennial; 2004 peak stream flow of 337 cfs	• Impaired use for aquatic life support and secondary recreational contact • Types of impairment: suspended solids, unionized ammonia, metals, pH, bio impairment, nutrients, low DO, pathogens, pesticides, and sediment/siltation
Burleman Branch	Upland channel; intermittent	N/A
Reese Creek	Upland channel; perennial	N/A
Rice Patch branch	Intermittent	N/A

Table 3.6.5-1: Potentially Affected Surface Waters, Richton

Water Body Name (and Relevant Segment)	Description	State Designations,[a] Uses, and Impaired Segments
Jakes Creek	Intermittent	N/A
Little Black Creek	Intermittent	• Impaired use for aquatic life support and secondary recreational contact • Types of impairment: bio impairment, nutrients, low DO, pesticides, pathogens, and sediment/siltation
Parkers Creek	Perennial	N/A
Black Creek	Perennial; 2004 peak stream flow of 1,516 cfs	• Recreation; • Impaired use for aquatic life support and primary and secondary recreational contact • Types of impairment: nutrients, low DO pesticides, pathogens, and sediment/siltation
Perkins Creek	Perennial	N/A
Burketts Creek	Perennial	N/A
Sandy Run	Perennial	N/A
Love Creek	Upland channel; perennial	N/A
Lake Serene	Lake; perennial	N/A
Tangipahoa River	Upland channel; perennial; 2003 peak stream flow of 300 cfs	• Impaired use for aquatic life support and primary and secondary recreational contact • Types of impairment: metals, pH, biological impairment, nutrients, low DO, pesticides, pathogens, and sediment/siltation
Minnehaha Creek	Upland channel; intermittent	• Impaired use for secondary recreational contact • Type of impairment: pathogens
Hominy Creek	Upland channel; perennial	N/A
Martin Creek	Upland channel; intermittent	N/A
Little Tangipahoa River	Upland channel; perennial	• Impaired use for aquatic life support and secondary recreational contact • Types of impairment: bio impairment, nutrients, low DO, pesticides, pathogens, sediment/siltation, and unknown toxicity
Bars Branch	Upland channel; perennial	• Impaired use for aquatic life support • Type of impairment: unknown
Magees Creek	Upland channel; perennial	• Recreation • Impaired use for aquatic life support and primary recreational contact • Type of impairment: nutrients, pesticides, and sediment/siltation
Dry Creek	Upland channel; perennial	• Impaired use for aquatic life support and primary and secondary recreational contact • Type of impairment: biological impairment, pathogens, nutrients, low DO, pesticides, and sediment/siltation

Table 3.6.5-1: Potentially Affected Surface Waters, Richton

Water Body Name (and Relevant Segment)	Description	State Designations,[a] Uses, and Impaired Segments
Leaf River	Upland river; perennial; annual average streamflow is 2,600 cfs	• Impaired use for aquatic life support and primary and secondary recreational contact • Type of impairment: nutrients, pathogens, pesticides, and sediment/siltation
Black Creek	Upland river; perennial	• Wild and scenic river • Recreation • Impaired use for aquatic life support and primary and secondary recreational contact • Type of impairment: pathogens, nutrients, low DO, biological impairment, pesticides, sediment/siltation, suspended solids, thermal modifications, and turbidity
Pearl River	Upland river, primary drainage for area (drainage area at Columbia is 5,720 square miles); perennial; annual average flow is 8,000 to 10,000 cfs	• Recreation • Impaired use for aquatic life support, primary and secondary recreational contact, and fish consumption • Types of impairment: mercury, pathogens, nutrients, low DO, biological impairment, pesticides, pH, sediment/siltation, and suspended solids
Bogue Chitto River	Upland channel, primary drainage for area (drainage area near Tylertown is 492 square miles); Perennial; average annual flow is 500 to 1,000 cfs	• Impaired use for aquatic life support and primary and secondary recreational contact • Types of impairment: biological impairment, low DO, pH, nutrients, pesticides, sediment/siltation, mercury, pathogens, and metals
East Fork Amite River	Upland channel; intermittent	• Impaired use for aquatic life support and primary recreational contact • Types of impairment: biological impairment, low DO, pH, nutrients, pesticides, sediment/siltation, and pathogens
Multi-purpose Pipelines to Pascagoula		
Thompson Creek	Upland channel; perennial	• Impaired use for aquatic life support • Types of impairment: biological impairment, nutrients, low DO/organic enrichment, pesticides, salinity, and sedimentation/siltation
Big Island Branch	Upland channel; perennial	N/A
Gaines Creek	Upland channel; perennial	• Impaired use for aquatic life support • Type of impairment: sediment/siltation
Atkinson Creek	Upland channel; perennial	N/A

Table 3.6.5-1: Potentially Affected Surface Waters, Richton

Water Body Name (and Relevant Segment)	Description	State Designations,[a] Uses, and Impaired Segments
Chickasawhay River	Upland channel; perennial	• Recreation • Impaired use for aquatic life support and primary and secondary recreational contact • Types of impairment: biological impairment, nutrients, sediment/siltation, pesticides, pathogens, suspended solids, pH, and salinity
Several small creeks	N/A	N/A
Big Creek	Upland channel; perennial	N/A
Escatawpa River	Upland channel; perennial; average annual flow is 750 to 1,000 cfs	• Fish and Wildlife with a DO requirement (>3.0 mg/L)
Black Creek	Upland river; perennial	• Recreation • Impaired use for aquatic life support and primary and secondary recreational contact • Types of impairment: pathogens, nutrients, low DO, biological impairment, pesticides, sediment/siltation, suspended solids, thermal modifications, and turbidity
Mill Creek	Upland channel; Perennial	• Impaired use for aquatic life support • Types of impairment: biological impairment, nutrients, low DO/organic enrichment, pesticides, salinity, and sedimentation/siltation
Crane Creek	Channel; perennial	• Impaired use for aquatic life support • Types of impairment: nutrients, pesticides, sediment/siltation
White Creek	Channel; perennial	N/A
Indian Creek	Channel; perennial	• Impaired use for aquatic life support • Types of impairment: biological impairment, nutrients, low DO, pesticides, and other habitat alterations
Big Cedar Creek	Channel; perennial	N/A
Big Oktibee Creek	Channel; perennial	N/A
Waterhole Branch	Channel; perennial	N/A
Holy Creek	Channel; perennial	N/A
McSwain Branch	Channel; perennial	N/A
Courthouse Creek	Channel; perennial	N/A
Wilson Lake	Lake; perennial	N/A

Notes:

[a] All of the waters in the MDEQ's basin approach are classified as Fish and Wildlife. Basin waters carrying other classifications are noted accordingly (MDEQ 2006a).

cfs = cubic feet per second (1 cfs = 0.03 cubic meters per second); DO = dissolved oxygen; $7Q_{10}$ = 7-day, 10-year low flow rate; N/A = not available;

Source: MDEQ 2005

Figure 3.6.5-1: Regional Surface Water Map for Richton Site

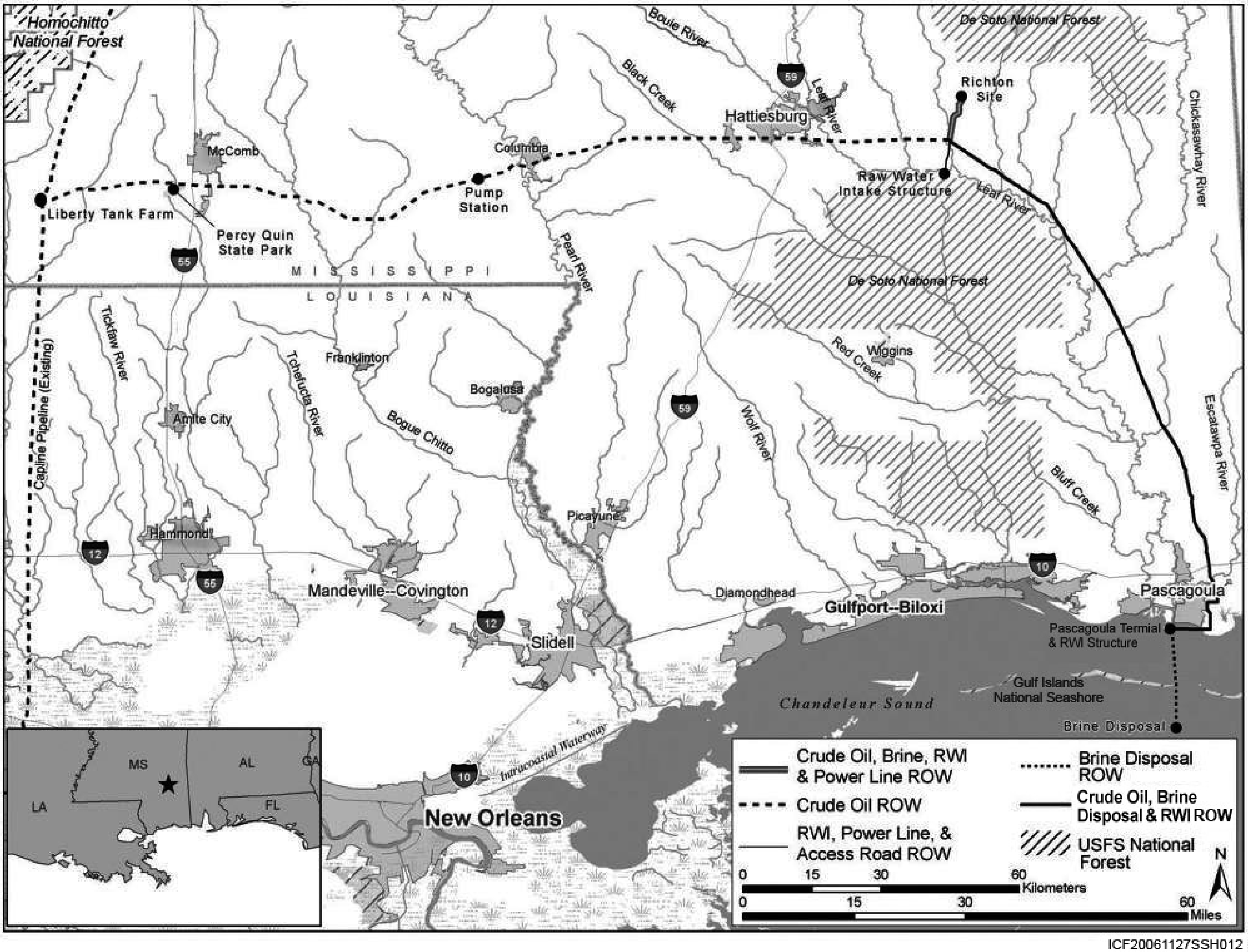
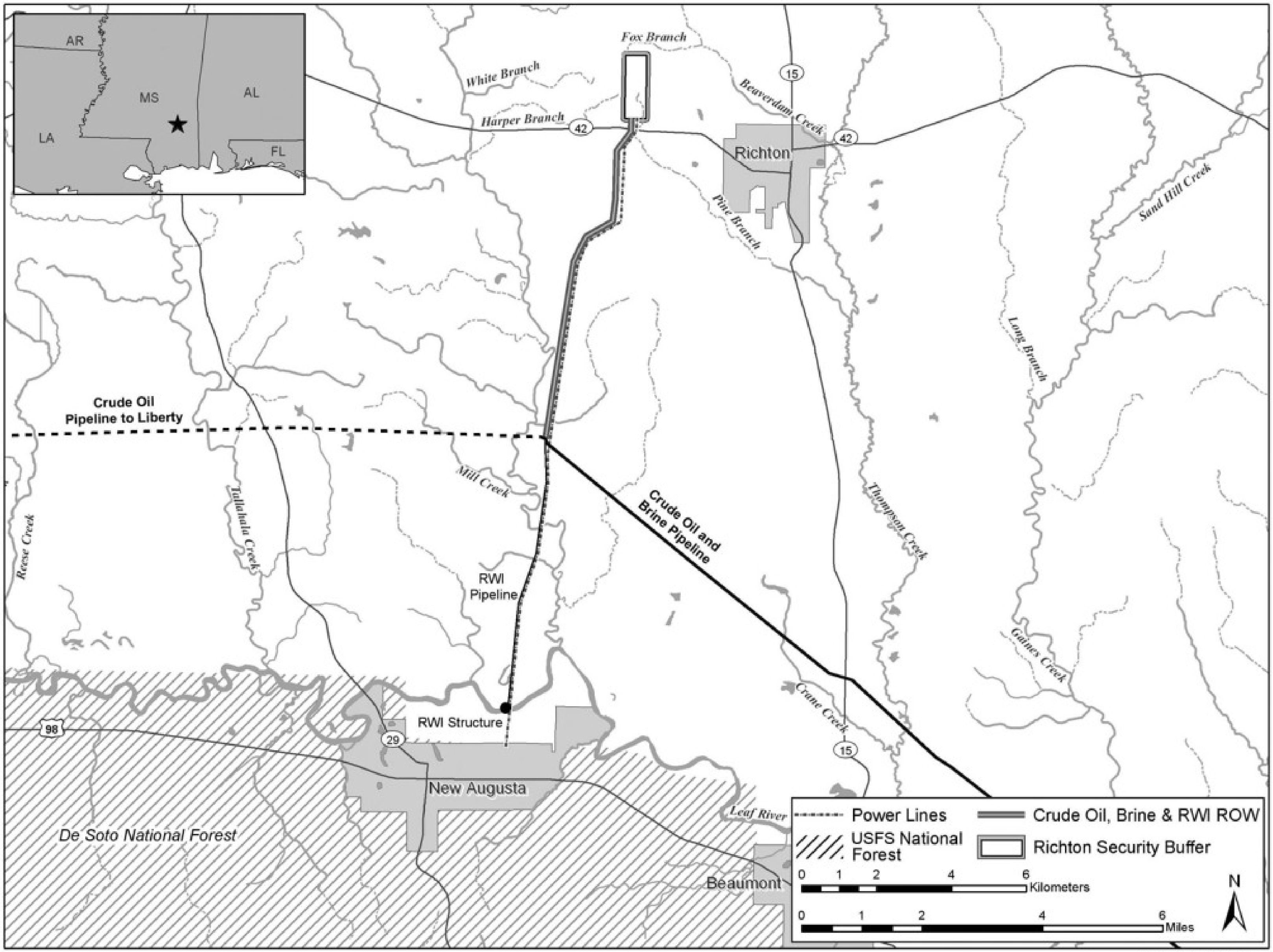


Figure 3.6.5-2: Local Surface Water Map for Richton Site



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The flow rate of the Leaf River is highly variable. From December 1983 to September 1991, discharge of the river at New Augusta ranged from 590 to 74,000 cubic feet per second (17 to 2,100 cubic meters per second). Average discharge for the period was 4,100 cubic feet per second (120 cubic meters per second), average annual minimum and maximum discharges were 720 cubic feet per second (20 cubic meters per second), and 30,100 cubic feet per second (850 cubic meters per second), respectively (DOI 1980).

Mississippi regulations establish the Minimum Instream Flow at which water withdrawal is permitted from State waters. This minimum threshold is set at the **$7Q_{10}$** flow rate (the 7-day, 10-year low flow rate). Only flow in excess of the $7Q_{10}$ can be withdrawn. However, because the Leaf River supports several federally listed species, the Minimum Instream Flow may be set higher to protect these species. More detail is provided on this subject in section 3.7.5. Based on flow data for the period 1939–1991 from stream gauges upstream of the proposed RWI site, MDEQ has estimated a $7Q_{10}$ for the Leaf River at New Augusta of 503 cubic feet per second (14 cubic meters per second). Thus, the river flow rate would have to be at least 581 cubic feet per second (16 cubic meters per second) to allow withdrawal at the full demand rate of 78 cubic feet per second (2.2 cubic meters per second). Over the 52-year period investigated by MDEQ, there were 160 days in which the Leaf River flow rate fell below the $7Q_{10}$. Overall, MDEQ results indicate that flow in the river would be sufficient to meet the raw water demand of the Richton site 99 percent of the time, although there could be dry years during which the river flow would be below the $7Q_{10}$ flow rate for as much as 15 percent of the time (MDEQ 1992). Cavern development, when the maximum amount of raw water would be required, would take up to 5 years unless low flow conditions in the Leaf River limit the water withdrawal and thereby slow down the solution mining process. Based on the 52-year record, it is unlikely that a sustained period of low water would occur during cavern development. However, if it did, additional water would be withdrawn from the Gulf of Mexico for cavern construction.

There are three NPDES permits on record permitting discharge into the Leaf River in the area of the Richton RWI structure. These three sources are permitted to discharge a total of 50,000 gallons per day (0.071 cubic feet or 0.002 cubic meters per second) (EPA 2006c). Reduction in the Leaf River flow associated with raw water withdrawal by the Richton SPR site would reduce the capacity of the river to assimilate wastes. This could result in higher concentrations of wastes in the river water column for waste streams that enter the river immediately downstream of the RWI station. The potential impacts to these discharges would also be considered during the permitting process for the RWI.

According to a permit database search conducted by the MDEQ, Mississippi has issued five current surface water withdrawal permits for the Leaf River. The permitted withdrawal amounts range from 0.0014 cubic feet per second (3.9×10^{-5} cubic meters per second) for livestock usage to 178 cubic feet per second (5.05 cubic meters per second) for industrial use. The total amount of Leaf River water withdrawal currently permitted is approximately 221 cubic feet per second (6.3 cubic meters per second) (Crawford 2006). Additional parties withdraw small amounts of water from the Leaf River, but are not required to obtain withdrawal permits, so there are no data available on these withdrawals (MDEQ 2006c).

The largest user of Leaf River water is the Eaton Plant of the Mississippi Power Company in Petal, MS. This plant is approximately 25 miles upstream of the Richton site. Its permit allows up to 178 cubic feet per second (5.05 cubic meters per second) to be withdrawn from the Leaf River. According to periodic NPDES permit (MS0002917) monitoring, however, the facility returns most or all of the withdrawn water to the river because it is used for cooling purposes. The next largest user of Leaf River water is Leaf River Cellulose, a pulp and paper mill in Richton. Its permit allows for up to 40.23 cubic feet per second (1.14 cubic meters per second) (Crawford 2006). Leaf River Cellulose holds a NPDES permit (MS0031704, as

Georgia Pacific) and, like the Mississippi Power Company, most or all of this water is used for cooling purposes and is recycled back into the river.

Withdrawal of water from the Leaf River for the Richton site would have minimal impacts on the river while it is flowing near or above its average flow rate of 4,100 cubic feet per second (116 cubic meters per second). At such times, raw water withdrawal would constitute less than 2 percent of river flow. However, the river flow can be expected to fall to near or below its average annual minimum discharge rate of 720 cubic feet per second (20 cubic meters per second) at some point every year. At this average annual minimum flow rate, water demand for the Richton site would constitute 11 percent of river flow. Although the probability is relatively low, the possibility exists that the river flow rate could drop to or below the minimum flow rate of 581 cubic feet per second (16 cubic meters per second) that would be required to meet the water demands for cavern development and maintain the minimum flow rate of 503 cubic feet per second (14 cubic meters per second) under the state $7Q_{10}$ regulation. Under this low flow scenario, water would be withdrawn for cavern construction from the Gulf of Mexico.

If one of the Richton alternatives is selected, DOE would apply for a Permit to Withdraw for Beneficial Uses from the Public Waters of Mississippi and coordinate with the Mississippi Office of Land and Water Resources to ensure that Minimum Instream Flows are maintained during the period of withdrawal. The withdrawal would also be coordinated with and permitted by USACE and the USFWS through the Section 404 permit process and the ESA.

DOE has evaluated potential impacts to floodplains in section 3.6.2.1.7 and appendix B. The extent of 100-year and 500-year floodplains in the Richton project area, including the site and pipelines, was determined based on the FEMA Flood Insurance Rate maps covering the project area. The Richton storage site is located in a predominantly undeveloped area with rolling topography. The proposed storage site is not located within the 100-year or 500-year floodplain, but all 49 acres (20 hectares) of the Pascagoula terminal would be located within the 100-year floodplain. Additionally, some of the pipelines do cross floodplains. However, as previously discussed, impacts associated with pipelines would be limited to the construction phase.

> Mitigation: To ensure adequate flow and assimilative capacity in the Leaf River, DOE would commit to withdrawing only that flow that is in excess of the $7Q_{10}$ minimum level during cavern construction. DOE would secure an agreement with Federal and state regulatory agencies that requires water conservation, supplemental sources, or agreements with upstream users to ensure that adequate instream flow is maintained in the river.

3.6.5.1.3 Richton Surface Water: Operations and Maintenance Impacts

Drawdown of oil from the cavern would occur sporadically during the operational phase of the project. If low flow conditions exist in the Leaf River during emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico, from other supplemental sources identified during the consultation process, and from the Leaf River to reach the proposed Richton oil distribution rate of 1.0 MMBD. Under this scenario, water withdrawal from the Leaf River could result in flow below the 7Q10. However, given the analysis of Leaf River flow provided in section 3.6.5.1.2, and the infrequency of drawdown events, it is unlikely that a drawdown event would coincide with drought conditions in the Leaf River.

3.6.5.2 Richton Groundwater

3.6.5.2.1 Richton Groundwater: Affected Environment

In the Richton storage site area, the aquifers are in descending order by depth: the Upper Aquifer, Upper Claiborne, and Wilcox. Each of these aquifers is separated by a very low-permeability confining unit. The salt dome has pushed through the aquifers, so that only the Upper Aquifer is above the dome. It begins just below the surface and extends to a depth of 1,100 feet (350 meters), just slightly above the domal caprock. The groundwater table is approximately 10 to 30 feet (3 to 9 meters) below land surface. The aquifer contains abundant freshwater, which grades with depth to moderately saline water to brine near the salt dome (PB-KBB 1991).

The Upper Claiborne aquifer abuts the side of the salt dome structure, and is characterized by a low permeability of 12 inches (320 millimeters) per year and moderately saline water that grades to brine. The base of the freshwater zone is approximately 590 feet (180 meters) below land surface. The Upper Claiborne is 1,500 to 2,000 feet (460 to 620 meters) below land surface and entirely below the base of the fresh-water zone at the site. The virtually confined Wilcox Aquifer, where not pierced by the dome, extends from approximately 1,900 to 5,300 feet (590 to 1,600 meters) below land surface. The Wilcox groundwater is brackish throughout the basin and very saline to brine near the Richton salt dome.

Groundwater flows south or southeast in each aquifer. In the Upper Aquifer, groundwater flows almost directly to the south, following the down dip of the aquifer toward local discharge into the Leaf River and other streams, and eventual discharge into the Gulf of Mexico.

The Upper Aquifer is the only aquifer used within a 6-mile (10-kilometer) radius of the site. Eight wells in this area tap the Upper Aquifer for a variety of uses—municipal, domestic, agricultural, and industrial purposes. The proposed SPR site does not appear to be within the SWPA for the Richton well field (Dunn 2005).

The pipeline to Liberty River would pass through or adjacent to the following groundwater supplies:

- Upgradient of the SWPA for the town of Quinlivan, MS;
- Downgradient of the SWPA at Fernwood, MS;
- Upgradient of the SWPA in Foxworth, MS;
- Downgradient of the SWPA at Columbia, MS;
- Downgradient of the SWPA at Oak Grove, MS;
- Through the SWPA at Pine Grove, MS; and
- Through the SWPA at Tylertown, MS.

The pipeline to Pascagoula would pass through or run adjacent to the following groundwater SWPA:

- Adjacent to the SWPA at Central, MS;
- Adjacent to the SWPA at Helena, MS; and
- Through the SWPA at Pascagoula, MS.

3.6.5.2.2 Richton Groundwater: Construction Impacts

The potential groundwater impacts associated with construction of the proposed Richton site and infrastructure are as described in the section 3.6.2.2. Although pipelines would be constructed through and adjacent to several groundwater SWPA areas, as described above, the probability of contaminant discharge during pipeline and facility construction is very low. There would be no brine disposal wells at this site, and wells installed to support cavern dissolution at the SPR facility would be grouted and pressure-tested to assure that leaks would not occur.

Four new oil storage tanks would be constructed at each of the Pascagoula and Liberty terminals. Construction of these tanks would not impact groundwater resources. Potential impacts from these types of tanks are discussed in the section 3.6.2.1.5. The tanks would be constructed with berms to avoid discharge and would be integrity-tested on a regular basis. Also, they would be used for buffering capacity, and only filled at specific times during cavern drawdown and filling.

3.6.5.2.3 Richton Groundwater: Operations and Maintenance Impacts

Potential sources of groundwater contamination include the brine ponds and pipelines, leakage of oil from the storage caverns, and other material spills. Potential impacts of each of these sources associated with the Richton site are comparable to those described above for construction and in section 3.6.2.2.

Discharge during operations and maintenance from the new oil storage tanks at Pascagoula and Liberty is unlikely. These tanks would be used as buffer for capacity, and would only be filled with oil during selected operational events, such as drawdown or cavern filling.

3.6.6 Stratton Ridge Storage Site

The Stratton Ridge site would involve the following activities:

- Construction and operation of 16 storage caverns for a combined capacity of 160 MMB and associated facilities including a wastewater treatment plant and access road;
- Construction and operation of a raw water pipeline and an intake structure on the ICW;
- Construction and operation of two brine ponds, a brine disposal pipeline, and brine diffuser discharge system in the Gulf of Mexico, including an offshore section with diffuser; and
- Construction and operation of a pipeline to Texas City, an extension to BP Facility, and a new tank farm in Texas City.

The following sections describe the potentially affected water resources and potential impacts specific to the Stratton Ridge storage site and associated infrastructure. The general impacts described in section 3.6.2 also apply to the Stratton Ridge site.

3.6.6.1 Stratton Ridge Surface Water

3.6.6.1.1 Stratton Ridge Surface Water: Affected Environment

The westernmost of the candidate new sites, Stratton Ridge would be located approximately 7 miles (11 kilometers) from the Texas shoreline. It is located east of the mouth of the Brazos River in the San Jacinto-Brazos Coastal Basin, within the Austin-Oyster Creek watershed. The site drains into Oyster Creek to the south. Oyster Creek flows through the urban areas of Lake Jackson and Clute, and then southeast through the coastal marshes to the Gulf of Mexico. No perennial streams were observed on the site during an October 2005 site visit. However, there was evidence of temporary water channels during periods with greater amounts of precipitation. One permanent small pond less than 1 acre (0.4-hectares) in size is located in the northwestern corner of the site (Fisher, et al. 1972).

3.6.6.1.2 Stratton Ridge Surface Water: Construction Impacts

The general impacts to surface water discussed in section 3.6.2.1 are applicable to the proposed Stratton Ridge site. Specific surface water bodies that could be affected by the proposed site are listed in table 3.6.6-1 and primary water bodies are shown in figure 3.6.6-1.

The predominant surface water quality problems in the San Jancinto-Brazos Coastal Basin are elevated fecal coliform bacteria and depressed dissolved oxygen levels (H-GAC 2005). The tidal portion of Oyster Creek has experienced a fish kill in the past due to low-oxygen conditions and has previously been listed on Texas's 303d list for elevated bacteria levels (TCEQ 2004c). Other streams within the coastal basin have elevated levels of nitrogen, phosphorus, metals, VOCs, and suspended sediments (TCEQ 2004c).

The proposed Stratton Ridge site and associated pipelines would be located in the coastal marshlands of Texas, except where the Texas City oil pipeline would enter the developed area as it approaches the terminal. Except for the ICW, most of the water bodies that would be crossed by pipelines are small. DOE would use directional drilling to lay pipeline below the ICW to minimize impacts during construction.

The Stratton Ridge site would withdraw raw water from the ICW. Potential impacts associated with this withdrawal are addressed in section 3.6.2.1.1 and would be insignificant.

The potential effects of discharging brine through diffusers into the Gulf of Mexico are discussed in section 3.6.2.1.2. Potential impacts were modeled based on monitoring data at operating SPR brine diffuser sites in the Gulf of Mexico, and the impacts from Stratton Ridge discharge would be localized.

The potential impacts of floodplains associated with the Stratton Ridge project is discussed in section 3.6.2.1.7 and in Appendix B. The extent of 100-year and 500-year floodplains in the project area, including the site and pipelines, was determined based on the FEMA flood insurance rate maps covering the project area. The Stratton Ridge storage site is located in a predominantly undeveloped wetland area. Table 3.6.6-2 provides a summary of the floodplains located within the project area.

Table 3.6.6-2: Total Area of Floodplains Affected by Stratton Ridge Storage Site

Floodplain	Area (acres)[a]	Area (hectares)[a]
100-year	140	55
500-year	190	75
Total [b]	**330**	**130**

Notes:

[a] Numbers have been rounded to two significant figures
[b] Numbers may not equal total due to rounding

All of the Stratton Ridge site lies within either the 100-year or the 500-year floodplain. A portion of the offsite pipeline construction would occur within a floodplain, but would only result in temporary impacts during construction. The floodplain in which the Stratton Ridge site is located extends over hundreds of square miles, and is part of the San Jacinto-Brazos Coastal Basin.

Table 3.6.6-1: Potentially Affected Surface Waters, Stratton Ridge

Water Body Name (and Relevant Segment)	Description	State Uses, Categories[a], and Impaired Segments
Cavern Site		
Oyster Creek (runs along southern property boundary)	Stream through marsh; primary drainage for the area; perennial	• Aquatic life use, contact recreation use, general use, fish consumption use, and public water supply use • Category 5b: aquatic life use not supported in 2004 due to depressed DO
Several isolated ponds present within the proposed facility footprint	N/A	N/A
RWI to Intracoastal Waterway		
Ridge Slough	Channel through marsh; intermittent	N/A
Bastrop Bayou	Channel through marsh; intermittent	• Aquatic life use, contact recreation use, general use, and fish consumption use • No category listed: aquatic life, contact recreation, and general uses are fully supported, but the fish consumption use was not assessed
Little Slough	Channel through marsh; perennial	N/A
Intracoastal Waterway	Major commercial and recreational waterway; USACE maintains navigable depths in the waterway through dredging and locks; perennial	• Used for both recreational boating and for commerce • Primary and secondary contact recreation and propagation of fish and wildlife • Has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods
Salt Bayou	Channel through marsh; intermittent	N/A
Essex Bayou	Channel through marsh; intermittent	N/A
Brine Disposal Pipeline Gulf of Mexico		
Bastrop Bayou	Channel through marsh; intermittent	• Aquatic life use, contact recreation use, general use, and fish consumption use • No category listed: the aquatic life, contact recreation, and general uses are fully supported, but the fish consumption use was not assessed
Little Slough	Channel through marsh; perennial	N/A
Ridge Slough	Channel through marsh; intermittent	N/A
Intracoastal Waterway	Major commercial and recreational waterway; USACE maintains navigable depths in the waterway through dredging and locks; perennial	• Used for both recreational boating and for commerce • Primary and secondary contact recreation and propagation of fish and wildlife • Has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods
Salt Bayou	Channel through marsh; intermittent	N/A
Essex Bayou	Channel through marsh; intermittent	N/A

Table 3.6.6-1: Potentially Affected Surface Waters, Stratton Ridge

Water Body Name (and Relevant Segment)	Description	State Uses, Categories[a], and Impaired Segments
Crude Oil Pipeline to Texas City (Parallel to Existing DOE Pipeline)		
Halls Bayou	Channel through marsh; perennial	• Aquatic life use, contact recreation use, fish consumption use • Category 5a: contact recreation use not supported in 2004 due to bacteria.
Willow Bayou	Channel through marsh; intermittent	N/A
Highland Bayou	Channel through marsh; intermittent	• Aquatic life use, contact recreation use, and fish consumption use • Category 5c: contact recreation use not supported and aquatic life use partially supported in 2002 due to bacteria and low dissolved oxygen. Fish consumption use was not assessed in 2002.
Austin Bayou	Channel through marsh; intermittent	N/A
Chocolate Bayou	Channel through marsh; perennial; annual average drainage flow = 88 cfs in 2003	• Aquatic life use, contact recreation use, and fish consumption use • No category listed: the aquatic life, contact recreation, and general uses are fully supported, but the fish consumption use was not assessed • Low DO killed 10,000 fish in 1998
Big Slough	Channel through marsh; intermittent	N/A
Bastrop Bayou	Channel through marsh, intermittent	• Aquatic life use, contact recreation use, general use, and fish consumption use • No category listed: the aquatic life, contact recreation, and general uses are fully supported, but the fish consumption use was not assessed
New Bayou	Channel through marsh; intermittent	N/A
Cottonwood Bayou	Channel through marsh; perennial	• Maintain waterfowl habitat
Persimmon Bayou	Channel through marsh; intermittent	N/A
Little Slough	Channel through marsh; perennial	N/A

Notes:

[a] Texas Commission on Environmental Quality (TCEQ) assigns each assessed water body to one of five categories to provide information to the public, EPA, and internal agency programs about water quality status and management activities. The categories indicate the status of the water body, how the state would approach identified water quality problems, and include the following:

Category 1 – Attaining the water quality standard and no use is threatened.

Category 2 – Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened.

Category 3 – Insufficient or no data and information to determine if any designated use is attained.

Category 4 – Standard is not supported or is threatened for one or more designated uses but does not require development of a Total Maximum Daily Load (TMDL).

Category 4a – TMDL has been completed and approved by EPA.

Category 4b – Other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future.

Category 4c – Nonsupport of the water quality standard is not caused by a pollutant.

Category 5 – The water body does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants. Category 5 water bodies comprise the 303(d) List.

Category 5a – A TMDL is under way, is scheduled, or will be scheduled.

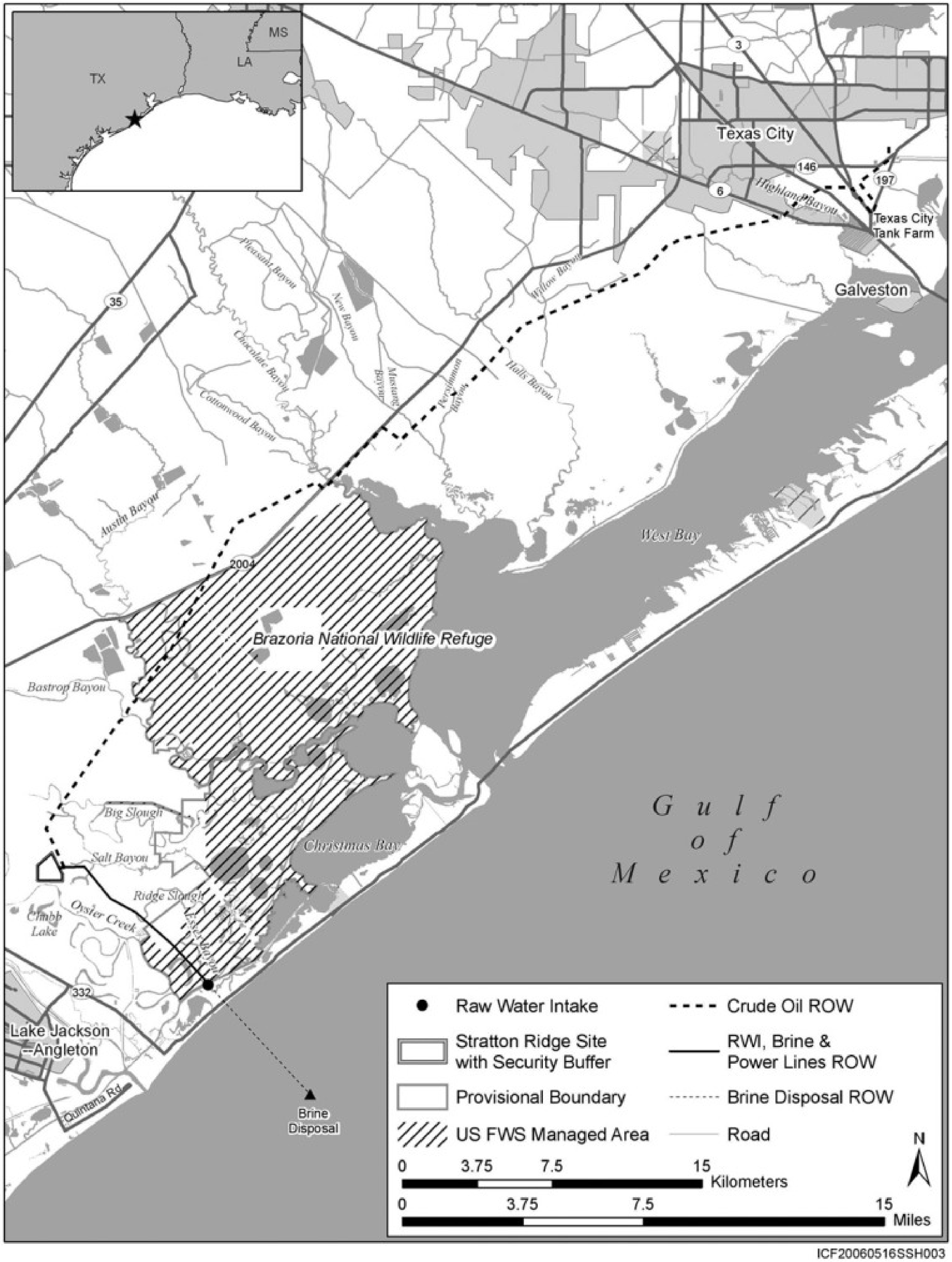
Category 5b – A review of the water quality standards will be conducted before a TMDL is scheduled.

Category 5c – Additional data and information will be collected before a TMDL is scheduled.

DO = dissolved oxygen; cfs = cubic feet per second (1 cfs = 0.03 cubic meters per second); N/A = not available

Source: TCEQ 2004a

Figure 3.6.6-1: Regional Surface Water Map for Stratton Ridge Site



3.6.6.1.3 Stratton Ridge Surface Water: Operations and Maintenance Impacts

Potential impacts from operations and maintenance are similar to those from construction. Brine would be discharged to the Gulf of Mexico and raw water would be taken from the ICW during the operational phase, although at lower rates than during the construction phase.

3.6.6.2 Stratton Ridge Groundwater

3.6.6.2.1 Stratton Ridge Groundwater: Affected Environment

Ground surface elevation at the proposed SPR site is approximately 17 feet (5.2 meters) above sea level. Table 3.6.6-3 characterizes the aquifer system underlying Stratton Ridge. The Upper Chicot is an important aquifer in the region, is the most widespread source of fresh groundwater in Brazoria County, and the only one in the Stratton Ridge area. It is primarily used for irrigation and aquaculture, and there has been concern about decreasing water levels in the Chicot Aquifer over the past decade.

Table 3.6.6-3: Aquifers Underlying the Proposed Stratton Ridge SPR Site Area

Aquifer	Depth to Top of Aquifer (depth below land surface)	Overlying Soils/ Permeability (centimeters/second)[a]	Water Quality; Degree of Salinity[b]
Upper Chicot	10 feet (3 meters)	Beaumont clays at surface; $5.0x10^{-5}$ at surface to $9.0x10^{-2}$ in sands	Fresh water to slightly saline
Lower Chicot	300 feet (90 meters)	Discontinuous clay beds; sands, $1.0x10^{-2}$	Slightly saline to saline
Evangeline	Away from dome 1,100 feet (340 meters)	Clay beds, join intermittently; $1.0x10^{-2}$ average in sands	Saline to brine
Jasper (Miocene)	Away from dome > 2,000 feet (> 600 meters)	Burkeville aquiclude; highly impermeable	Saline to brine

Notes:

[a] 1 centimeter = 0.394 inches
[b] Salinity determined by dissolved solids content, in parts per thousand (ppt): Fresh water, Less than 1 ppt; Slightly saline, 1–3 ppt; Moderately saline, 3–10 ppt; very saline, 10–35 ppt; brine, more than 35 ppt

3.6.6.2.2 Stratton Ridge Groundwater: Construction Impacts

All of the general groundwater impacts discussed in section 3.6.2.2 are applicable to the proposed Stratton Ridge site.

The oil pipeline to Texas City would pass adjacent to or through the following groundwater source areas:

- The 100-year capture zone for the public water system in Hitcock, TX (in the vicinity of the Texaco City Terminal);
- The Area of Primary Influence for the Peterson Landing, TX public water system; and
- The Oyster Creek public water system in Oyster, TX (Owojori 2006).

The brine pipeline to the Gulf of Mexico and the RWI pipeline would pass adjacent to or through four public water systems in Oyster Creek, TX. Freeport, a major center of development, is located 6.0 miles (9.7 kilometers) south of the site, and reportedly draws their drinking water from the Brazos River (Meeks

2005). However, some residents in the smaller coastal towns in the vicinity of the project, including Liverpool, Danbury, Angleton, Lake Jackson, Clute, and Oyster Creek, draw water from wells. Groundwater in the area is also used for rice farm irrigation, livestock, and industry.

The underlying Chicot Aquifer is an important groundwater resource, and any potential contaminant discharges from the SPR could result in degradation of water quality. However, best management practices outlined in section 3.6.2.2 should mitigate such an occurrence. Overall, the probability of discharges along the brine or oil pipelines is low, and there should be no impacts to these groundwater uses.

3.6.6.2.3 Stratton Ridge Groundwater: Operations and Maintenance Impacts

Potential impacts due to operations and maintenance activities at Stratton Ridge are discussed in section 3.6.2.2. The site-specific factors affecting any impacts are discussed above for construction impacts.

3.6.7 Bayou Choctaw Storage Site and Associated Infrastructure

Proposed expansion of the Bayou Choctaw site would include the following activities:

- Construction of two new storage caverns and associated well pads and access roads;

- Possible additional acquisition of one existing storage cavern and minor upgrades of existing infrastructures used, which would include new roads, bridge replacement, and modifications to onsite pipelines;

- Expansion of the capacity of the existing RWI system, which currently withdraws water from Cavern Lake located north of the site;

- Construction of an offsite brine disposal pipeline and six new brine injection wells; and

- Installation of new onsite pipelines.

The following sections describe the potentially affected water resources and potential impacts specific to the Bayou Choctaw storage site and associated infrastructure. The common impacts described in section 3.6.2 also apply to the Bayou Choctaw site.

3.6.7.1 Bayou Choctaw Surface Water

3.6.7.1.1 Bayou Choctaw Surface Water: Affected Environment

The proposed expansion of Bayou Choctaw site includes new cavern and road construction activities at the existing SPR site, a new offsite brine pipeline and brine injection wells south of the existing SPR site, and an increase in RWI and brine discharge. Surface water bodies that could potentially be affected by development of the Bayou Choctaw site include the following:

- Cavern Lake and connected surface water bodies near the point of RWI; and
- Various streams and bayous draining the inland Bayou Choctaw site.

The Bayou Choctaw SPR site, brine pipeline, and brine injection wells are located in the east-central portion of Iberville Parish and the Louisiana portion of the Western Gulf Coastal Plain Province. This low-lying area, approximately 5 feet (1.5 meters) above sea level, is composed of the Mississippi River floodplain, coastal marshes, and a series of Pleistocene terraces and low hills. The undeveloped portions of the Bayou Choctaw SPR site consist of forested (cypress swamp) and open-water wetlands connected to Bull Bay and Bayou Bourbeaux west of the site.

Bayou Bourbeaux and several small canals are connected to the forested and open-water wetlands on the SPR site and drain excess water from the site into Bull Bay and wetlands in the southern portion of the site that extend to the south. These surface water bodies drain into the ICW (also called Bayou Choctaw) to the west, and to the marsh to the south via drainage streams.

Additionally, a manmade pond, Cavern Lake, is located at the site, adjacent to Bayou Bourbeaux. This pond resulted from the collapse of former Cavern No. 7. The pond is approximately 26 meters (85 feet) deep with a surface area of about 12 acres (4.9 hectares), and is connected to the ICW via a canal. It is assumed that the lake is conical in shape containing a volume of 338 acre-feet (4.17 x 10^5 cubic meters) of water (DOE 1978b).

3.6.7.1.2 Bayou Choctaw Surface Water: Construction Impacts

The proposed Bayou Choctaw expansion project would utilize existing facilities, develop two new storage caverns and possibly also acquire an existing third cavern. Offsite construction would include installing a new brine disposal pipeline and adding six new brine injection wells to the existing brine injection well network. All of the potential impacts general to SPR sites listed in section 3.6.2.1 are applicable to Bayou Choctaw. Bayou Choctaw would inject brine into the subsurface and would not discharge to the Gulf of Mexico, as discussed below. Potential impacts of extracting raw water from an onsite lake are described below.

Surface waters that could potentially be affected by the project are listed below in table 3.6.7-1 and shown in figure 3.6.7-1. The facility site is located within a swampy area. The brine pipeline would originate from the existing brine injection wells and extend to the new area; no specific surface water bodies would be crossed by the brine disposal pipeline.

The Bayou Choctaw SPR facility would have a maximum raw water demand of 0.615 MMBD to achieve the planned maximum drawdown rate. Raw water demand during leaching would be considerably lower at 0.110 MMBD. Raw water for the site would be withdrawn from Cavern Lake, which would be replenished by flow from the ICW by way of two canals (the north-south and east-west canals) that connect Cavern Lake to the ICW.

Potential impacts to these surface waters associated with raw water withdrawal for the Bayou Choctaw site were studied in detail in the 1976 EIS for the Bayou Choctaw SPR facility (DOE 1976 and appendix G.1). This study assumed a water withdrawal rate of 0.667 MMBD. Based on the 1976 study, maximum depth change (height differentials) in any of the affected bodies of water resulting from raw water withdrawal would be in the order of several thousandths of a foot (i.e., less than a millimeter). Flow velocities induced by RWI would range from 0.18 feet per second (0.20 kilometers per hour) in the north-south canal, to 0.23 feet per second (0.25 kilometers per hour) in the ICW. The raw water withdrawal would slightly affect salinity levels in Cavern Lake and possibly in the smaller connecting water bodies (north-south canal, east-west canal). Modeling conducted for the 1976 EIS (DOE 1976) indicates that overall salinity changes would be less than 1 part per thousand in Cavern Lake.

DOE has evaluated the potential impacts to floodplains in section 3.6.2.1.7 and appendix B. Because the entire site is located within the 100-year floodplain and the undeveloped portions consist of forested and open water wetlands, construction of all new onsite and offsite pipelines and brine disposal wells would

Table 3.6.7-1: Potentially Affected Surface Waters, Bayou Choctaw

Water Body Name (and Relevant Segment)	Description	State Designations,[a] Uses, and Impaired Segments
Cavern Site		
Drained by several creeks flowing through and around site into wetlands on southern portion of site and to the south, and then into Bayou Choctaw (ICW). The site is at 5 feet (1.5 meters) above sea level.	Creeks through marsh; perennial	N/A
Cavern Lake	Manmade pond resulting from the collapse of former Cavern No. 7; connected to the ICW via canal	N/A
Bayou Bourbeaux runs north-south through site	Creek through marsh; perennial	N/A
Bull Bay (drains Bayou Bourbeaux west of site)	Coastal bay	N/A
RWI (only flow increase, no new pipeline)		
Intracoastal Waterway (also called Bayou Choctaw)	Major commercial and recreational waterway	• Used for both recreational boating and for commerce • Primary and secondary contact recreation and propagation of fish and wildlife • Has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods • USACE maintains navigable depths in the waterway through dredging and locks

Notes:

[a] State designations are defined as:

Primary Recreation: "any recreational or other water use in which there is prolonged and intimate body contact with the water involving considerable risk of absorbing waterborne constituents through the skin or of ingesting constituents from water in quantities sufficient to pose a significant health hazard."

Secondary Recreation: "any recreational or other water use in which body contact with the water is either incidental or accidental, and in which the probability of ingesting appreciable quantities of water is minimal."

Fish and Wildlife Propagation: "the use of water for aquatic habitat, food, resting, reproduction, cover, and/or travel corridors for any indigenous wildlife and aquatic life species associated with the aquatic environment. This use also includes the maintenance of water quality at a level that prevents damage to indigenous wildlife and aquatic life species associated with the aquatic environment and contamination of aquatic biota consumed by humans."

Drinking Water Supply: "refers to the use of water for human consumption and general household use."

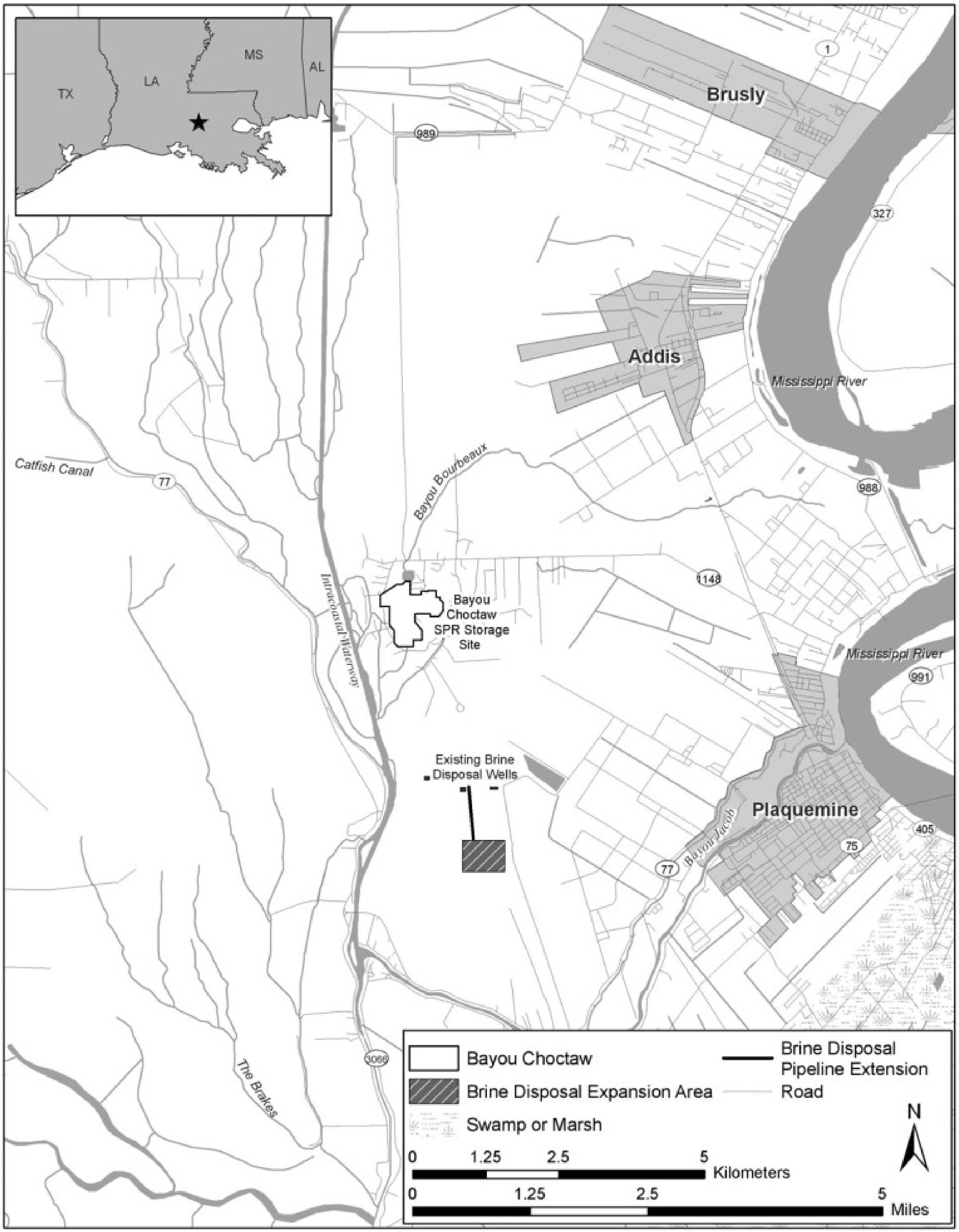
Oyster Propagation: "the use of water to maintain biological systems that support economically important species of oysters, clams, mussels, or other mollusks so that their productivity is preserved and the health of human consumers of these species is protected."

Agriculture: "the use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption."

Outstanding Natural Resource Waters: "include water bodies designated for preservation, protection, reclamation, or enhancement of wilderness, aesthetic qualities, and ecological regimes, such as those designated under the Louisiana Natural and Scenic Rivers System or those designated by the department as waters of ecological significance. Characteristics of outstanding natural resource waters include, but are not limited to, highly diverse or unique in stream and/or riparian habitat, high species diversity, balanced trophic structure, unique species, or similar qualities."

Source: LDEQ 2005

Figure 3.6.7-1: Local Surface Water Map for Bayou Choctaw Site



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occur within the floodplain. Construction of the pads for the two new caverns and the new access roads would require filling approximately 5 acres (2 hectares) of floodplains. The floodplain in which the Bayou Choctaw site is located is an extensive floodplain, part of the West Gulf Coastal Plain. Table 3.6.7-2 provides a summary of the floodplains located within the project area.

Table 3.6.7-2: Total Area of Floodplains Affected by Bayou Choctaw Storage Site

Floodplain	Area (acres)[a]	Area (hectares)[a]
100-year	24	10
500-year	N/A	N/A
Total	**24**	**10**

[a] Numbers have been rounded to two significant figures

3.6.7.1.3 Bayou Choctaw Surface Water: Operations and Maintenance Impacts

The potential impacts on surface water from the expanded Bayou Choctaw site would be similar to those described above for construction. The RWI would be operational during the life of the facility.

3.6.7.2 Bayou Choctaw Groundwater

3.6.7.2.1 Bayou Choctaw Groundwater: Affected Environment

In the Bayou Choctaw Dome area, the subsurface water system is principally comprised of Pleistocene-aged, interconnected freshwater bearing sands that form the Plaquemine artesian aquifer system. The Plaquemine aquifer is highly permeable with porosities of 40 percent and permeability coefficients of approximately 1,000 to 2,000 gallons per day (3.8 to 7.6 cubic meters per day). The aquifers in the vicinity of the Bayou Choctaw site are able to deliver large quantities of slightly-to-moderately-saline water (DOE 1978b, pp. 3.2-8, 3.2-9). Although the underlying aquifer is an important groundwater resource, there are no Groundwater Protection Areas in the vicinity of the Bayou Choctaw site, indicating that groundwater use is fairly limited in this geographic area, especially as a potable source.

According to the Louisiana Department of Transportation and Development water well registry, a number of groundwater wells are located in the vicinity of the Bayou Choctaw site (LADOTD 2005). The identified wells are primarily screened at depths ranging from approximately 120 to 250 feet (37 to 76 meters) below ground surface, and consist of industrial, rig supply, and public supply wells. Some shallower monitoring wells are installed at depths ranging from 3 to 40 feet (0.91 to 12 meters) below ground surface. Groundwater depths reported from the identified wells generally range from 1 to 5 feet (0.30 to 1.5 meters) below ground, and have reported well yields up to 2.7 cubic feet per second (0.076 cubic meters per second).

3.6.7.2.2 Bayou Choctaw Groundwater: Construction Impacts

The general impacts to groundwater discussed in section 3.6.2.2 are applicable to the Bayou Choctaw site. Although the aquifer underlying the site is used as a drinking water supply by Baton Rouge to the northeast, groundwater from the site is expected to flow toward the ICW to the west and to the marsh to the south. Thus, any contaminant discharges from the site should not impact groundwater quality in Baton Rouge. There would be no use of groundwater for this proposed candidate alternative.

Proposed new and existing injection wells would be used to dispose of brine from cavern development. The Bayou Choctaw proposed expansion would utilize the existing brine disposal injection system with the addition of a new, brine filtration system and six new injection wells.

The brine would be disposed of via injection into subsurface saline strata at two injection areas located south of the dome. The existing system is comprised of a well field with 10 disposal wells and was designed to accommodate a maximum of 0.01 MMB per hour of displaced brine. The proposed new injection area would be located approximately 3,000 feet (900 meters) south of the existing area and would inject brine into the same receiving formation. According to previous studies, the proposed receiving formation for injection of brine ranges in depths from 5,000 to 7,000 feet (1,500 to 2,100 meters), which is significantly below any aquifers containing fresh or slightly saline water. (DOE 1978b, pp. A.4-10, C.6-8). The aquifers used for potable water and those used for brine injection are confined aquifers that are separated by impermeable strata. The potential impacts of brine disposal in the existing disposal wells has been extensively studied in previous EIS studies (DOE 1976; DOE 1978b) and were found to be minimal. Therefore development of six new brine disposal wells that would inject brine into the same formation would result in minimal impacts on groundwater. The brine disposal rate would remain at the permitted rate of 0.110 MMBD. Thus, impacts to groundwater associated with the disposal of brine by deep well injection would be minimal.

According to the USGS, large withdrawals from the aquifer system in the Baton Rouge area have altered groundwater flow patterns. Saltwater now encroaches into formerly fresh-water areas and local officials are concerned about the impacts of increasing salinities on public water supplies (USGS 1999). The proposed Bayou Choctaw project would not contribute to saltwater encroachment into fresh groundwater resources, since the brine would be injected into the deep saline strata, far below fresh groundwater. Also, the aquifers used for potable water and those used for brine injection are confined aquifers that are separated by impermeable strata (DOE 1976; DOE 1978b).

3.6.7.2.3 Bayou Choctaw Groundwater: Operations and Maintenance Impacts

Potential impacts due to operations and maintenance at Bayou Choctaw would be similar to those described above for the construction phase. Use of brine injection wells would continue through the operational phase.

3.6.8 Big Hill Storage Site and Associated Infrastructure

The Big Hill site would take advantage of the existing infrastructure, but still require an expansion or upgrade of several major systems, including the following activities:

- Construction and operation of new storage caverns;
- Installation of a new RWI and injection pumps as well as new motors to the existing RWI system, which draws water from the ICW;
- Construction of an additional anhydrite pond for brine disposal adjacent to the existing ponds;
- Replacement of a segment of the existing brine pipeline to repair corrosion damage;
- Construction and operation of pipeline to Sun Terminal in Nederland and new onsite oil injection pumps; and

- Site-support facilities including construction of a security fence, clearing a security buffer beyond the security fence, and construction of access roads.

The following sections describe the potentially affected water resources and potential impacts specific to the Big Hill storage site and associated infrastructure. The general impacts described in section 3.6.2 also apply to the Big Hill site.

3.6.8.1 Big Hill Surface Water

3.6.8.1.1 Big Hill Surface Water: Affected Environment

The existing Big Hill SPR site is located within the Neches-Trinity Coastal Basin in the Texas portion of the Gulf Coastal Plain Province. The proposed cavern expansion site is located on a local topographic high between elevations of 10 to 30 feet (3 to 9 meters) above sea level. DOE would construct 8, 10, or 12 MMB caverns to expand capacity by 80 or 96 MMB. Surface drainage is toward a pond and unnamed stream to the north and a wetland-stream complex to the south.

The predominant surface water quality problems for the Neches-Trinity Coastal Basin include depressed dissolved oxygen levels, high nutrient concentrations, and elevated concentrations of aluminum (Lower Neches Valley Authority (LNVA 2004). These deficiencies are related to the sluggish water flow, point and nonpoint source pollution, and industrial contamination. Most water bodies are designated for fish consumption use, contact recreation, and aquatic life support (TCEQ 2004). The construction of artificial shipping channels and pipeline canals to serve these industries has facilitated saltwater encroachment into previously fresh waters.

3.6.8.1.2 Big Hill Surface Water: Construction Impacts

The particular water bodies in the area are listed below in table 3.6.8-1 and shown in figure 3.6.8-1. The existing brine disposal pipeline runs from the cavern site, crosses the ICW and continues through an extensive coastal marsh complex that includes the McFaddin National Wildlife Refuge to the Gulf of Mexico. Only the initial 1.3 miles (2.1 kilometers) of the brine disposal pipeline would be replaced with the proposed expansion of Big Hill, so construction would not extend into the ICW for the National Wildlife Refuge. The new crude oil pipeline would cross several perennial and intermittent canals and bayous.

Brine would be discharged to the Gulf of Mexico through an existing brine-diffuser system, and potential impacts are described in section 3.6.2.1.2. The most currently available NPDES monitoring report (2003) indicates that discharge water quality is consistently within permit requirements at Big Hill (DOE, 2004f). Brine discharge would result in localized elevations in salinity.

As in the past, the Big Hill site would withdraw raw water from the ICW. Impacts associated with raw water withdrawal from the ICW are addressed in Section 3.6.2.1.1 and would be expected to be minimal.

DOE has evaluated potential impacts to floodplains in section 3.6.2.1.7 and in appendix B. The proposed Big Hill expansion site is located partially in a predominantly undeveloped, extensive floodplain system. However, a large percentage of this proposed expansion site would be located outside of the 100-year and the 500-year floodplain. The proposed expansion would utilize areas that are already built up above the floodplain elevations from previous construction activities. The expansion site would affect 11 acres (5 hectares) of the 100-year floodplain and approximately 27 acres (11 hectares) for the 500-year floodplain associated with the onsite facilities (wellpads, roads, anhydrite pond, and well heads). The

Table 3.6.8-1: Potentially Affected Surface Waters, Big Hill

Water Body Name (and Relevant Segment)	Description	State Uses, Categories[a], and Impaired Segments
Cavern Site		
The cavern site drains to unnamed pond and stream to the north and wetlands-stream complex to the south	N/A	N/A
RWI (flow increase only; no new pipeline)		
Intracoastal Waterway	Major commercial and recreational waterway; USACE maintains navigable depths in the water way through dredging and locks; perennial	• Used for both recreational boating and for commerce • Primary and secondary contact recreation and propagation of fish and wildlife • No category listed: the aquatic life, contact recreation and general uses are fully supported, but the fish consumption use was not assessed in 2004 • Has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods
Spindletop Marsh	Swamp	N/A
Salt Bayou Marsh and Salt Bayou	Swamp	N/A
Brine Disposal Pipeline (upgrade of 7,000 feet)		
Un-named canal	N/A	N/A
Intracoastal Waterway	Major commercial and recreational waterway; USACE maintains navigable depths in the water way through dredging and locks; perennial	• See above; used for both recreational boating and commerce • Primary and secondary contact recreation and propagation of fish and wildlife • No category listed: the aquatic life, contact recreation and general uses are fully supported, but the fish consumption use was not assessed in 2004 • Has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods
Tributary to Star Lake	Marshlands upstream of the McFaddin National Wildlife Refuge	• Areas of concern: nitrate+nitrite nitrogen, depressed DO, orthophosphorus, and total phosphorus
Spindletop Marsh	Swamp	N/A
Salt Bayou Marsh and Salt Bayou	Swamp	N/A
McFaddin National Wildlife Refuge	Extensive coastal marsh	• 55,000-acre national wildlife refuge
Crude Oil Pipeline to Sun Terminal at Nederland (23-mile)		
Several Unnamed canals	N/A	N/A
Taylor Bayou (above tidal)	Lake, perennial	• Aquatic life use, contact recreation use, general use, fish consumption use • Category 5c: aquatic life use not supported in 2004 due to depressed DO

Table 3.6.8-1: Potentially Affected Surface Waters, Big Hill

Water Body Name (and Relevant Segment)	Description	State Uses, Categories[a], and Impaired Segments
Willow Marsh Bayou	Channel through marsh; perennial	• Aquatic life use, contact recreation use, fish consumption use • No category listed: the aquatic life use is fully supported, but the contact recreation and fish consumption uses were not assessed in 2004
Hildebrant Bayou	Channel through marsh, perennial	• Aquatic life use, contact recreation use, general use, fish consumption use • Category 5c: aquatic life use partially supported in 2004 due to depressed DO

Notes:

[a] TCEQ assigns each assessed water body to one of five categories to provide information to the public, EPA, and internal agency programs about water quality status and management activities. The categories indicate the status of the water body, and how the state would approach identified water quality problems:

Category 1 – Attaining the water quality standard and no use is threatened.

Category 2 – Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened.

Category 3 – Insufficient or no data and information to determine if any designated use is attained.

Category 4 – Standard is not supported or is threatened for one or more designated uses but does not require the development of a Total Maximum Daily Load (TMDL).

Category 4a – TMDL has been completed and approved by EPA.

Category 4b – Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.

Category 4c – Nonsupport of the water quality standard is not caused by a pollutant.

Category 5 – The water body does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants. Category 5 water bodies comprise the 303(d) List.

Category 5a – A TMDL is under way, is scheduled, or will be scheduled.

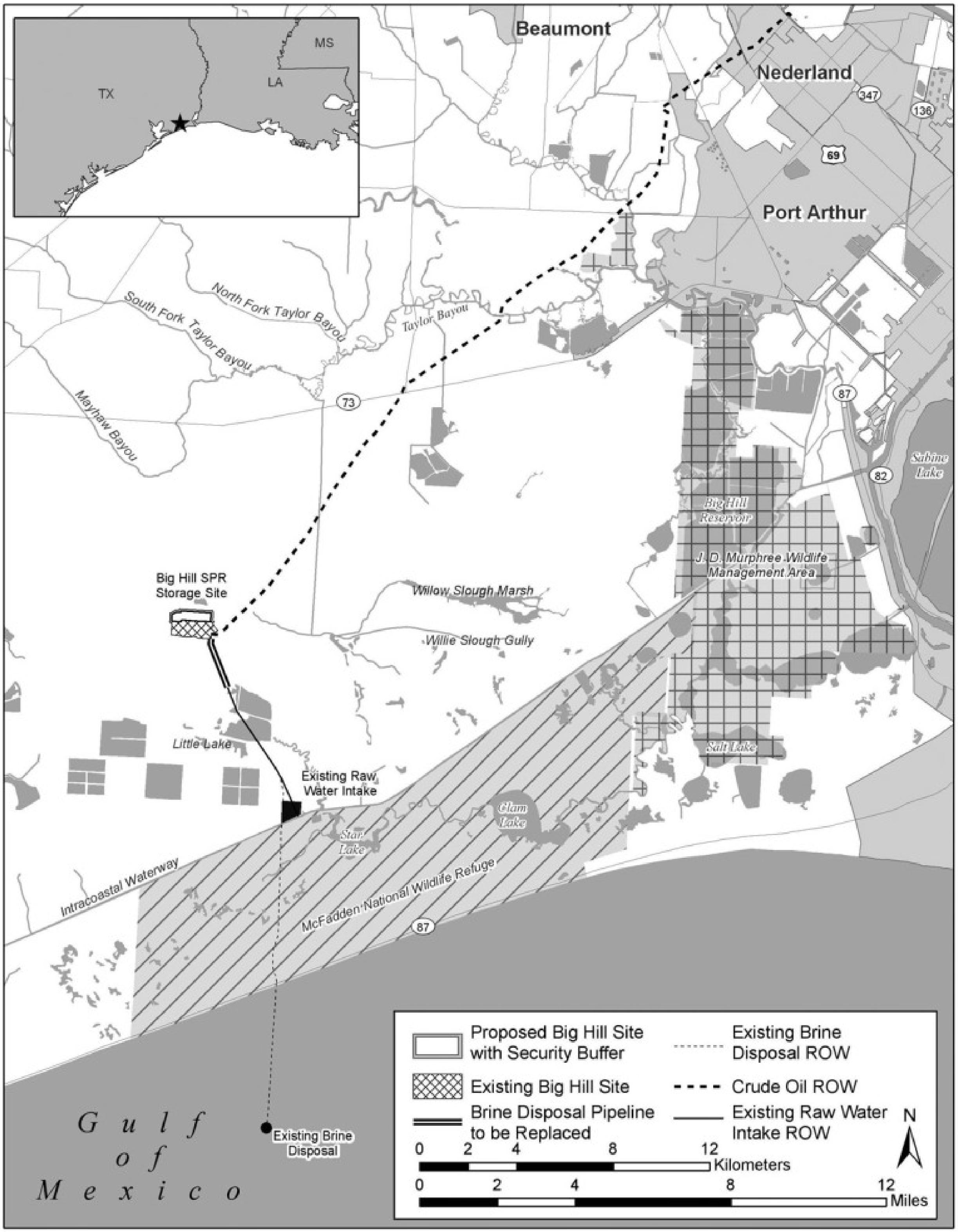
Category 5b – A review of the water quality standards will be conducted before a TMDL is scheduled.

Category 5c – Additional data and information will be collected before a TMDL is scheduled.

DO = dissolved oxygen; N/A = not available; 1 acre = 0.404 hectare; 1 foot = 0.30 meters; 1 mile = 1.609 kilometers

Source: TCEQ 2004a

Figure 3.6.8-1: Regional Surface Water Map for Big Hill Site



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floodplain in which the Big Hill site is located extends over hundreds of square miles, and is part of the Neches-Trinity Coastal Basin.

3.6.8.1.3 Big Hill Surface Water: Operations and Maintenance Impacts

Operations and maintenance activities would have the same potential impacts as described above for the construction phase and in section 3.6.2.1. The RWI and the Gulf of Mexico brine discharge diffuser would also be active during the operational phase.

3.6.8.2 Big Hill Groundwater

3.6.8.2.1 Big Hil Groundwater: Affected Environment

Table 3.6.8-2 characterizes the aquifers underlying the Big Hill site. The groundwater surface varies from a depth of approximately 6.6 feet (2.0 meters) below land at the center of the hill to almost ground level near the base of the hill 26 feet (8.0 meters) above sea level. The fresh water base of the upper unit of the Chicot aquifer, which normally sits at approximately 1,200 feet (370 meters) below land surface, has been uplifted to as high as 98 feet (30 meters) below land directly above the salt dome. Slightly saline groundwater exists in the lower unit of the Chicot at a depth of 300 feet (90 meters). The interface of the Upper Chicot and Lower Chicot is virtually unconfined at the site. Both the semi-confined Evangeline and the totally-confined Jasper are pierced by the salt dome. Both aquifers are too deep and too saline to be used as a water supply or affected by surface operations.

Table 3.6.8-2: Characterization of Aquifers Underlying the Big Hill Site

Aquifer	Depth to Top of Aquifer (Below Land Surface)	Overlying Soils/ Permeability (cm/sec)	Degree of Salinity[a]
Upper Chicot	7.0 feet (2.0 meters)	Porous; west and south surface edges less porous, 1.0×10^{-2}	Mostly fresh water
Lower Chicot	300 feet (90 meters)	Intermittent clay bed, 1.0×10^{-6} to 1.0×10^{-4}; sands 1.0×10^{-2}	Slightly saline
Evangeline	Away from dome, 1,500 feet (460 meters)	Discontinuous thick clay bed, 1.0×10^{-6} to 1.0×10^{-4}	Moderately saline to brine
Jasper	Away from dome, > 2,000 feet (600 meters)	Burkeville Aquiclude, highly impermeable	Moderately saline to brine

Notes:

[a] Salinity determined by dissolved solids content, in parts per thousand (ppt): fresh water, less than 1 ppt; slightly saline, 1–3 ppt; moderately saline, 3–10 ppt; very saline, 10–35 ppt; brine, more than 35 ppt

cm/sec = centimeters per second

Sources: Barbie 1991a and 1991b; Hart 1981; TWDB 1971; Davies 1984

3.6.8.2.2 Big Hill Groundwater: Construction Impacts

Potential impacts general to the SPR sites are discussed in section 3.6.2.2, and are applicable to the Big Hill site expansion.

The Chicot Aquifer is an important groundwater resource in Louisiana and Texas. It is a sole source aquifer, and according to the Louisiana Department of Environmental Quality, there is a concern about over-pumping, which results in salt water intrusion into the aquifer (Jennings 2006). Use of the aquifer for irrigation of rice farms, in addition to other uses, in this area puts pressure on the groundwater resource. According to the EPA's Federal Reporting Data System, no municipal wells are within 5 miles (8 kilometers) hydraulically downgradient of the Big Hill site. Since the land surrounding the site is swampy and contains many oil fields, extensive development of groundwater resources in the near future appears unlikely, and any impacts from the proposed project are unlikely.

The existing water intake and brine discharge pipelines run through coastal marsh, south from Big Hill to the ICW and the Gulf of Mexico, respectively. There is little population or established use of groundwater in the area between Big Hill and the ICW and Gulf of Mexico region. No towns or major withdrawal centers are along the pipelines' path toward the Gulf of Mexico. Impacts to groundwater along the pipeline route would be unlikely, but if they did occur, there would be none to minimal impact to current groundwater usage.

3.6.8.2.3 Big Hill Groundwater: Operations and Maintenance Impacts

Likewise, the general impacts discussion in section 3.6.2.2 captures the potential operations and maintenance impacts to groundwater at Big Hill. The site specific groundwater conditions discussed above in construction impacts would also apply to operations and maintenance impacts. The ongoing groundwater monitoring program at the Big Hill SPR site indicates that groundwater has not been impacted by brine releases from the brine pond (DOE 2004f). One small release was identified from an underground brine pipeline, but it was quickly remediated (DOE 2004f). This historic data indicates very low probability of any impacts to groundwater from the proposed project.

3.6.9 West Hackberry Storage Site

The proposed West Hackberry expansion would use the existing infrastructure, including the existing RWI system, crude oil distribution system, and brine disposal system, without the need for significant upgrades. The only changes would be the following:

- Acquisition and use of three existing 5–MMB caverns adjacent to the site (no new cavern leaching or drilling would be required);
- Construction of new onsite pipelines to connect the acquired caverns to the existing onsite water, brine, and crude oil systems;
- Installation of firewater main line and string flush and oily water lines; and
- Addition of site support facilities including construction of a security fence, clearing a security buffer beyond the security fence, construction of cavern spill containment features, and new site access road.

The following sections describe the potentially affected water resources and potential impacts specific to the West Hackberry storage site and associated infrastructure. The general impacts described in section 3.6.2 also apply to the West Hackberry site.

3.6.9.1 West Hackberry Surface Water

3.6.9.1.1 West Hackberry Surface Water: Affected Environment

The West Hackberry site would include no new offsite pipelines and no significant upgrades to the RWI facility, crude oil distribution capabilities, or the brine disposal system. Surface water bodies that could potentially be affected by the West Hackberry expansion site include inland water bodies surrounding or downstream of the West Hackberry site. In addition, the ICW would continue to serve as the source of raw water for the site, as it has in the past.

The West Hackberry site is located approximately 6.0 miles (10 kilometers) west of Calcasieu Lake within the estuarine part of the Calcasieu River Basin. Local drainage is to Black Lake and Black Lake Bayou, which surround the site to the north, west, and southwest. The site is approximately 5.0 to 10.0 feet (1.5 to 3.0 meters) above sea level. The surface water system in the vicinity of the site is comprised of brackish marsh interconnected with a network of bayous and canals that connect to Black Lake, Calcasieu Lake, Calcasieu River, Calcasieu Ship Channel, and the ICW. In general, the surface waters in the area are brackish, with a salinity of approximately 12 parts per thousand (Nipper et al. 2005).

The surface water system in the area is used for a variety of purposes, including transportation, industrial activities, commercial fishing, rice farming, livestock watering, irrigation of crops, and as habitat for wildlife (DOE 1978d, p. 3.2-6). The major water quality issues in this area result from saltwater intrusion into freshwater systems, priority organics, and indicators of pathogens. For example, the Louisiana Department of Environmental Quality issued an informal fish consumption advisory primarily related to organic contamination for the Calcasieu River **estuary** to the Gulf of Mexico.

3.6.9.1.2 West Hackberry Surface Water: Construction Impacts

The proposed expansion at West Hackberry would involve acquisition of existing storage caverns adjacent to the existing SPR site. As noted above, the expansion would utilize the existing brine disposal, RWI, crude oil intake, and oil distribution systems. Brine would be disposed of in subsurface injection wells, and raw water would be withdrawn from the ICW.

The primary water bodies in the area are listed in table 3.6.9-1 and shown in figure 3.6.9-1.

Because there is no offsite pipeline construction associated with this proposed site, potential construction impacts to surface water would be limited to the vicinity of the West Hackberry site itself. Brine would be disposed of via deep well injection, and would not affect surface water. The West Hackberry site would withdraw raw water from the ICW. Potential impacts associated with raw water withdrawal from the ICW are addressed in section 3.6.2.1.1, and would be expected to be minimal.

DOE has evaluated the potential impacts to floodplains in section 3.6.2.1.7 and appendix B. The West Hackberry expansion would involve acquisition of existing storage caverns adjacent to the existing SPR site. While a very small portion of the land to be acquired is within a floodplain, no new onsite construction would be required within the floodplain. As noted above, the proposed expansion would utilize the existing brine disposal, RWI, crude oil intake, and oil distribution systems. It would not require any new offsite construction in the floodplain. Therefore, no impacts to floodplains in the project area would result from project construction or operation.

Table 3.6.9-1: Potentially Impacted Surface Waters, West Hackberry

Water Body Name (and Relevant Segment)	Description	State Designations, Uses,[a] and Impaired Segments
Cavern Site		
Black Lake	Lake; perennial	• Primary and secondary contact recreation and fish and wildlife propagation
Black Lake Bayou	Stream through marsh; perennial	• Agriculture, primary and secondary contact recreation, and outstanding natural resource water • Portions of Black Lake Bayou are used recreationally and are classified as natural and scenic by the Louisiana Department of Wildlife and Fisheries
RWI (flow increase)		
Intracoastal Waterway	Major commercial and recreational waterway; USACE maintains navigable depths in the waterway through dredging and locks; perennial	• Used for both recreational boating and commerce • Primary and secondary contact recreation and fish and wildlife propagation • The ICW has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods

Notes:

[a] State designations are defined as:

<u>Primary Recreation:</u> "any recreational or other water use in which there is prolonged and intimate body contact with the water involving considerable risk of absorbing waterborne constituents through the skin or of ingesting constituents from water in quantities sufficient to pose a significant health hazard."

<u>Secondary Recreation</u>: "any recreational or other water use in which body contact with the water is either incidental or accidental, and in which the probability of ingesting appreciable quantities of water is minimal."

<u>Fish and Wildlife Propagation</u>: "the use of water for aquatic habitat, food, resting, reproduction, cover, and/or travel corridors for any indigenous wildlife and aquatic life species associated with the aquatic environment. This use also includes the maintenance of water quality at a level that prevents damage to indigenous wildlife and aquatic life species associated with the aquatic environment and contamination of aquatic biota consumed by humans."

<u>Drinking Water Supply</u>: "refers to the use of water for human consumption and general household use."

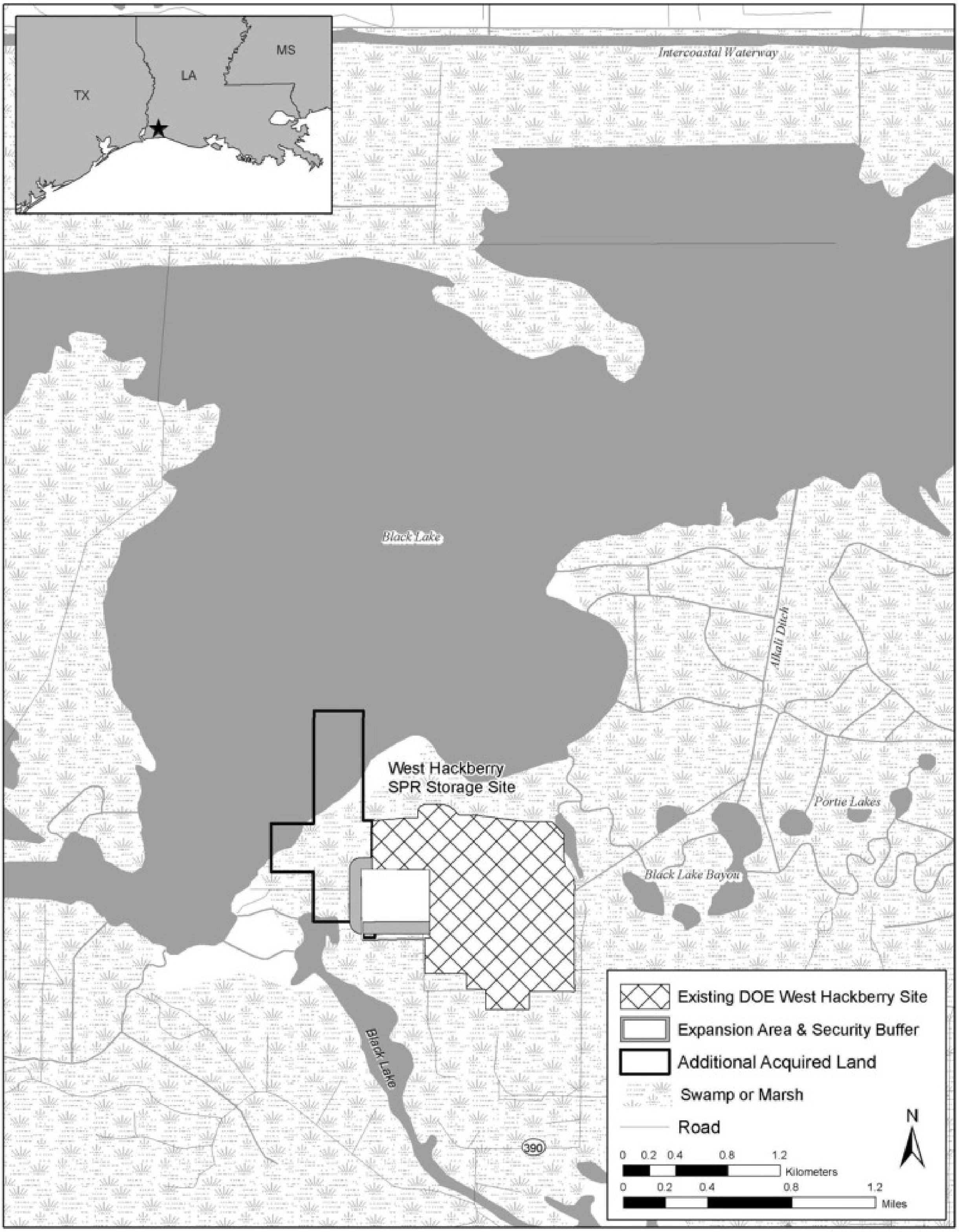
<u>Oyster Propagation</u>: "the use of water to maintain biological systems that support economically important species of oysters, clams, mussels, or other mollusks so that their productivity is preserved and the health of human consumers of these species is protected."

<u>Agriculture</u>: "the use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption."

<u>Outstanding Natural Resource Waters</u>: "include water bodies designated for preservation, protection, reclamation, or enhancement of wilderness, aesthetic qualities, and ecological regimes, such as those designated under the Louisiana Natural and Scenic Rivers System or those designated by the department as waters of ecological significance. Characteristics of outstanding natural resource waters include, but are not limited to, highly diverse or unique in stream and/or riparian habitat, high species diversity, balanced trophic structure, unique species, or similar qualities."

Source: LDEQ 2005

Figure 3.6.9-1: Regional Surface Water Map for West Hackberry Site



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3.6.9.1.3 West Hackberry Surface Water: Operations and Maintenance Impacts

The potential impacts to surface water discussed in section 3.6.2.1 are applicable to the West Hackberry site. No additional site-specific issues regarding potential impacts to surface water were identified.

3.6.9.2 West Hackberry Groundwater

3.6.9.2.1 West Hackberry Groundwater: Affected Environment

The site is underlain by the Chicot Aquifer, which extends from the ground surface to over 1,000 feet (305 meters) below grade in the site area. In general, the Chicot is mostly fresh water in the upper reaches, but becomes increasingly saline with depth (DOE 1992a). The aquifer is underlain by the Evangeline and Jasper Aquifers, as summarized in table 3.6.9-2 below.

The underlying Chicot Aquifer is a sole source aquifer, and according to the Louisiana Department of Environmental Quality, there is concern about over-pumping, which could result in saltwater intrusion into the aquifer (Jennings 2006). Use of the aquifer for irrigation of rice farms, in addition to other uses, puts pressure on the groundwater resource. Although groundwater only provides 20 percent of total water usage in the area, with surface water providing the remaining 80 percent, the Chicot Aquifer is an important water resource.

Table 3.6.9-2: Aquifers in Vicinity of West Hackberry Expansion Site

Aquifer	Groundwater Description	Depth of Aquifer
Chicot	Mostly fresh water north of Cameron Parish and saline water in the coastal region	Ranges from less than 100 feet thick in Beauregard Parish to more than 7,000 feet under the Gulf of Mexico; extends from the surface to 1,100 feet below land surface
Evangeline	Freshwater north of Calcasieu Parish and saline water from southern Calcasieu Parish to the coast	Not available for site
Jasper	Saline water from the middle of Beauregard Parish south to the coast	Not available for site

1 foot = 0.30 meters

Source: DOE 1978c

There are a number of groundwater wells located in the vicinity of the West Hackberry site (LADOTD 2005). Louisiana Department of Transportation and Development records indicate that the wells are screened at depths ranging from 10 to 500 feet (3.0 to 150 meters) below land surface within the Chicot Aquifer system, and consist of industrial, monitoring, and domestic use wells. Groundwater depths reported from the shallower wells generally range from 3.0 to 15 feet (0.90 to 4.6 meters) below land surface. Groundwater depths from the wells screened in the deeper intervals (e.g., 200 to 500 feet [61 to 150 meters] below land surface) range from approximately 30 to 60 feet (9 to 18 meters) deep, and have reported well yields up to 4.46 cubic feet per second (0.13 cubic meters per second). Hydraulic conductivities of the Chicot Aquifer reportedly range from 40 to 220 feet per day (12 to 67 meters per day). The general groundwater flow direction at the West Hackberry site is expected to be south towards the Gulf of Mexico.

3.6.9.2.2 West Hackberry Groundwater: Construction Impacts

The general impacts to groundwater discussed in section 3.6.2.2 are applicable to the West Hackberry site. Given that the site is underlain by a sole source aquifer, any impacts to the aquifer could result in impacts to water use in the area. Also, the aquifer is found at shallow depths, making it more susceptible to any surface discharges of contaminants during construction. However, best management practices described in section 3.6.2.2 would result in very low probability of a discharge or significant impact to groundwater.

In addition to the general impacts, deep injection wells would be used to dispose of brine at the West Hackberry site. The injection wells would be used during cavern filling operations as the caverns already exist. The potential impacts of brine disposal via deep well injection were assessed and modeled in detail in the 1977 final EIS for the West Hackberry site (FEA 1977). This study determined that brine disposal would not result in negative impacts to groundwater resources. The West Hackberry expansion would use the existing SPR brine disposal facilities and the proposed maximum brine disposal rate for the West Hackberry expansion would be well below the disposal rate considered for the 1977 EIS.

3.6.9.2.3 West Hackberry Groundwater: Operations and Maintenance Impacts

The general impacts associated with operations and maintenance discussed in section 3.6.2.2 would be applicable to West Hackberry, as discussed in the previous subsection. There have been some brine discharges to groundwater and soils from a former brine pond at the operating West Hackberry SPR. However, the current site monitoring there includes 11 monitoring wells and 15 recovery wells, which are showing improvement in groundwater quality (DOE 2004f). If there should be a release at the West Hackberry site in the future, this monitoring network would help with early identification and rapid remedial response.

3.6.10 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the Chacahoula storage site and if the proposed site could be developed by a commercial entity for oil and gas purposes, some spill risk to water resources could exist. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity, which could involve brine spill risk to water resources.

For the portions of the proposed storage site pipelines that follow existing ROWs, the risk of a spill associated with the no-action alternative would be limited to spill risk to water resources that already exists from the existing pipelines. For the portions of the pipeline in new ROW, the no-action alternative would not have any spill risk to water resources. For the sites of terminals that are in developed petroleum storage areas, it is possible that a commercial entity could develop them for storage and some spill risk to water resources could occur as a result. Sites in undeveloped areas are unlikely to be developed as terminals and present no foreseeable risk.

Potential impacts to surface and groundwater would not occur as a result of the selection of the no-action alternative.

3.7 BIOLOGICAL RESOURCES

This section addresses the potential impacts of SPR expansion on the following types of biological resources:

- Plant communities, wetlands, and wildlife;
- Special status species to include threatened and endangered species and their designated critical habitat;
- Migratory birds, bird nests, and eggs regulated by the Migratory Bird Treaty Act;
- EFH; and
- Protected areas including Federal and state parks, forests, wildlife refuges, conservation areas, and other areas of ecological importance.

This section presents the methodology for characterizing the affected environment and analyzing the potential and common impacts associated with a new or expansion SPR site. Following the common impacts, DOE presents the affected environment and associated potential impacts specific to each proposed new and expansion site. This section discusses the plants, wetlands, and wildlife, the special status species, the EFH, and the special status areas associated with each proposed expansion and new site and its associated infrastructure. Each site section is organized by major SPR facility component—namely storage site and associated facilities, pipeline, access road, and power line ROWs, RWI structure, and brine diffuser or injection systems. DOE has adopted this approach because different types of biological resources may be located at each of these often distant locations. The evaluation considered whether the proposed action would be compliant with numerous state and Federal regulations and executive orders on the protection of wetlands, special status species, managed fisheries, migratory birds, fish and wildlife resources, and controlling invasive species. These are described in detail in appendices B, D through H, and I.

3.7.1 Methodology

This section describes DOE's approach and assumptions for characterizing the affected environment and analyzing potential impacts on biological resources from construction and operations and maintenance at each proposed new and expansion site and the associated infrastructure.

3.7.1.1 Plants, Wetlands, and Wildlife

DOE first identified the areas that could be affected by the development or expansion of storage sites and associated infrastructure based on their conceptual designs. The potentially affected areas include all construction-related areas including equipment lay-down, staging areas, and temporary access roads. To describe the vegetation and wetland communities present in the potentially affected areas, DOE compiled geospatial data from the following sources:

- National Land Cover Dataset (USGS 1992), which is a land classification system for the entire United States;
- State GAP Analysis Program (USGS 2003) land cover datasets, which include a state-specific land classification system; and

- National Wetlands Inventory (USFWS 2005), which describes approximate wetland location and type according to the Cowardin classification system.

DOE performed a site walkover of each proposed new storage site plus portions of pipeline and power line ROWs to verify and update the spatial data and observe firsthand the ecological context. Aerial photographs, site descriptions, and available literature and databases were used to describe the biological conditions at the proposed expansion sites. DOE also conducted a geospatial analysis to supplement information gathered during site visits and agency consultation.

To assess the potential impacts on the various plant communities and wildlife, DOE calculated the area of each land classification type that could be affected during construction and operation and identified the vegetation types and wildlife species that could be affected. DOE used the construction easement and permanent ROWs for the pipelines, power lines, and access roads presented in chapter 2 to calculate the acreage of vegetation and wetland types associated with the potentially affected area of each site. The conceptual site plans, pipeline and power line ROWs, brine diffuser or injection sites, and RWI locations were then modified or shifted to avoid environmental resources to the extent practicable within engineering and cost constraints. A pipeline alignment was selected that followed existing utility/pipeline/roadway and canal corridors as much as feasible and practicable. The Least Environmentally Damaging and Practicable Alternatives for the ROW corridors were developed (where data allowed) by applying a least impact model that identified a route that utilizes existing utility corridors and best avoids wetlands, especially high value forested wetlands. Details on the methodology used in the model and developing the Least Environmentally Damaging and Practicable Alternatives are provided in appendix B. Appendix B also includes figures showing the footprint of the proposed storage sites, terminals, ROWs, off-site facilities, and National Wetlands Inventory maps of wetland types.

This process resulted in an estimate of the potentially affected area to account for all direct and indirect potential impacts of constructing and maintaining an ROW based on the existing vegetation. DOE used the USFWS National Wetlands Inventory maps to identify the wetlands potentially affected. To provide a summary of the major types of wetland systems, DOE consolidated the categories of the National Wetlands Inventory maps into the categories presented in table 3.7.1-1.

Table 3.7.1-1: Wetland Types and Description

Wetlands Type	Description
Palustrine – forested	Tidal and nontidal wetlands dominated by woody vegetation greater than or equal to 16 feet (5 meters) in height, and wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 5 parts per thousand. Total vegetation coverage is greater than 20 percent. This wetland category includes fresh-water swamps and bottomland hardwood forest.
Palustrine – scrub-shrub	Tidal and nontidal wetlands dominated by woody vegetation less than 16 feet (5 meters) in height, and wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 5 parts per thousand. Total vegetation coverage is greater than 20 percent. The species present could be true shrubs, young trees and shrubs, or trees that are small or stunted due to environmental conditions.
Palustrine – emergent	Tidal and nontidal wetlands dominated by persistent emergent vascular plants, emergent mosses or lichens, and wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 5 parts per thousand. Plants generally remain standing until the next growing season. Total vegetation cover is greater than 80 percent. This category is also referred to as fresh-water marsh.

Table 3.7.1-1: Wetland Types and Description

Wetlands Type	Description
Estuarine – forested	Tidal wetlands dominated by woody vegetation greater than or equal to 16 feet (5 meters) in height, and wetlands that occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 5 parts per thousand. Total vegetation coverage is greater than 20 percent.
Estuarine – scrub-shrub	Tidal wetlands dominated by woody vegetation less than 16 feet (5 meters) in height, and wetlands that occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 5 parts per thousand. Total vegetation coverage is greater than 20 percent.
Estuarine – emergent	Tidal wetlands dominated by erect and rooted plants that can live in water, excluding mosses and lichens. Wetlands that occur in tidal areas where salinity due to ocean-derived salts is equal to or greater than 5 parts per thousand and that are present for most of the growing season in most years. **Perennial** plants usually dominate these wetlands. Total vegetation cover is greater than 80 percent. This wetland category includes saltwater marsh.
Palustrine – aquatic bed	Tidal and nontidal wetlands and deepwater habitats in which salinity due to ocean-derived salts is below 5 parts per thousand and that are dominated by plants that grow and form a continuous cover principally on or at the surface of the water. These include algal mats, detached floating mats, and rooted vascular plant assemblages. Total vegetation cover is greater than 80 percent.
Lacustrine	These include wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses, or lichens with greater than 30 percent areal coverage; and (3) total area exceeds 20 acres (8 hectares).
Riverine	These include all wetlands and deepwater habitats contained in natural or artificial channels periodically or continuously containing flowing water or water that forms a connecting link between the two bodies of standing water. Upland islands or palustrine wetlands may occur in the channel, but they are not part of the riverine system.
Marine	Open ocean and high energy coastlines with salinities exceeding 30 parts per thousand and little or no dilution except outside the mouths of estuaries.
Palustrine – unconsolidated bottom	These include wetlands and deepwater habitats with at least 25 percent cover of substrate particles smaller than stones and a vegetative cover less than 30 percent. Water regimes are restricted to permanently flooded, intermittently exposed, and semi-permanently flooded. Characterized by the lack of large stable surfaces for plant and animal attachment. Salinity is below 5 parts per thousand.
Palustrine – unconsolidated shore	These wetland habitats have three characteristics: (1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders, or bedrock; (2) less than 30 percent areal cover of vegetation other than pioneering plants; and (3) any of the following water regimes: irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, intermittently flooded, saturated, or artificially flooded. Salinity is below 5 parts per thousand.
Palustrine – open water	Small, shallow bodies of open fresh water lacking significant emergent vegetative cover.

Wetlands provide multiple functions and values including groundwater recharge and discharge areas; flood flow alteration; fish and shellfish habitat; food production for aquatic species and wildlife; sediment retention; nutrient removal, transformation, and export; shoreline stabilization; wildlife habitat; recreation; and visual or aesthetic values. DOE considered these functions and values in assessing the potential impacts on wetlands, although no formal assessment for permitting of wetland functions and values was conducted. The evaluation of the significance of the potential impact takes into account both direct and indirect impacts, local uniqueness of the resources that would be affected, duration of the impact, and mitigation or compensation measures that would be implemented.

DOE also considered the proposed action in terms of compliance with Executive Order 11990 Protection of Wetlands, 10 CFR Part 1022 (DOE's regulations for complying with the Executive Order), Sections 404 and 401 of the CWA, and relevant state regulations.

3.7.1.2 Special Status Species

DOE took special consideration of biological resources regulated by specific regulatory programs, including but not limited to the following:

- Federally listed threatened, endangered, and **candidate species** and designated critical habitat regulated by the Federal Endangered Species Act (ESA);
- State-listed threatened and endangered species regulated by laws in each state;
- Species included in the U.S. Forest Service's Regional Forester Sensitive Species List;
- Marine mammals regulated by the Marine Mammal Protection Act; and
- Managed fisheries regulated by the Magnuson-Stevens Fishery Conservation and Management Act (EFH and managed species).

Detailed analysis of each resource is provided as follows in a separate appendix, along with other background information:

- Appendix B on wetlands (as well as floodplains);
- Appendix C on brine discharges to the Gulf Coast;
- Appendix D on species names;
- Appendix E on EFH;
- Appendices F, G, and H on federally listed species in Louisiana, Mississippi, and Texas, respectively;
- Appendix I on state-listed species; and
- Appendix O on conceptual compensation plan for wetland and stream impacts.

DOE assessed potential impacts on federally and state endangered and threatened species, managed fisheries, and marine mammals, respectively, based on information provided by and Section 7 Consultation with the USFWS, the NOAA fisheries, and various state agencies. DOE reviewed the life characteristics, designated critical habitat, and preferred habitat of each special status species against the actions and locations associated with each proposed new and expansion site.

Special status species

State and federally listed threatened, endangered, and candidate species; marine mammals; federally managed fisheries; and the U.S. Forest Service's Regional Forester Sensitive Species.

DOE evaluated the potential impacts of the proposed alternatives and no-action alternative on the federally listed species (see appendices F, G, and H) to prepare and document its findings of "no effect" and "may affect" in accordance with the definitions found in the Final ESA Section 7 Consultation Handbook (Consultation Handbook) dated March 1998 and a letter from USFWS dated September 29, 2005 (see appendix K), as presented below. For the purpose of the evaluation, DOE has defined "may affect" to include "is not likely to adversely affect" or "is likely to adversely affect."

- **No effect.** The proposed action would not affect federally listed species or designated critical habitat because individuals or suitable habitat for the species are not present in or adjacent to the action area.
- **Is not likely to adversely affect.** The project may affect listed species and/or designated critical habitat; however, the effects would be discountable, insignificant, or beneficial. Certain avoidance and minimization measures may be needed in order to reach this level of effect.
- **Is likely to adversely affect.** Adverse effects to listed species or designated critical habitat may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect would not be discountable, insignificant, or beneficial. If the overall effect of the proposed action would be beneficial to the listed species, but also would be likely to cause some adverse effects to individuals of that species or designated critical habitat, then the proposed action "is likely to adversely affect" the listed species.

The evaluation of significance of the potential impact takes into account both direct and indirect impacts, the duration of the impact, cumulative impacts, and mitigation measures that would be implemented. For the finding of "may affect," DOE acknowledges that it has not completed onsite surveys where potential habitat exists for a special status species. In those cases, DOE cannot reach a finding of "is not likely to adversely affect" or "is likely to adversely affect." Therefore, DOE can reach only a finding of "may affect" in the EIS. DOE has initiated informal Section 7 Consultation with and secured agreement in principle from USFWS concerning this approach. Once DOE has issued a Record of Decision and selected a specific new site and expansion sites for development, DOE would perform site- and species-specific habitat screenings and/or surveys for all the species that received a finding of "may affect" under that alternative. If any part of the selected action may adversely affect a listed species or designated critical habitats, DOE would complete a formal consultation with USFWS and/or NOAA Fisheries as mandated under Section 7 of the ESA. As part of formal consultation, DOE would prepare a Biological Assessment. If the action may adversely affect a species proposed for listing, DOE would complete a conference with the USFWS and/or NOAA Fisheries. DOE would also consider potential impacts of the selected action on candidate species. DOE would implement any requirements that are contained in the Biological Opinion prepared during formal consultation by USFWS and/or NOAA Fisheries.

For the state-listed special status species, DOE consulted with state agencies (see appendix K) and reviewed the NatureServe Global Conservation Status of the species (NatureServe 2005) to obtain a broader perspective. NatureServe and natural heritage member programs have developed a method for evaluating the relative peril of species. Conservation status ranks are based on a one-to-five scale ranging from critically imperiled (G1) to secure (G5). The global status assessments are based on the best available information and consider a variety of factors such as abundance, distribution, population trends, and threats. Once DOE has issued a Record of Decision and selected a specific new site for development, it would perform site- and species-specific surveys or habitat screenings for all the state-listed species that received a finding of "may affect" under the alternative. DOE would evaluate the impacts on the listed species in consultation with the appropriate state agency. If the selected action would involve a take of a state-listed species, DOE would secure permits from the appropriate state agency and complete any mitigation required by the permit.

3.7.1.3 Essential Fish Habitat

DOE generated GIS maps with EFH boundaries layered according to each of the offshore and onshore elements associated with the proposed new and expansion SPR sites to determine the potentially affected area and assess potential impacts on EFH and managed species in the Gulf of Mexico as well as estuaries and some tidally influenced waters and substrates. The proposed new and expansion SPR sites with offshore elements include Big Hill, Stratton Ridge, Chacahoula, and Richton. Based on data from NOAA Fisheries, the composition of species managed under the Magnuson-Stevens Fishery Conservation and Management Act is identical for the three proposed and the two existing brine diffusion sites and their accompanying pipeline ROWs. DOE assumed that the species composition was similar at all potential SPR sites.

DOE evaluated potential impacts on EFH by defining the spatial boundaries of the EFH close to offshore pipelines and brine diffuser and reviewing the life characteristics and preferred habitat of each managed species with a designated EFH against the offshore actions and locations associated with each proposed new and expansion site. In order to identify the EFH within the tidal reaches, DOE used different methodologies depending on the location. For Louisiana sites, DOE overlaid a GIS layer of tidal reaches (http://logic.lsu.edu/loscoweb/Louisianaoilspillcoordinator) with National Wetland Inventory maps to identify the approximate areas of EFH. For Texas and Mississippi, DOE overlaid the National Wetland Inventory data of estuarine wetlands to identify approximate EFH areas. Appendix E is the EFH Assessment Report required by the Magnuson-Stevens Fishery Conservation and Management Act. It provides a more detailed description of the process used by DOE to evaluate the impacts to EFH.

3.7.1.4 Special Status Areas

DOE defined the special status areas to include federally controlled lands (national forests, national parks, national wildlife refuges, wilderness areas, and national marine sanctuaries), wild and scenic rivers, and lands managed by states, including state forests, state parks, bird rookeries, and wildlife management areas. DOE identified these special status areas through geo-referenced data sources including the Texas Colonial Waterbird Census (USFWS 2006a) and ESRI's street map. DOE reviewed the location of such areas in relation to the actions and locations associated with each proposed new and expansion site.

The evaluation of the severity of the potential impact takes into account the uniqueness of the local resources that would be affected, the duration of the impact, direct and indirect impacts, and potential mitigation measures that would be implemented.

3.7.2 Impacts Common to Multiple Sites

This section describes the potential direct and indirect impacts of the activities that are common at proposed new and expansion sites. The discussion of the common impacts associated with each proposed new and expansion site presents the magnitude of the impacts that would be similar at all locations, thereby avoiding the need to discuss the same impact on a site-by-site basus. Subsequent sections analyze the magnitude of these impacts in the context of the site-specific environment.

The construction and operations and maintenance of a new or expansion SPR site and its associated infrastructure would involve many similar activities across all proposed sites or associated infrastructure. These activities generally would have the same types of impacts, although the scale of those impacts would vary from site to site. For example, clearing a site for construction would result in a loss of vegetation and disturbance to wildlife. The nature and magnitude of these impacts would depend on the size of the area and the specific plant and animal community in and around it. In this section, DOE describes how common activities could generally affect biological resources. The section reflects the general characteristics (upland and wetlands and open water) of an area where a new facility (the storage site, RWI structure, wastewater treatment plant, tank farm, marine terminal, brine injection diffuser or well injection field, and access road) would be constructed. Because pipeline and power line ROWs represent narrow linear corridors that would be allowed to revegetate, DOE prepared a separate discussion of the common impacts associated with the ROWs. The discussion of the common impacts includes mitigation measures specific to impacts and a discussion of the common mitigation measures that DOE may implement. At the conclusion of the construction impacts section, DOE presents a discussion of common wetland mitigation measures that would be implemented as appropriate. Where appropriate, the unique context and severity of these potential impacts and associated mitigation measures are presented in the site-specific analysis.

3.7.2.1 Construction Impacts

The following subsections present the common impacts associated with construction of all the proposed facilities with the exception of pipeline and power line corridors. The ROWs involve linear construction activities, resulting in potential short- and long-term impacts that differ from construction of the other facilities. A discussion of the common impacts in proposed ROWs is presented after the discussion of impacts on uplands, wetlands, and open water.

3.7.2.1.1 Clearing, Grading, and Construction Activities

The upland and wetlands portions of all new and expansion storage sites, RWIs, access roads, brine diffusers or injection wells, and terminals would require clearing, grubbing, and grading activities within the proposed site boundary or construction footprint. Additional clearing of a 300-foot (91-meter) security area would be completed around the new storage sites. For existing SPR sites, the additional clearing would occur only around the expansion area. Because no land expansion would occur at the Bayou Choctaw storage site under the proposed action, no additional clearing would be required.

The clearing and grading activities would result in direct and indirect impacts on the upland and wetland communities. Direct impacts would include the conversion of forests and alteration of plant communities. DOE would convert upland and wetland communities within the site boundary into managed lawns, managed fields, emergent wetlands, or open water. Woody vegetation would generally not be permitted to remain at the site or be re-established.

The dust and increased runoff associated with construction activities could affect adjacent plant and wetland communities and affect downstream wetlands by increasing siltation and turbidity. Clearing, grubbing, and grading activities and the loss or alteration of upland plant and wetland communities would also affect some wildlife. Mobile wildlife species, such as deer and birds, would be displaced while less mobile species, such as turtles, snakes, and small rodents, might be unable to escape. Displaced species and species that are not tolerant of human disturbances would migrate from the construction area to suitable surrounding areas if they are able to do so. The displacement could, at least temporarily, increase the density of wildlife in the surrounding areas and increase the inter- and intra-specific competition for available resources, including foraging and nesting areas. Although some individuals would be affected, no changes in wildlife populations are expected to occur on a regional scale. Small animal species, such as reptiles, amphibians, and small mammals, would be excluded from areas that are cleared because of loss of habitat.

In addition to clearing and grading, DOE would import and place fill materials to support permanent infrastructure such as well heads, brine ponds, package wastewater treatment plants, buildings, and access roads. Placement of fill in wetlands would cause a permanent loss of wetland functions and would have the potential to increase erosion and sedimentation into the surrounding areas. Increases in turbidity could decrease the concentration of dissolved oxygen in the water column of nearby water bodies. For aquatic species, the increase in runoff and erosion and the associated increase in suspended particles during construction could interfere with the ability of those species to respire, feed, and find suitable habitat.

Open water construction, primarily dredging, would affect some benthic organisms and their habitat. It could also release sediments into the water column, thereby increasing turbidity and decreasing the concentration of dissolved oxygen. Because of the increased turbidity and reduced concentration of dissolved oxygen, fish and other mobile organisms would likely avoid such areas.

The temporary impacts such as siltation from construction are expected to be relatively small because the construction would be temporary and would use appropriate best management practices required by the approved Erosion and Sediment Control Plan and Stormwater Pollution Prevention Plan and NPDES stormwater permit for construction activities. As described in chapter 2, DOE would adhere to all relevant and applicable state and Federal best management standards to minimize erosion and sedimentation. Standard construction operating procedures—including dust suppression, use of silt fencing, silt curtains/cofferdams, sediment detention basins, reseeding, stabilization of denuded areas, slope protection, and use of hay bales—would be employed to reduce impacts.

The potential impact on wetlands and uplands due to temporary disturbance, permanent conversion, or filling is discussed in the site-specific discussions and appendix B. For the selected alternative, DOE would conduct a delineation of waters of the United States, including wetlands in accordance with the USACE Wetland Delineation Manual (1987) and subsequent regulatory guidance. A wetland delineation is a survey conducted by a qualified person to determine the extent of a jurisdictional wetland and the types of wetland that would be affected by a project. A jurisdictional wetland must exhibit water tolerant vegetation, hydric soils, and wetland hydrology. Wetlands would be delineated on the selected new and expansion sites, along all ROWs, and at all locations for proposed ancillary facilities such as storage terminals and brine disposal well fields. Wetlands that are regulated under Section 404 and 401 of the CWA would be delineated. Isolated wetlands are generally not considered within the jurisdiction of the USACE. DOE would coordinate with the appropriate USACE District to secure a jurisdictional determination (or confirmation) of the delineation.

DOE would prepare the appropriate application for a Section 404 Permit from the USACE and the 401 Water Quality Certificate from the relevant state agency. This permit process requires a comprehensive analysis of alternatives to avoid impacts to jurisdictional wetlands and waters of the United States, an analysis of measures taken to minimize impacts, and a compensation plan to mitigate for unavoidable impacts to waters of the United States, including wetlands. Avoidance and minimization strategies could include measures such as refinement or modification of facility footprints to avoid wetlands, minimization of slopes in fill areas, use of geotechnical fabric under wetland fills to minimize mudwave potential, and restoration of the disturbed wetlands outside the permanent footprint of the facility. The compensation plan would be developed by DOE and submitted with the permit application. Compensation for unavoidable impacts to wetlands could take the form of preservation, restoration, or creation of wetlands in the project area or within the watersheds affected. DOE could also use payment of an lieu-of fee where the USACE and state allow such payment or the purchase of mitigation credits from an approved wetland mitigation bank in the appropriate service area (region or watershed). The compensation plan would include provisions for protecting the mitigation site through a conservation easement or similar mechanism and postconstruction mitigation monitoring to evaluate the success of the mitigation. Additional detail on the compensation plan is included section 3.7.2.1.3 and appendix O.

Federal and state resource agencies would have the opportunity to review and comment on the proposed mitigation plan prior to final approval. DOE's mitigation plan would be consistent with the EPA and

USACE proposed rulemaking on wetland mitigation entitled *Compensatory Mitigation for Losses of Aquatic Resources, Proposed Rule* (33 CFR Parts 325 and 332). DOE's mitigation actions would ensure that the proposed action is compliant with Executive Order 11990 on Wetlands Protection and 10 CFR Part 1022, which are DOE's implementing regulations for the Executive Order. Appendix O discusses potential compensatory mitigation opportunities. Dredge spoils, if generated, would be disposed of in a manner approved by the USACE. DOE would identify beneficial uses for the dredge spoil (such as wetland restoration) as appropriate. DOE would secure section 10 permits wherever required for proposed obstructions in navigable waterways that are regulated by the U.S. Coast Guard and USACE under the Rivers and Harbors Act.

3.7.2.1.2 Right-of-Way Construction Activities

DOE would construct power lines, temporary construction access roads, and pipeline ROWs under the alternatives considered for the proposed action. Power line construction activities would involve clearing and grubbing, while pipeline construction activities would involve clearing, grubbing, trenching, and grading. Because of its linear nature, an ROW may pass through an array of upland, wetlands, and open-water communities, which dictate different methods of construction. DOE located the ROWs along existing power line, pipeline, canal, and road corridors wherever possible and practicable in order to minimize the disturbance to undisturbed and higher value plant communities and wetlands. As presented in chapter 2, DOE would use specific methods for construction in the following areas:

- Uplands,
- Wetlands without standing water,
- Inundated wetlands (wetlands with standing water),
- Inland open water, and
- Offshore (these methods are presented in terms of brine disposal and offshore pipelines).

DOE would coordinate construction in the ROW, from initial surveying and clearing to backfilling and grading, to minimize habitat disturbance and erosion. These temporary disturbances, at any single point along the new ROW, would last about 6 to 10 weeks. During construction, wildlife would be displaced from within and adjacent to the construction ROW due to the noise, traffic, human activity, and habitat disruption. A small number of animals and **invertebrates** would be unable to escape the construction and would be killed.

<u>Construction of ROWs in upland areas</u> would result in the same common construction impacts as those presented under upland clearing, grading, and construction activities, with some exceptions. During construction, the ROW would be graded where necessary to create a level working surface to allow for safe passage of construction equipment and materials. Trees would be cut to grade. Stumps would be removed only if within 15 feet (4.6 meters) of the pipeline trench, the centerline of a power line, or where safety concerns would dictate. For pipeline trenches, topsoil would be segregated and stockpiled for use as the final backfill material to aid in postconstruction revegetation activities. After the pipeline has been placed and backfilled with subsoil horizons, the topsoil would be placed on top of the ROW and the grade would be returned to its previous topography. Excess excavated material would be removed from the construction area and used as fill material in a suitable upland area.

For power lines, monopoles would be installed, which would require minimal clearing and excavation for the installation of the 75-foot (23-meter) power line pole. Tall vegetation would be removed from the power line corridor.

<u>Construction of ROWs in wetlands</u> that are not inundated would be similar to construction in the uplands. For pipelines, the impact on the wetland community would be based on the length of the wetland

crossing. For wetland crossings less than 100 feet (30 meters), wetland soils would be stockpiled in an adjacent upland area within the ROW, allowing the construction ROW width within the wetlands to be reduced to 85 feet (26 meters) as opposed to 150 feet (46 meters). For wetland crossings more than 100 feet (30 meters), directional drilling would be used where practicable. If directional drilling was not practicable, the full construction ROW (150 feet [46 meters]) would be required for traditional trenching installation. A temporary timber road would be installed to allow passage of equipment with minimal disturbance of the surface and vegetation. The access road would be removed after construction was completed and the footprint would be regraded and revegetated with native species. Trees would be cut to grade, but stumps would be removed only within 15 feet (4.6 meters) of the pipeline trench, the centerline of a power line, or where safety concerns would dictate. Topsoil would be segregated, stockpiled, and used as the final backfill material. A vegetative buffer zone would be left between the wetland and the upland construction areas. Where wetlands are inundated, it may be impossible to segregate and stockpile the topsoil/sediment for reuse in the trench.

Impacts associated with power line construction in wetlands would include the alteration and clearing of some of the vegetation along the ROW. Where feasible, power line poles would not be placed in wetlands. The power line poles placed in wetlands would require access to the pole location, which typically would be from an adjacent pipeline corridor.

> A **spud barge** is a flat-decked floating structure that has devices similar to legs, called spuds, which are lowered from underneath the barge and pushed into the waterway floor to anchor the structure in place.

<u>The construction of ROWs in inundated wetlands</u> would involve a crane mounted on specially designed pontoons equipped with tracks, referred to locally as a “marsh buggy.” The marsh buggy would travel along the centerline of the pipeline and excavate the trench. Where possible, staging areas would be set up on **spud barges** temporarily anchored in navigable waterways. As described in chapter 2, pipe would be fabricated at the temporary staging area, then floats would be attached to the pipe to minimize dragging through the wetland system, and the pipe would be pushed into the pipe trench. Once the section of pipe has been floated into place, the floats would be cut free and the pipe would be allowed to sink to the bottom of the trench. The marsh buggy would then backfill the trench with the excavated dredge material and the disturbed area would be restored. This process would keep the construction ROW to the minimum width necessary for the pipe trench and the temporary dredge spoil pile. The construction of ROWs in submerged wetlands would affect coastal and estuarine emergent wetlands that are tidally influenced and mostly submerged. Impacts associated with pipelines would include the loss of the vegetative community along the ROW and decreased functions and values of the surrounding wetlands due to increased turbidity, erosion, and sedimentation. In addition to the impacts within the ROW, for remote pipeline routes primarily associated with Chacahoula, temporary staging areas would be established within or adjacent to navigable waters. Because of the submerged conditions, topsoil would not be segregated from the subsoil. Such measures would result in a temporary impact on the vegetative and wetland communities along and adjacent to the pipeline ROW as the emergent wetland vegetation typically would revegetate the area in two to three growing seasons.

<u>Open water construction</u> in a river, lake, or stream would cause temporary sedimentation and turbidity from any pipeline trenching. Trenching would be used in river and stream crossings less than 100 feet (30 meters) wide. Pipeline trenching effects would also include alteration of stream substrate, reduction in macroinvertebrate abundance and diversity, and a potential reduction in fish populations. In small streams, the increased suspended sediment concentration would dissipate relatively quickly depending on stream flow, keeping the impacts of trenching relatively localized. Water bodies less than 33 feet (10 meters) wide typically would be crossed using the open trench methodology in less than a day. Slightly larger streams, between 33 feet and 66 feet (10 and 20 meters) wide, typically would be crossed in 1 to 3 days (Reid and Anderson 2006). Monitoring results have demonstrated that the effects of open trench

construction on water quality and macroinvertebrate communities are short term and are not severe (Tsui and McCart 1980; Reid and Anderson 2006). Power line poles would not be placed in a river or stream, but would be placed at opposite banks and the power line elevated above the river.

The construction of pipelines in inland open water and navigation channels (rivers and streams) 100-feet (30-meters) wide or greater would involve horizontal directional drilling, as described in chapter 2. For such situations, any power lines would be co-located under the water body with the pipeline. The water body would not be affected because the pipeline and power line would be drilled and placed beneath the water body. Indirect impacts in the adjacent open water and navigation channels may result from stormwater runoff and erosion entering the water body from the work zone and staging area.

The construction of pipelines in open coastal waters associated with the brine pipelines and some oil pipelines may involve jet sleds, dredges, or shallow-draft spud barges, and would affect the vegetation and aquatic wildlife in the open water communities. Impacts would include the loss of benthic communities, increased sedimentation in the surrounding area, and increased turbidity in the water column. As described in chapter 2, the use of jet sleds, dredges, or spud barges would be based on site-specific conditions to minimize the area affected by construction operations. The impacts would be temporary and non-persistent impacts as the wildlife and vegetation would return to the area (postconstruction). The impacts created by the construction of a pipeline across a bay or estuary would be temporary, and with the river or stream bed returning to its pre-construction conditions over time. The time required for this to occur would depend on the method of construction and the water and biological conditions.

Temporary impacts, such as siltation from construction, are expected to be relatively small because the construction would be temporary and would use appropriate best management practices in accordance with an Erosion and Sediment Control Plan, Stormwater Pollution Prevention Plan, and an NPDES stormwater permit for construction activities. As presented in chapter 2, DOE would adhere to all relevant and applicable state and Federal best management standards to minimize erosion and sedimentation. Standard construction operating procedures—including dust suppression, use of silt fencing, sediment detention basins, reseeding, stabilization of denuded areas, slope protection, and use of silt curtains in open water—would be employed to reduce impacts.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (regrade to preconstruction contours and greater than 100 feet [30 meters]) or in areas containing sensitive habitat. DOE would regrade to preconstruction contours and reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct problems that are identified.

3.7.2.1.3 Wetland Mitigation Common to Multiple Sites

DOE's primary mitigation measure for wetland impacts would be avoidance and minimization. As described in chapter 2 and in the preceding text, DOE would locate temporary access roads and staging areas in upland areas or would use temporary floating staging areas, as appropriate. Larger wetlands (about 100 feet [30 meters] or wider) would be directionally drilled wherever practicable. DOE would continue to refine the concept plans for the site storage areas and terminals to avoid placing aboveground structures and fill in wetlands as much as practicable. Where the security buffers around the storage areas or permanent ROW easements would extend into wetlands, DOE would preserve emergent wetlands and allow herbaceous species to re-establish themselves within the forested wetlands that were cut. Within the temporary construction easements of the ROWs, DOE would promote the restoration and re-establishment of the existing plant community by stockpiling and reusing the hydric soils (and their diverse seed bank) from the disturbed wetlands. In this way, some wetland functions and values would be preserved. In addition, wetlands would be restored more quickly if there was a temporary impact to wetlands or a permanent conversion from forested to emergent wetlands. For wetland impacts that cannot be avoided, DOE would implement one or more of the following mitigation measures:

- As described in chapter 2, DOE would install trench plugs (using low-permeability clay placed around the pipe) at intervals to prevent the unintentional draining of water from the wetlands or mixing of fresh-water and marine wetland systems.

- Excess dredged material would be disposed of in consultation and in accordance with permits issued by USACE and the state. Dredge spoils would be used for wetland creation or restoration activities wherever possible.

- Where possible, power line poles would not be placed in wetlands.

- If the wetlands are forested, tree stumps and root mass from all plants would be left intact, except where this would interfere with excavation of the pipeline trench.

- For wetlands that are not inundated or that have shallow standing water, equipment would be supported on timber mats or on prefabricated equipment mats. Spoil from the trench would be stored within the ROW on the nonworking side of the pipeline ROW. Topsoil would be stored separately, where appropriate. Stockpiling of soil would be interrupted at appropriate intervals to prevent change of surface water flow (sheet flow). If the bottom of the pipeline trench would be at a lower elevation than the wetlands, a permanent trench plug of impervious clay would be placed into the trench at the wetland boundaries. If a fresh-water marsh (palustrine emergent wetlands) would likely be exposed to brackish or marine water by connection with these water sources via the pipeline trench, then temporary trench plugs would be used during construction and permanent trench plugs would be installed after the pipe is lowered into the trench. The trench plugs would be installed between the fresh-water marsh (palustrine – emergent wetlands) and any adjacent body of water with a higher salinity.

- Excavated wetlands would be backfilled with either the same hydric topsoil that was removed or a comparable material capable of supporting similar wetland vegetation. Original wetland elevations would be restored and adequate material would be used so that following settling and compaction of the material, the proper preconstruction elevation would be attained. After backfilling, DOE would implement erosion protection measures to stabilize and revegetate the site and prevent further wetland degradation.

- DOE would remove all construction-related materials, such as timber mats, rip rap, silt fence, prefabricated equipment mats, and geotextile fabric, upon completing construction. Where the pipeline trench may drain wetlands, DOE would construct trench breakers and/or seal the trench bottom as necessary to maintain the original wetland hydrology. For each wetland area crossed, DOE would install a permanent slope breaker and a trench breaker at the base of the slopes near the boundary between the wetlands and the adjacent upland areas. The trench breaker would be located immediately upslope of the slope breaker. DOE would not use fertilizer, lime, or mulch along the ROW within wetlands, nor immediately upslope from wetlands. Reseeding activities would use a seed mix of native wetland species. For ongoing ROW maintenance, DOE would limit vegetation to a narrow corridor over the pipeline and to either side to facilitate periodic pipeline corrosion and leak surveys. DOE would not use herbicides or pesticides in or within 100 feet (30 meters) of wetlands. DOE would conduct a postconstruction monitoring program of the disturbed wetlands within the ROWs to ensure that the hydrology and wetland plant community is re-establishing successfully. The monitoring would follow approved procedures contained in the USACE Section 404 permit. If the monitoring showed that wetland plants and hydrology were not successfully re-established, DOE would implement corrective action.

- **Other potential mitigation measures or best management practices (to be considered during permit application and design):**
  - Other than the construction ROW, only use pre-existing roads within wetlands. Do not construct new access roads through wetlands.
  - Assemble a pipeline in an upland area and use the push technique to place the pipe in the trench where water and other site conditions allow.
  - Minimize the duration of construction-related disturbance within wetlands.
  - Schedule the construction-related disturbance during the dry season.
  - Limit construction equipment operating in wetland areas to equipment needed to clear the ROW, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the ROW.
  - Cut vegetation off at ground level, leaving existing root systems in place, except within the path of the pipe trench.
  - Do not pile woody vegetation within wetlands.
  - Do not store hazardous materials, chemicals, fuels, or lubrication oils, or perform concrete coating activities in wetlands or within 30 yards (9.1 meters) of any wetland boundary.
  - Attempt to refuel all construction equipment in an upland area at least 30 yards (9.1 meters) outside a wetland boundary. If construction equipment must be refueled within wetlands, follow fueling procedures outlined in project-specific spill prevention or contingency plans.
  - Do not use rock, soil imported from outside the wetlands, tree stumps, or brush rip rap to stabilize the ROW.
  - If standing water or saturated soils are present, use low-ground-weight construction equipment or operate normal equipment on timber mats or prefabricated equipment mats.
  - Do not cut trees outside the construction ROW to obtain timber for equipment mats.
  - Do not discharge hydrostatic test water into wetlands.

Where wetland impacts cannot be avoided, DOE would conduct the required wetlands delineations, secure jurisdictional determinations, and then complete and submit the appropriate permit application to USACE and the state agency. Unavoidable wetland impacts would be compensated by creating, restoring, and/or preserving wetlands, paying an in-lieu of fee, or buying credits from an approved mitigation bank. Potential opportunities for mitigation are described in appendix O. DOE would develop and submit the detailed compensation plan as part of the Section 404/401 permit process. Wetland creation would typically involve alteration of an upland (generally though excavation) to create the proper hydrology for wetlands and planting of wetland species at the site. Restoration typically involves the modification of a previously disturbed wetland that may no longer function as a wetland because it has been ditched or drained. The wetland hydrology is restored and wetland species are planted at the site. Wetland preservation typically involves the purchase and preservation in perpetuity of existing wetlands.

Compensation credits and a compensation ratio would be established based on the functions and values of the affected wetland, the acreage of wetland impacts, and the type of compensation offered. Because the compensation ratio is based on the functions and values of the wetlands and the type of mitigation proposed, one compensation credit does not necessarily equate to one acre of wetlands. The type of mitigation is important in determining how many acres need to be preserved, created, or restored to equal one compensation credit. For example, the compensation required for preservation of wetlands would be much higher than that for wetland restoration to reach one compensation credit.

The type of wetland affected and its rarity are important in determining the compensation ratio. The filling of palustrine forested wetlands would cause a complete loss of functions and values of a relatively rare and ecologically important resource. This type of impact would require the highest compensation ratio, such as 5:1 or 7:1. On the other hand, impacts to emergent wetlands within the permanent easement for pipeline corridors would only cause a temporary loss of the wetland functions and values and would probably require compensation at the lowest ratio, such as 3:1 or 1:1.

Representative mitigation ratios for unavoidable impacts to wetlands are presented in Table 3.7.2-1 Wetland Mitigation Ratios. Potential opportunities for mitigation are described in appendix O. If required by the USACE, the compensation ratios would be determined through a formal assessment of wetland functions and values, which would be completed during the permit application stage. The Vicksburg, Mobile, and New Orleans Districts indicated that they would probably require DOE to use the USACE Charleston District methodology for determining wetland compensation ratios (USACE Charleston District 2002).

Table 3.7.2-1: Approximate Wetland Mitigation Ratios

State	Approximate Compensation Requirements		
	High Wetland Functions and Values	Moderate Wetland Functions and Values	Low Wetland Functions and Values
Louisiana	5:1	3:1	2 to 1:1
Mississippi	5:1	3:1	2 to 1:1
Texas	7:1	5:1	3 to 1:1

Notes:

These are estimates of the compensation ratios that may be required by regulatory agencies. The actual requirements would depend on several factors, including existing wetland conditions and their functions and values. If required for the selected alternative, a formal assessment of affected wetland functions and values would be completed to determine appropriate compensation ratios.

Source: U.S. Army Corps of Engineers, New Orleans, Vicksburg, Galveston, and Mobile Districts

3.7.2.1.4 Brine Disposal Systems

New brine disposal systems that discharge into the Gulf of Mexico would be constructed for the proposed new sites at Chacahoula, Richton, and Stratton Ridge. Existing brine disposal systems that discharge into the Gulf of Mexico would be used at Big Hill. The Bayou Choctaw and West Hackberry expansion sites would use underground injection wells for brine disposal. Brine disposal pipeline and diffuser construction would be similar for each site. The components of the brine disposal system are discussed further in section 2.3.3. Construction impacts would be limited to areas immediately surrounding the pipeline trench and staging area. These impacts would include increased turbidity due to sediment disturbance and noise.

Some loss of common sedentary macroinvertebrates would be expected during the excavation, laying, staging, and hydraulic jetting of the pipeline. Sensitive mobile species, including finfish and marine mammals, would move out of the area during the duration of construction. Impacts associated with pipeline construction would be temporary and organisms would be able to re-colonize the area postconstruction. Because a portion of the diffuser and pipeline would be located in jurisdictional waters, DOE would conduct the required delineations, secure jurisdictional determinations, and complete and submit the appropriate Section 404/401 permit application. The permit/water quality certification would require that impacts to jurisidictional waters be minimized and that appropriate best management practices are implemented to protect aquatic resources.

Brine disposal in the Gulf of Mexico would be associated with new cavern development at proposed new storage sites at Chacahoula, Richton, and Stratton Ridge, and at the Big Hill expansion site. The process of brine creation and details on brine disposal are discussed in section 2.3.3, and details on the potential impacts from the brine plume are discussed in section 3.6 and appendices C and E. DOE would secure an NPDES discharge permit from the appropriate state agency for the brine diffusers. The permit would establish effluent discharge standards, a permitted flow rate, and regular monitoring and reporting requirements that protect water quality and aquatic resources.

Several studies have examined the effects of brine discharge on the composition of bottom-dwelling organisms at brine diffuser sites (DOT 1976 V.2; Barry A. Vittor & Associates 2002). In a 2001 to 2002 study on the impacts of the LOOP and associated facilities, no measurable impact on benthic assemblages was found at the brine diffuser site (Barry A. Vittor & Associates 2002). A study conducted by Texas A&M University in 1991 examined the impact of brine discharge from the West Hackberry and Bryan Mound diffuser sites on water quality and associated biota. This study determined through extensive post-disposal analyses of bioassays and sediment samples that impacts associated with brine disposal at these sites have not been significant. No significant biological impacts were observed at either diffuser site and levels of metals, ions, and other contaminants were similar to those detected at control stations. The researchers found that a decrease in the abundance of benthic species occurred mainly within 31 to 2,000 acres (12.5 to 809 hectares) of the diffusers at Bryan Mound and West Hackberry (DOE 1992a). Fish that feed on bottom-dwelling organisms would move from the diffuser area to feed in unaffected areas.

The population of commercially important white shrimp and brown shrimp could vary based upon the salinity changes associated with brine discharge. Subadult brown shrimp prefer high-salinity areas while white shrimp are typically found in areas of lower salinity. White shrimp are thought to have a wider variation of salinity tolerance, but might still move to other areas to avoid higher salinity in the area around the diffuser (DOT 1976 V.2).

3.7.2.1.5 Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act established a new mandate for the NOAA Fisheries, regional fishery management councils, and other Federal agencies to identify and protect important marine and **anadromous fish** habitat. The EFH provisions of the Act support one of the Nation’s overall marine resource management goals in maintaining sustainable fisheries. Essential to achieving this goal is the maintenance of suitable marine fishery habitat quality and quantity. The fishery management councils, with assistance from NOAA Fisheries, have delineated EFH for federally managed species.

The composition of the federally managed species with designated EFH in the Gulf of Mexico depends on the distance offshore; however, they are largely the same at each of the potential brine disposal sites associated with Big Hill, Chacahoula, Richton, and Stratton Ridge. For the nearshore portions of the brine pipelines located in estuarine environments, the federally managed species with designated EFH are brown shrimp, cobia, gray snapper, greater amberjack, king mackerel, lane snapper, pink shrimp, red drum, red grouper, red snapper, Spanish mackerel, stone crab, and white shrimp (GMFMC 2006). Most inland bodies of water that are tidally influenced including wetlands, rivers, and streams are considered EFH for some life stages of brown shrimp, white shrimp, and red drum. All of these species are also located at the potential offshore brine diffusion sites, along with spiny lobster and yellowtail snapper. Appendix E includes a detailed discussion of the potential impacts to EFH and managed fisheries.

DOE evaluated the potential impacts on EFH recognizing that the managed species found throughout the Gulf of Mexico region are sufficiently mobile to avoid areas of temporary disturbance. Any temporary impacts associated with construction, including increased sedimentation and possible disruption of species movement would be short-term. The affected environment would quickly revert to pre-disturbed conditions once construction had been completed. The only potentially lasting effect of construction could be alteration of sediment type. The increased concentration of suspended and bedded sediments associated with construction may change the composition of the sediment, temporarily altering the diversity of organisms that live in the soft sea bottom. Complete recovery of soft-bottomed benthic communities may take up to 2 years from the time of construction, or longer for shell substrate. Although the recovery period is long, the project area is small relative to the amount of substrate habitat that exists throughout the Gulf of Mexico. The proposed RWIs for the Chacahoula and Stratton Ridge sites, the Pascagoula terminal and RWI at Pascagoula for the Richton site, and the security buffer for the West Hackberry expansion would cause a permanent impact to EFH. Many of the stream crossings within the coastal areas would be directionally drilled under the stream bed so there would be little to no disturbance of EFH. Section 3.7.2.1.2 provides a detailed discussion of how the pipeline and other infrastructure would be constructed. Most of the EFH impacts would be temporary due to pipeline construction. Permanent impacts to EFH would be mitigated in accordance with the Section 404 permit and consultation with NOAA Fisheries, through creation, restoration or preservation of EFH, and incorporation of conservation recommendations from NOAA Fisheries.

Depending on the site, the brine diffusion systems would operate for 3 to 5 years during cavern solution mining and could alter the physiochemical makeup of the water column. For the Richton alternative, the solution mining and brine discharge may take longer if low-flow conditions in the Leaf River reduce the available water for solution mining. If this situation occurred, the volume of brine discharge would be reduced commensurately with the reduced water available for solution mining. The brine would leave the diffusers at a rate of 30 feet (9.1 meters) per second at or near ambient temperature, and at a concentration of about 260 parts per thousand (ppt). The area immediately adjacent to the brine port nozzles would have an average estimated salinity increase of 4.7 parts per thousand. From the initial diffusion point, the brine would spread outward in plumes of decreasing salinity. The total potentially affected area has been modeled for each site and is presented in appendix C.

The plumes would range in extent, but would generally be similar with respect to shape and maximum salinity increase at all sites. However, the brine discharge for the Chacahoula site would have a slightly higher increase in salinity because of the unusual bathymetry around the brine diffusers (see discussion under site specific impacts and appendix C). The size of the diffusion plumes would be up to 7.2 square nautical miles (25 square kilometers) for the +1 part per thousand contour, 4.0 square nautical miles (14 square kilometers) for the +2 part per thousand contour, 2.0 square nautical miles (7.0 square kilometers) for the +3 part per thousand contour, and 1.2 square nautical miles (4 square kilometers) for the +4 part per thousand contour. However, because of the freshwater influx from the Mississippi River, Gulf of Mexico species are generally adapted to salinity changes. Furthermore, the majority of the federally managed species are mobile and would be likely to leave any affected areas. The benthic community near the diffuser could be altered by increased salinity, which could affect the food supply of managed species. In addition, the species composition could change to those more tolerant of increased salinity. The area of potential benthic community changes would be relatively small compared to the range of the species found throughout the Gulf of Mexico and would persist during solution mining (3 to 5 years in most cases), cavern drawdown and maintenance, and for a short period after the discharge terminates.

> Mitigation: DOE will continue to consult with NOAA Fisheries on strategies to avoid and minimize impacts to EFH. DOE will develop a detailed plan to mitigate for permanent loss of EFH and would implement conservation recommendations of NOAA Fisheries identified by the EFH consultation process.

3.7.2.2 Operations and Maintenance Impacts

The following subsections discuss the potential operations and maintenance impacts associated with new and expansion sites and tank farms, RWI structures, pipeline and power line ROWs, and brine diffusion systems.

3.7.2.2.1 New and Expansion Storage Sites and Terminals

The operations and maintenance activities at a new or expansion storage site or terminals would include lawn maintenance, security lighting, equipment maintenance, testing, increased noise from equipment and workers, and vehicular traffic in and around the facility. Such activities would preclude non-tolerant wildlife species from using the site and immediately surrounding habitats. An 8-foot (2.4-meter) higher security fence would be constructed around a new SPR storage facility. The security fence would prevent most animals from returning to the site; however, some animals such as songbirds, raptors, waterfowl, armadillos, otters, egrets, herons, and alligators have been reported to visit or inhabit the existing SPR storage sites.

The structures and lighting associated with a new or expansion site or terminal may increase the number of injuries or mortality of resident and migratory birds. The proposed sites and terminals are located within two important and slightly overlapping North American migratory flyways—the Central and the Mississippi. The artificial lighting on tall structures can disorient birds migrating at night and cause collisions with the lighted structures or become fatigued from hovering around such light sources (Jones and Francis 2003).

> Mitigation: DOE would use down-shielded, low-mast lights on new buildings and storage tanks. Existing SPR facilities mitigate impacts on migratory birds that frequent the facilities during the year (DOE 2004f). During normal operations, environmental safety and health managers survey the property for migratory birds. Nests, when discovered, are flagged for the duration of nesting season and use of certain equipment, such as landscaping equipment or other non-mission critical equipment, is limited or prohibited to minimize the impact on migratory birds. These activities are conducted with the cooperation of the USFWS.

3.7.2.2.2 Raw Water Intake Structure

The operation of the RWI withdrawal during cavern creation, fill, and drawdown would affect aquatic communities by reducing the quantity of water in the water body and potentially altering currents and water quality. Conceptual drawings for the RWIs are shown in figures 2.3.2-1, 2.4.3-3, and 2.4.3-4. The intakes for proposed new sites would withdraw up to 0.5 to 1.2 MMBD (21 to 50 million gallons per day) for solution mining during the typical 4- to 5-year construction of the caverns. The water withdrawal for the Richton alternatives could operate for longer if low-flow conditions in the Leaf River limit the water available for solution mining. The intake also could affect aquatic organisms by entraining organisms small enough to pass through the mesh screens or impinging larger aquatic organisms on the screen. Because of the fluctuations in the rivers and the presence of sensitive aquatic resources, DOE would use cylindrical mesh screens fixed in the water column and equipped with compressed air backwash system on the RWI for Bruinsburg and Richton (Leaf River). The cylindrical intake screens would be oriented parallel to the flow of the river to maximize the sweeping velocity along the screens. The intakes would have an intake velocity of 0.5 feet per second (0.15 meters per second) and mesh size of 0.5 inches (1.3 centimeters). This design reduces the potential for entrainment and impingement (Gowan et al. 1999). A secondary RWI at Pascagoula is proposed for the Richton alternative because of the endangered species and potential low-flow conditions in the Leaf River (see 3.7.5.2.3).

RWI structures at Stratton Ridge, Chacahoula, and the Pascagoula RWI for the Richton alternatives would use a different type of RWI structure with traveling screens on the intake. Because the RWI structures would have a traveling screen that moves across the intake flow, most organisms would not become impinged for extended periods of time. The screen would travel across the intake current, picking up most aquatic organisms and carrying them back to the stream. Some impinged organisms would be injured or killed. Small aquatic organisms, such as juveniles, larval stages, small adults, and dispersed eggs that are entrained would not be returned to the stream. Larger fish, mammals, and other large animals would be protected from the intake structure by the combination of trashbars, a relatively low intake velocity of about 0.5 feet per second (0.15 meters per second), and the size of the mesh in the screens (about 0.5 inches [1.3 centimeters]). Studies have shown that large volume water intake structures can impinge and entrain thousands of fish during the course of a year, but effective traveling screens and bypass systems can, in some cases, result in a survival rate of 80 to 90 percent of the impinged fish (Henderson and Seaby 2000). The severity of the impact from impingement and entrainment due to large volume intakes depends on the site-specific conditions at the intake site, the composition and life history of aquatic species, and whether those species disperse eggs in the water column or lay eggs in a nest.

The operation of the water withdrawal pumps at locations along the ICW (for Stratton Ridge, Big Hill, and Chacahoula) and the Pascagoula RWI in the Gulf of Mexico (for Richton) would not reduce the quantity of water because the ICW waterway and Gulf are tidal. The operation of the RWI structure would have minor localized effects on the currents in the ICW and could affect the salinity gradient by allowing higher salinity water to migrate further upstream. The RWI for the Bruinsburg site would be located on the Mississippi River. The operation of the RWI structure on the Leaf River for the Richton site could significantly reduce the streamflow needed to create habitats for aquatic organisms, including special status species and their designated critical habitats. Further, water withdrawals during low streamflow periods could increase the rate of fish entrainment and impingement in the Leaf River. This is discussed in detail in section 3.7.5. The operation of the RWI would also generate noise that could disturb nearby wildlife and aquatic organisms, especially those that are sensitive to disturbance or that may be nesting, breeding, or caring for young. The RWI would also require security lighting and a 300-foot (91-meter) security buffer. Artificial lighting can disorient birds migrating at night and cause them to collide with lighted structures.

The construction and operation of the RWI would require DOE to complete and submit the Section 404/401 permit application to the USACE and appropriate state agency. The permit application would require that DOE demonstrate avoidance and minimization of impacts to aquatic resources. Other resource agencies such as the USFWS, NOAA Fisheries, and the state agency responsible for water resources/fisheries would be involved in the review of the permit application. DOE would coordinate with these agencies during the permit process and incorporate their recommendations into the design of the facility where possible.

Mitigation: Should the RWI be located near a noise sensitive area—for example, a national wildlife refuge, nesting area for a special status species, or bird rookery—noise attenuation (such as concrete enclosures and/or use of low noise pumps) would be incorporated into the structure.

Mitigation: If the selected alternative involves a new RWI and water source with vulnerable special status species, DOE would modify the design and use appropriate screen size, intake velocity, withdrawal limits, and screen orientation to minimize the impact to that species. The design and construction method for the RWI would be reviewed and approved by the USACE, USFWS, NOAA Fisheries, and appropriate state agency as part of the Section 404/401 permit process and, in the case of the Richton alternative, through consultation under the ESA.

Mitigation: DOE would use down-shielded, low-mast lighting at the RWI to minimize the impacts to migratory birds.

3.7.2.2.3 Rights-of-Way

DOE would actively maintain a portion of the pipeline and power line ROWs to prevent trees and dense scrub-shrub communities from revegetating in the corridor. The maintenance would involve periodic mechanical clearing of shrubs and trees using a mower, bush-hog, or marsh buggy or periodic pesticide application to suppress woody vegetation. The linear corridors created by new and expanded ROWs can contribute to habitat loss and fragmentation and allow the spread of exotic organisms (invasive species). The impacts of an ROW depend highly on the sensitivity of biota and are greatest when the managed vegetative composition of the ROW sharply contrasts with the surrounding habitat (Graham 2002). Some sensitive species, such as neotropical migrant songbirds, that are in decline along the Gulf Coast, have experienced diminished population levels along pipeline corridors 50- to 75-feet (15- to 23-meters) wide due to habitat loss and fragmentation (Rich et al. 1994). ROWs comprised of grasses and shrubs act as barriers to the crossing of other forest sensitive species, limiting overall habitat availability for some organisms and dividing breeding populations. Invasive species and other generalist organisms tolerant of modified and fragmented habitat conditions within the pipeline corridors can out-compete native vegetation that is sensitive to disturbance. Invasive species can reduce local biodiversity by out-competing native species and can reduce local wildlife habitat and food availability. Maintained corridors can lead to the spread of exotic organisms for several years after their creation (Zink et al. 1995). Examples of exotic species prevalent in southern forests and observed during site visits to the proposed storage sites include the Chinese tallowtree and kudzu (Graham 2002). Other invasive species that are likely to be present in uplands, wetlands, or water bodies along the proposed ROWs and/or the storage and terminal sites include hydrilla, giant salvinia, cogon grass, fire ant, zebra mussel, and nutria.

Several of the candidate sites and proposed ROWs have already experienced significant invasion by the Chinese tallowtree, an introduced species. As required by Executive Order 13112 (Invasive Species), DOE would implement appropriate measures to control invasive species on the selected site. Some native plants and wildlife may actually benefit from the creation of herbaceous dominated corridors, especially if the surrounding region is dominated by forest. In such a case, the establishment of a different type of plant habitat can enhance the local plant and animal biodiversity.

The operations and maintenance impacts associated with the power line ROWs would be the same as those described above. Low-growing vegetation would remain intact under the power lines, while tall vegetation would occasionally need to be trimmed to maintain an adequate distance between the tops of trees and the conductors so as to not interfere with safe operation of the power line. Additional impacts would include the potential for mortality of birds and bats resulting from collisions with the lines or poles.

Local movements of birds are difficult to predict since they vary seasonally and annually and are often linked to climatic conditions. For this reason, the number of potential collisions with poles and/or power lines cannot be quantified or predicted with any specificity. Habitat adjacent to specific portions of each of the corridors determines bird abundance and the species present within that portion of the corridor.

Some mortality resulting from bird collisions with manmade structures within the power line corridor is considered unavoidable. Anticipated mortality levels are not expected to result in long-term loss of population viability in any individual species for any of the proposed corridors because mortality levels are anticipated to be low throughout the life of the power line. Electrocution is not expected to be a substantial hazard because the lines would be spaced wider than the largest local raptor's (eagles and vultures) wingspan. Furthermore, DOE would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Power lines: the State of the Art in 1996* (APLIC 1996). None of the towers is anticipated to require lights for aircraft avoidance, which has been associated with nighttime collisions (Kerlinger 2000). Additional impacts to birds listed under the Migratory Bird Treaty Act would include a loss of some vegetation, an important habitat component.

The type and nature of the impact plant communities and wetlands would depend on whether the affected area is located within the permanently maintained easement (about 50 feet [13 meters] wide per pipeline) or within the temporary construction easement. Additional detail on the width and purpose of the permanently maintained easement and temporary construction easement is included in section 2.3.9.

The permanently maintained easement would be actively managed and therefore forested wetlands and upland forests would be converted to herbaceous plant communities. Upland herbaceous and emergent wetlands that were disturbed by construction would re-establish. The upland forest and forested and scrub-shrub wetlands within the temporary construction easement would re-establish within 5-25 years following construction, depending on the type of community affected. DOE would regrade to pre-construction contours, seed with native plant species, and re-apply the original topsoil, which would promote the re-establishment of the impacted community. About 33 to 40 percent of the acreage affected by the ROW would be located within the permanently maintained easement. Appendix B provides the approximate acreage of potential impacts to wetlands within both the temporary construction and permanently maintained easement.

> Mitigation: DOE management practices would reduce the actively managed area through forested areas to within 15 to 25 feet (5 to 8 meters) on either side of the pipeline, which would reduce the effects of habitat fragmentation. Where appropriate and in accordance with Federal Aviation Administration regulations, lighting would not be placed on the power line power poles. For the proposed power lines, DOE would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Power lines: the State of the Art in 1996* (APLIC 1996). DOE would also conduct postconstruction monitoring of the ROWs to ensure that the construction easements and wetlands hydrology are restored, original contours re-established, and appropriate species have re-established at the site. If the monitoring shows that restoration of the disturbed wetlands has not been successful, DOE would implement a plan to correct the problem. Monitoring procedures would be established by conditions in the Section 404/401 permit.

> Mitigation: DOE would actively manage pipeline ROWs to control invasive species and limit their spread along the corridor. DOE would manage the permanently maintained ROWs in accordance with DOE's 2003 standard procedures for *Offsite Pipeline Maintenance and Repair Instruction* (Publication AS16400.20) (DOE 2003c). DOE would employ the following:

- use seed mixes that are free of noxious or invasive species when reseeding disturbed areas;
- develop a management plan on sites where the Chinese tallowtree or another invasive species has already established;
- monitor the ROW corridors and sites postconstruction to determine if invasive species have colonized the area (DOE would monitor the corridors in accordance with monitoring guidelines established by state and Federal resource agencies; DOE would also take corrective action such as pesticide application or mechanical clearing if invasive species become established within the corridor); and
- restore and reseed disturbed areas with native species immediately after final grades have been achieved.

3.7.2.2.4 Brine Disposal Systems

After storage cavern construction, brine would periodically be released into the Gulf of Mexico for cavern drawdown or maintenance. For example, at the existing Big Hill SPR site, DOE released brine 220 times in 2001, 194 times during 2003, and 243 times during 2004 as part of maintenance or drawdown activities. The average brine discharge during those days was about 36,000 barrels/day with a minimum of 158 barrels/day and a maximum of 125,076 barrels/day. This frequency and volume of discharge is probably representative of the brine discharge that would occur at any of the new SPR sites once the caverns were operational. The impacts of brine disposal during operations and maintenance on aquatic organisms would be much smaller than those discussed for brine disposal during construction because the volume and duration of brine discharge during operations and maintenance generally would be less than that during cavern construction.

3.7.2.2.5 Impacts of a Brine or Petroleum Release

As discussed in section 3.7.2.1.4 and 3.2.2.1, there is a low risk of an accidental brine or oil discharge during operation of an SPR storage site, pipelines, and petroleum terminal. Although the likelihood of such an event is remote, the consequences of a release could be significant if the release was large and/or it migrated into a sensitive aquatic system or plant community. Sections 3.7.2.1.4 and 3.2.2.1 describe the probability of a release and the typical volume involved in past releases at SPR facilities. DOE would notify the appropriate state, local, and Federal agencies and respond quickly to contain any release of brine or oil. Nevertheless, a large release of oil could result in mortality for plants and animals through chemical toxicity, physical smothering, respiratory interference, food and habitat loss, and inhalation or ingestion. Impacted communities can take decades to recover from a large release. A release of brine could cause significant and sometimes fatal physiological trauma to plants and animals, especially bird eggs, fish eggs, and fish larvae. If a release occurred, DOE would remediate, restore, and monitor the impacted area to help mitigate for the impact. As discussed below, the potential impact and response action would be different depending on the type of community that was affected, including the following:

<u>If an upland community was affected by a release</u>, there would probably be plant mortality but most mobile animal species would likely be able to avoid the area. Plants in areas covered by oil could die or be stressed due to chemical toxicity, reduced photosynthetic activity, and reduced growth and reproduction. It is likely that some plants and non-mobile ground dwelling invertebrates and animals would die within the footprint of the area covered by the release. However, a release into an upland would also create a better opportunity to contain and remediate the release, thereby limiting its impact.

If flowing water was affected, the release would potentially be distributed across a larger area. A brine release would be diluted relatively quickly but a release of oil would not. The flowing water would potentially distribute the oil over a wide area and thereby reduce the severity of the impact. However, oil degrades relatively slowly in water and can persist for years. A brine release would have a less severe impact if the receiving water body was a tidally influenced system. A brine release into a fresh-water system would cause more significant impacts, but would not persist. Some sensitive aquatic organisms such as waterfowl, fur-bearing mammals, **phytoplankton** and **zooplankton**, invertebrates, and some fish larvae would probably die within the immediate area of the brine or oil release. In the case of an oil release, the affected area could remain biologically unproductive for a long period of time unless full restoration was successful.

If a stationary water body was affected, the brine or oil would not be transported as far or diluted as quickly. Therefore, the impact would probably cause a higher incidence of plant and animal mortality. The incidence of mortality from a brine release would be reduced in a marine or estuarine environment because the species are adapted to saline conditions.

If wetlands were affected, the brine or oil would probably not be transported as far or diluted as quickly unless the wetlands were inundated. Therefore, the potential impact would probably be more severe. Emergent wetland plants, invertebrates, and waterfowl within the immediate footprint of the impacted area could die or become severely stressed. If the wetlands were inundated, some fish (especially fish eggs and juvenile fish) and aquatic invertebrates would be affected. If the wetlands were an **estuarine system** with plants and animals adapted to saline environments, the severity of a brine release would be reduced. The productivity of the wetlands could be greatly reduced for a long period unless full restoration was successful.

> Mitigation: DOE would notify the appropriate agencies immediately upon a release of oil or brine and attempt to contain it as quickly as possible. DOE would prepare a Spill Prevention, Control, and Countermeasure plan; conduct spill training; and have spill containment equipment onsite so that DOE personnel could respond immediately to contain a release. DOE would establish an agreement with an emergency response contractor to handle large releases, which may require specialized equipment for containment and remediation. If a release occurred, DOE would follow all appropriate reporting requirements for a release, including EPA's reporting requirements for petroleum releases greater than 25 gallons. DOE would respond to all releases in accordance with the facility's Spill Control and Countermeasures Plan. DOE would work with the appropriate resource agencies to assess the extent of impacts to the biological resources and restore the impacted community to the extent practicable. This would include following all required remediation and compensation requirements for impacts to water resources, migratory waterfowl, wetlands, endangered species, and trust resources.

3.7.3 Bruinsburg Storage Site

This section addresses the following areas:

- The proposed Bruinsburg storage site, associated facilities, and site access road;
- The proposed pipeline, and power line ROWs;
- The proposed RWI structure;
- The proposed terminal in Peetsville;
- The proposed terminal in Anchorage, LA; and
- The proposed 60 brine disposal wells.

At the terminal in Anchorage, LA, DOE would use existing docks at the Placid refinery. Regardless of whether DOE selects one of the proposed Bruinsburg alternatives, the refinery is upgrading the docks to receive oil tankers. The upgrade would accommodate DOE's dock needs for the marine terminal.

3.7.3.1 Affected Environment

3.7.3.1.1 Bruinsburg Storage Site

Plants, Wetlands, and Wildlife

The proposed Bruinsburg storage site would occupy about 364 acres (150 hectares) located 10 miles (16 kilometers) west of Port Gibson, MS. This area includes the 266-acre (108-hectare) storage site with a 99-acre (40-hectare) security buffer surrounding the facility. The site is in the Bluff Hills **ecoregion** of Mississippi in the alluvial plain of the Mississippi River (Chapman et al. 2004). The Bluff Hills ecoregion contains a mosaic of habitats including sloping hills, ravines, and small cypress swamps. Approximately two-thirds of the proposed Bruinsburg site is located in a relatively flat landscape, currently occupied by cultivated cotton fields, cypress swamp, and deciduous forest. The remaining one-third of the proposed site, where the administrative buildings, pumps, and brine pond would be located, would encompass an upland area outside the floodplain of the Mississippi River.

The cypress swamp (palustrine forested wetlands) is characterized by large cypress trees situated in 3 to 4 feet (1 to 1.3 meters) of standing water with Spanish moss on the branches. The cypress swamp is surrounded by fresh water emergent wetlands dominated by sedges and grasses. Water oak and hickory dominate the intermittent or semipermanently flooded forested wetlands on the site. Other trees common throughout the forested wetlands include sweet gum, basswood, water oak, tupelo, and box elder. The **understory** includes holly, bamboo, and arrowwood, while groundcover consists of various grasses and sedges, horsetail, clearweed, and smartweed. Portions of the forested wetlands that were not inundated during the site visit display signs of periodic inundation such as water marks on trees and tree buttressing. Forested wetlands are characterized by water oaks, box elder, and tupelo. The upland forested areas are dominated by oak and hickory, with some sweet gum.

The natural hydrology of the site has been altered by a levee extending across the center of the site separating a bayou from the cotton fields to the north. Beaver dams have further altered the surface water flow by creating temporary ponds along the intermittent streams crossing the central portion of the site. Two intermittent streams converge onsite to form a bayou, which is the only permanent stream within the proposed boundaries. Areas adjacent to the bayou are permanently flooded; the remaining areas show signs of intermittent or semipermanent flooding.

The administrative buildings would be located on the eastern side of the site. This area is characterized by steep rolling hills and ravines covered with mixed hardwood and pine forests. The area appeared previously disturbed due to the presence of bamboo mixed in the interior of the upland forest. The forest is dominated by oaks and hickories intermingled with pine. The understory is comprised of herbaceous cover, shrubs, and seedlings.

The wildlife observed in the vicinity of the Bruinsburg site during the site visit includes white-tailed deer, armadillo, beaver, slider turtle, American woodcock, owl, and woodpecker.

The proposed Bruinsburg site is located along the Mississippi River flyway (Birdnature.com 2005). The Mississippi alluvial valley is an important wintering habitat for waterfowl, particularly mallards, wood ducks, and numerous other bird species that are regulated by the Migratory Bird Treaty Act.

Special Status Species

A literature review identified that the following federally listed species may be present within the county where the proposed Bruinsburg storage site is located: the interior least tern, the bayou darter, the pallid sturgeon, and the Louisiana black bear. However, a review of the conditions at the proposed Bruinsburg storage site and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that the proposed storage site would not affect any federally listed threatened, endangered, or candidate species (see Appendix G Evaluation and Federally Listed Species in Mississippi).

Species that are listed as threatened or endangered by the states of Mississippi or Louisiana, but that are not federally listed, are summarized in appendix I for the counties or parishes containing parts of the proposed Bruinsburg development.

Special Status Areas

There are no special status areas in or adjacent to the proposed storage site.

Essential Fish Habitat

No EFH is located in or near the proposed storage site.

3.7.3.1.2 Bruinsburg Rights-of-Way

Four pipelines and five power line ROWs would be required for the Bruinsburg storage site (see figure 2.4.1-1 in chapter 2). An access road to the brine injection wells would follow the brine disposal pipeline ROW.

Pipeline ROWs

- A proposed 109-mile (176-kilometer) crude oil pipeline from the Bruinsburg site to the Anchorage terminal. The pipeline would share an ROW with the brine disposal pipeline and RWI pipeline for 3.5 miles (5.6 kilometers) and then continues in a shared ROW with the brine disposal pipeline for another 10 miles (17 kilometers). Approximately 34 miles (55 kilometers) of the ROW would be along existing ROWs.

- A proposed 39-mile (62-kilometer) crude oil pipeline to the Peetsville terminal. This pipeline would start at the Bruinsburg storage site and end at the Peetsville terminal.

- A 4-mile (6.4-kilometer) RWI pipeline from the Bruinsburg site to the RWI structure on the Mississippi River. The pipeline would share an ROW with the brine disposal pipeline and the crude oil pipeline to Anchorage for 3.5 miles (5.6 kilometers).

- A 14-mile (22 kilometer) brine disposal pipeline and access road from the Bruinsburg site to the brine injections wells. The pipeline and access road would share an ROW with the crude oil pipeline to Anchorage and RWI pipeline for 3.5 miles (5.6 kilometers).

Power Line ROWs

- A proposed 5.4-mile (8.7-kilometer) ROW for a 138-kilovolt power line from the Bruinsburg site to the Grand Gulf substation.
- A proposed 7.2-mile (12-kilometer) ROW for a 138-kilovolt power line from the Bruinsburg site to the Port Gibson substation. This ROW would follow the crude oil pipeline ROW to the Peetsville terminal.
- A proposed 4.1-mile (6.6-kilometer) ROW for dual 34.5-kilovolt power lines from the Bruinsburg site to the RWI structure. This ROW would follow the RWI pipeline.
- A proposed 11.1-mile (17.9-kilometer) ROW for dual power lines to the brine disposal wells from the RWI structure. This ROW would follow the pipeline ROW of the RWI and brine disposal pipeline.

Plants, Wetlands, and Wildlife

About 60 percent of the shared 3.5-mile (5.6-kilometer) ROW for the crude oil, brine disposal, and RWI pipelines would cross hardwood forested habitat. This ROW would include the power line ROW for the RWI structure. According to the National Wetlands Inventory data, most of this forest is palustrine forested wetlands, which is typical of the Mississippi River floodplain. Approximately 16 percent of the area crossed by the proposed pipelines is agricultural land.

The RWI ROW would continue for 0.5 mile (0.8 kilometer) west from the shared existing ROW. Approximately 44 percent of the ROW would cross palustrine forested wetlands. The remaining habitat is a mixture of riverine wetlands and hardwood forest.

From the shared ROW, the proposed crude oil and brine disposal pipeline ROW would continue south for 10.3 miles (16.6 kilometers). This ROW would include the power line and access road among the brine disposal wells. Approximately 38 percent of the area that would be crossed by the shared crude oil and brine disposal pipeline ROW is hardwood forest and 15 percent is palustrine forested wetlands. The remainder is a mixture of grassland and disturbed or management habitat.

The crude oil pipeline would continue from the last brine injection well for 95.5 miles (153.4 kilometers) to the Anchorage terminal. Hardwood forested habitat is the dominant land classification crossed by this ROW. The pipeline ROW would flank the Mississippi River in the alluvial plain, which is characterized by oxbow lakes that are remnants of the former channel of the Mississippi River. Almost 30 percent of the proposed ROW area contains wetlands, most of which are palustrine forested or scrub-shrub associated with the floodplain. This proposed ROW follows an existing pipeline ROW for 34.0 miles (54.7 kilometers) that spans from Mississippi into Louisiana, which represents approximately 32 percent of the ROW.

About 60 percent of the land crossed by the proposed crude oil pipeline to the Peetsville terminal and the power line ROW to Port Gibson is forested. Most of the forests consist of deciduous hardwoods with 20 percent of the land classified as evergreen (pine) forest. Most of the evergreen forest land crossed by the proposed pipeline ROW is managed pine plantations. The remaining landscape contains scrub-shrub habitat, which likely includes areas formerly harvested for pine or used in agriculture.

The only power line not following a pipeline corridor would depart from the proposed Bruinsburg site and head northeast for 5.5 miles (8.6 kilometers) to the Grand Gulf Entergy substation. The power line ROW would continue within the alluvial plain of the Mississippi River, avoiding the steep topography located to the east. More than 70 percent of the proposed ROW contains hardwood forested habitat, most of which is palustrine forested wetlands.

Based on the various land classification types and the wetlands present along the proposed ROWs, several common mammals, birds, amphibians, and reptiles may use the existing habitats in the proposed ROWs. The species would be similar to those described under the proposed Bruinsburg storage site.

Special Status Species

A literature review identified that the following federally listed species may be present within the counties where the proposed ROWs would cross: bald eagle, interior least tern, red-cockaded woodpecker, bayou darter, gulf sturgeon, pallid sturgeon, Alabama heelspitter mussel, fat pocketbook mussel, Louisiana black bear, West Indian manatee, and ringed map turtle. However, a review of the conditions along the proposed ROWs and consultations with the USFWS and the Mississippi Natural Heritage Program revealed proposed pipeline ROWs associated with the proposed Bruinsburg site may affect the fat pocketbook mussel. Although some potential habitat for other federally listed species may exist along the ROWs, DOE has determined there would be no effect to these species (see appendix G).

A population of the federally endangered fat pocketbook mussel was recently discovered in the Mississippi River and associated tributaries in Jefferson County, MS (Aycock 2005; NatureServe 2005). The proposed construction of the pipeline ROW from Bruinsburg to Anchorage passes through Jefferson County and crosses Coles Creek and Fairchilds Creek, which are believed to support the fat pocketbook mussel.

Species that are listed as threatened or endangered by the states of Mississippi or Louisiana, but that are not federally listed, are summarized in Appendix I State Listed Species Screening Evaluation for the counties or parishes containing parts of the proposed Bruinsburg development. The Mississippi Natural Heritage Program did not identify any populations of state-listed species within 2 miles (3 kilometers) of the proposed ROWs. Based on this information, DOE does not expect the proposed ROWs to affect state-listed species.

Special Status Areas

The proposed crude oil pipeline ROW to the Peetsville terminal would cross through the Natchez Trace Parkway and the proclamation area of the Homochitto National Forest. The Natchez Trace Parkway is a 440-mile (710-kilometer) highway, managed by the National Park Service, created to commemorate an ancient trail that connected portions of the Mississippi River to salt licks located in central Tennessee. The crude oil pipeline would connect with an existing power line corridor before entering the proclamation area, and then it would follow that corridor through the parkway.

The Homochitto National Forest is in southwestern Mississippi. It contains close to 189,000 acres (765,000 hectares) of pine trees and deciduous hardwoods. The proposed crude oil pipeline to the Peetsville terminal from the Bruinsburg site would travel through private property in the proclamation boundary of the Homochitto National Forest for 6.8 miles (11 kilometers). The proclamation area includes land that the Forest Service could acquire in the future to expand the official boundaries of the National Forest. Approximately 5.6 miles (9 kilometers) of the pipeline would run parallel to Highway 550. The remainder of the ROW would follow an existing power line corridor.

Essential Fish Habitat

No EFH is located in or near the proposed ROWs.

3.7.3.1.3 Raw Water Intake Structure

The proposed RWI structure would be located on the Mississippi River approximately 3 miles (5 kilometers) southwest of the proposed storage site. Access to the facility would be available from an existing road; therefore, an additional access road would not be required.

Plants, Wetlands, and Wildlife

The RWI would disturb approximately 16 acres (7 hectares) along the Mississippi River. The RWI would be located on or adjacent to an existing elevated road. The area along the road is forested, containing similar vegetation as the site of the proposed storage facility. Along the road, some areas have been cleared to attract deer during the hunting season. The site is deciduous hardwood forest, classified as palustrine forested wetlands according to National Wetlands Inventory data. The area is susceptible to periodic flooding by the Mississippi River.

The lower Mississippi River basin fish habitat is characterized by swift current, shifting substrates, high suspended sediment concentrations, and low primary productivity (Wiener et al. 2005). More than 150 species inhabit the lower Mississippi River basin, which includes representatives of the following families: Cipenseridae, Catostomidae, Clupeidae, Cottidae, Cyprinidae, Esocidae, Gasterosteidae, Ictaluridae, Lepisosteidae, Poeciliidae, and Polyodontidae (Page and Burr 1991; Froese and Pauly 2006; Hoese and Moore 1998). Most fish reside near the banks of the river and along the channel bottom where the current is slower.

The Mississippi River is an important visual landmark for migratory birds. Numerous North American bird species use the corridor to reach wintering habitat available in the swamps and bottomland hardwood forests of Louisiana, southern Mississippi, and other areas along the Gulf of Mexico. Many of these species are regulated by the Migratory Bird Treaty Act.

Special Status Species

A literature review identified that the following federally listed species may be present within the county where the proposed RWI would be located: The interior least tern, the bayou darter, the pallid sturgeon, and the Louisiana black bear. Consultations with the USFWS and Mississippi Natural Heritage Program determined that the proposed RWI structure may affect the pallid sturgeon. Potentially suitable habitat exists near the RWI structure for the interior least tern, but there are no recorded occurrences of this species within 2 miles (3 kilometers) of the proposed RWI site. DOE determined that the proposed RWI would not affect the interior least tern. Detailed discussion of these species and the habitat found at the site is provided in appendix G.

The pallid sturgeon is a federally listed endangered species known to inhabit the Missouri/Mississippi River drainage. The sturgeon is listed in five counties in Mississippi, including Clairborne County where the proposed RWI structure would be located. This segment of the Mississippi River is not designated as critical habitat for the pallid sturgeon. Adults are seasonal visitors to the area, but larvae and juveniles could be found in this segment of the river year-round. If one of the Bruinsburg alternatives is selected, DOE would conduct a survey along this segment to determine if the pallid sturgeon is present near the proposed RWI. DOE would initiate formal Section 7 Consultation with the USFWS and NOAA Fisheries if any portion of the project would adversely affect the pallid sturgeon.

Species that are listed as threatened or endangered by Mississippi or Louisiana, but are not federally listed, are summarized in appendix I for the counties or parishes containing parts of the proposed

Bruinsburg storage site and related infrastructure. The Mississippi Natural Heritage Program did not identify any populations of state-listed species within 2 miles (3 kilometers) of the ROWs. Based on this information, DOE does not expect the proposed RWI to affect state-listed species.

Special Status Areas

No special status areas occur in or near the boundaries of the proposed RWI structure.

Essential Fish Habitat

No EFH occurs in or near the boundaries of the proposed RWI structure.

3.7.3.1.4 Peetsville Terminal

Plants, Wetlands, and Wildlife

The proposed 71-acre (29-hectare) Peetsville terminal would be located adjacent to a pump station for the existing Capline pipeline. Managed pine plantations and rural housing surround the site for the proposed terminal, which is recovering from a relatively recent pine harvest. Approximately 53 percent of the site contains scrub-shrub habitat with approximately 27 percent of the total area occupied by hardwood deciduous forest. The remaining area is occupied by evergreen pine forest and disturbed or managed land.

The wildlife in the project area includes common, mobile species such as the nine-banded armadillo and white-tailed deer, which are adapted to living in somewhat disturbed habitat.

Special Status Species

A review of the conditions at the proposed Peetsville terminal and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that the proposed terminal would not affect any federally listed threatened, endangered, or candidate species (see appendix G).

The proposed Peetsville terminal does not provide suitable habitat for any state-listed threatened or endangered species (see appendix I) and none were found within 2 miles (3 kilometers) of the proposed Peetsville terminal (MNHP 2006).

Special Status Areas

The Homochitto National Forest is located approximately 2 miles (3 kilometers) west of the proposed Peetsville terminal location.

Essential Fish Habitat

No EFH occurs in or near the proposed Peetsville terminal.

3.7.3.1.5 Anchorage Terminal

Plants, Wetlands, and Wildlife

The proposed 75-acre (31-hectare) Anchorage terminal would be located south of the Exxon/Mobil and Placid refineries. These facilities flank the Mississippi River levee. The existing land use for the area where the proposed facility would be located is row-crop agriculture. Most of the land surrounding the proposed site is also disturbed and is used for industrial, agricultural, and some residential purposes. According to the National Wetlands Inventory data, there are no wetlands or natural habitat on the proposed site. Because the area is disturbed and actively farmed, it would support only a limited amount of wildlife.

Special Status Species

A literature review identified that the following federally listed species may be present within the county where the proposed Anchorage terminal would be located: bald eagle, pallid sturgeon, and the Louisiana black bear. However, a review of the conditions at the proposed Anchorage terminal and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that the proposed terminal would not affect any federally listed threatened, endangered, or candidate species (see appendix G).

The proposed Anchorage terminal site also does not provide suitable habitat for any state-listed threatened or endangered species (see appendix I) and none was found within 2 miles (3 kilometers) of the proposed terminal (MNHP 2006).

Special Status Areas

No special status areas are located in or near the boundaries of the proposed terminal.

Essential Fish Habitat

No EFH is located in or near the boundaries of the proposed terminal.

3.7.3.1.6 Brine Injection Wells

Sixty brine disposal injection wells, each occupying an area of about 1.2 acres (0.5 hectares), would be located at 1,000-foot (300-meter) intervals along 11.2 miles (18.0 kilometers) of the proposed pipeline ROW from the Bruinsburg site toward Anchorage.

Plants, Wetlands, and Wildlife

The area proposed for the brine injection wells is located east of the Mississippi River in the Holocene floodplain of the Mississippi alluvial plain. The area is characterized by oxbow lakes, natural levees, and abandoned channels separated by upland hardwood forests and agricultural land. The land that would be affected by the proposed wells is roughly half hardwood deciduous forests and half agricultural land. According the National Wetlands Inventory data, 20 percent of the affected area is classified as palustrine forested or scrub-shrub wetlands.

Special Status Species

A literature review identified that the following federally listed species may be present within the county where the proposed brine injection wells would be located: the interior least tern, the bayou darter, the pallid sturgeon, and the Louisiana black bear. However, a review of the conditions at the proposed brine injection wells and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that the proposed injection wells would not affect any federally listed threatened, endangered, or candidate species (see appendix G).

The area for the brine injection wells does not provide suitable habitat for any state-listed threatened or endangered species (see appendix I), and none was found within 2 miles (3 kilometers) of the proposed wells (MNHP 2006).

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Special Status Areas

No special status areas are located in or near the boundaries of the proposed brine injection wells.

Essential Fish Habitat

No EFH occurs in or near the proposed brine injection wells.

3.7.3.2 Impacts

3.7.3.2.1 Bruinsburg Storage Site

Plants, Wetlands, and Wildlife

The clearing and grading associated with the Bruinsburg storage site would affect about 364 acres (147 hectares). This area would include the 266-acre (108-hectare) storage site with a 300-foot (91-meter) cleared security buffer surrounding the site and the 0.6-mile (0.9-kilometer) long site access road. Trees would be removed within the security buffer; however, emergent wetlands vegetation and herbaceous upland species would be allowed to revegetate following construction. Preparation of the site for the administrative buildings and brine disposal pond would require clearing, filling, and grading of steep, forested ravines. The proposed construction of the site and the access road would affect the following areas:

- 28 acres (12 hectares) of evergreen (pine) forest,
- 115 acres (47 hectares) of hardwood forest,
- 103 acres (42 hectares) of palustrine forested wetlands (cypress swamp),
- 30 acres (12 hectares) of grassland and scrub-shrub,
- 87 acres (35 hectares) of disturbed or managed land, and
- 38 acres (16 hectares) of water or emergent wetlands.

Clearing and grading the palustrine forested wetlands would permanently fill 91 acres (37 hectares), the impacts of which are described in section 3.7.2. Although the forested wetlands are adjacent to actively managed cotton fields, the forested wetlands contain large cypress trees, which indicate that the wetlands have been relatively undisturbed for several decades. Clearing and grading of the forested wetlands would result in the loss of a relatively stable and ecologically valuable **ecosystem** capable of supporting a variety of wildlife species. DOE modified this facility footprint and shifted the administrative buildings to the east to avoid wetlands. The small size and configuration of the salt dome makes it impractical to further reduce or avoid wetlands impacts. If this site is developed, this ecologically important wetlands may be adversely affected, which would be mitigated somewhat by compensating for the impacts to jurisdictional wetlands.

If one of the Bruinsburg alternatives is selected, DOE would complete a wetlands delineation and secure a jurisdictional determination from the USACE. In addition, DOE would refine the conceptual site plan to avoid filling in wetlands and preserve onsite emergent wetlands to the maximum extent practicable. DOE would submit a Joint Permit Application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to wetlands. DOE would implement the mitigation measures described in the Common Impacts section (section 3.7.2) and in accordance with the 404 permit and 401 Water Quality Certificate from the USACE and the Mississippi Department of Environmental Quality. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetlands impacts.

As discussed in section 3.7.2, some wildlife would be killed or displaced to surrounding areas during construction. The forested wetlands habitat continues 1 mile (2 kilometers) to Bayou Pierre. It would provide sufficient habitat for displaced wildlife. Common animals such as white-tailed deer and nine-banded armadillo could find sufficient habitat in the surrounding area, including locally abundant upland forested areas. After the security fencing is constructed, wildlife use of the site would be limited; however, some mobile species and birds would still visit the site.

The operations and maintenance activities described in section 3.7.2 would preclude wildlife sensitive to human disturbance from entering the area. These animals either would adapt to the disturbance or would move to new habitat. Similar forested habitat is available adjacent to the proposed site. Most common species (e.g., deer and armadillos) could tolerate noise and activities at the new SPR facility. The construction, operations, and maintenance impacts might disrupt individual animals, but would not alter the state or regional population or viability of these wildlife species.

The proposed construction of the Bruinsburg site and related infrastructure would affect aquatic and terrestrial species such as beavers, amphibians, small reptiles, and fish that use the cypress swamp. The downgradient wetlands offsite would experience some sedimentation and temporary water impacts as the site vegetation is removed, the surrounding wetlands filled, and local streams diverted. Aquatic organisms would need to find suitable aquatic habitat in the adjacent wetlands or other nearby streams.

The clearing, filling, and grading of the steep, forested ravines in site preparation for the administrative buildings and brine pond would cause construction-related erosion. As presented in chapter 2, erosion would be minimized with the use of best management practices. An erosion and sediment control plan and NPDES stormwater permit issued by the Mississippi Department of Environmental Quality for construction activities would be secured, which would require the use of best management practices to minimize the impact to water bodies. After site preparation is completed, DOE would grade and contour the adjacent hillside at a slope that allows revegetation of herbaceous plants, which plants would help control runoff, minimize erosion, and stabilize the surrounding ravines.

The potential for operational and maintenance impacts on migratory birds is described in section 3.7.2.

> Mitigation: DOE would use low-mast, down-shielded lights to minimize the impacts to migratory birds. DOE, in cooperation with the USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. If one of the Bruinsburg alternatives is selected, DOE would conduct a survey of raptor nests and secure any necessary permits in accordance with the requirements of the Migratory Bird Treaty Act.

Special Status Species

The proposed Bruinsburg storage site would not affect any federally listed threatened or endangered species, candidate species, or designated critical habitat (see appendix G).

DOE would conduct a habitat assessment to determine if any areas of the ROWs meet the habitat requirements of state-listed species presented in appendix I and to determine if surveys are necessary.

Special Status Areas

No special status areas are located in or near the boundaries of the proposed site.

Essential Fish Habitat

No EFH exists in or near the boundaries of the proposed site.

3.7.3.2.2 Bruinsburg Rights-of-Way

Plants, Wetlands, and Wildlife

Construction in the pipeline and power line ROWs would result in clearing all the vegetation within the ROW. The ROW clearing would affect the following land types as determined by Gap Analysis Program data (USGS 2003):

- 243 acres (98 hectares) of evergreen (pine) forest,
- 926 acres (375 hectares) of deciduous forest,
- 463 acres (187 hectares) of grassland and scrub and shrub habitat,
- 453 acres (183 hectares) of disturbed or managed areas,
- 106 acres (43 hectares) of water and emergent wetlands, and
- 5 acres (2 hectares) of other land categories that could not be determined with available data.

Some of the evergreen and deciduous forested habitat has already been disturbed and fragmented from existing pipeline corridors, agricultural lands, and pine plantations.

GAP Analysis Program data do not accurately classify wetlands areas, particularly forested wetlands. DOE used National Wetlands Inventory data and the proposed construction easements to determine that the ROWs would affect the following wetlands:

- 216 acres (87 hectares) of palustrine forested wetlands (cypress swamp),
- 44 acres (18 hectares) of palustrine scrub-shrub wetlands,
- 5 acres (2 hectares) of palustrine unconsolidated bottom, and
- 69 acres (28 hectares) of riverine wetlands.

The proposed pipeline and power line corridors would permanently affect about 33 to 40 percent of the acreage described above because only a 50-foot-wide (15-meter-wide) easement per pipeline would be maintained permanently. The vegetation in the construction easement would be cleared, but DOE would regrade to preconstruction contours and reseed with native species in this area to re-establish native habitat. The area within the permanent easement would be permanently maintained, but some wetlands functions would be restored because the area would be regraded to preconstruction conditions and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands and the nature and amount of wetland impact from the permanent and construction easements. In addition, many of these wetlands would be avoided by the use of directional drilling under the wetlands from the adjacent uplands. Moreover, about 34 percent of the pipeline ROWs would be within or parallel to an existing ROW. Use of existing ROW corridors to the maximum extent practicable would minimize the impact to undisturbed communities and wildlife.

In accordance with the Section 404/401 permit conditions, DOE would compensate for the wetland impacts.

As stated in the section 3.7.2, construction in the proposed ROWs would displace or kill some aquatic and terrestrial wildlife. Noise and human activity may temporarily preclude some animals from using the nearby habitat. The duration of construction through these areas would be short (6 to 10 weeks at any one location) and ample habitat would be available nearby for most species. The elevated portion of the power lines could represent a strike hazard for resident and migratory birds; however, the maximum tower height is expected to be 75 feet (23 meters), which would greatly reduce the hazard. These impacts may disrupt individual animals, but they would not alter the regional population or species viability.

The potential impacts associated with the operations and maintenance of the proposed ROWs is described in section 3.7.2.

> <u>Mitigation</u>: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct any problems that are identified.
>
> DOE would use low power line poles (less than 75 feet [23 meters]) and would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Power lines: the State of the Art in 1996* (APLIC 1996).

Special Status Species

The federally endangered fat pocketbook mussel is believed to be present in Coles Creek and Fairchilds Creek, both of which would be crossed by the ROW to Anchorage. Coles Creek would also be crossed by the access road to the brine injection wells. Because these tributaries are small, conventional construction methods (e.g., open-ditch excavation) would normally be used to bury the pipeline below the streambeds. During construction of the stream crossings at Coles and Fairchilds Creeks, excavation may directly affect fat pocketbooks, if they are present. In addition, construction would temporarily disrupt sand, silt, or clay streambed habitat favored by the species. If construction were to occur during the reproductive stage (July to October) of the species, construction may drive away hosts of the mussel's larval stage, such as red drum or other fish.

If one of the Bruinsburg alternatives is selected for development, a qualified biologist would survey Coles Creek and Fairchilds Creek in the area of the proposed crossings to determine if the fat pocketbook mussel is present. If the mussels are identified in those areas, DOE would initiate formal Section 7 Consultation with the USFWS and complete a Biological Assessment if required. DOE would use directional drilling to avoid disturbance to the stream, if practicable or the mussels would be relocated to suitable habitat outside the area of disturbance. Relocation of fresh-water mussels has been documented as a successful strategy to avoid impacts during instream construction disturbances (Reutter et al. 2001). After construction, the streambeds would be restored to their original condition. Operations and maintenance of the pipelines would not affect the mussels because such activities would be minor and infrequent.

A small bridge or box culvert would be built for the brine access road to cross Coles Creek. Construction of the box culvert may have a temporary effect on the mussels (if they are present) because some in-stream disturbance would occur even with best management practices to control siltation. The streambed would be restored after construction. Operations and maintenance of the road would occur infrequently and would not affect the mussels.

Special Status Areas

The proposed crude oil pipeline to the Peetsville terminal would cross the Natchez Trace Parkway in an existing utility ROW and would follow an existing highway through private land within the proclamation boundary of the Homochitto National Forest. Construction through the Natchez Trace Parkway would require an expansion of the existing ROW and the clearing of additional vegetation; however, the existing corridor has already fragmented the forest. Construction of the pipeline through the proclamation boundary of the national forest would also require clearing of additional vegetation along the highway easement. Trees would not be allowed to regrow within the 50-foot (15-meter) maintained easement; though the remaining area affected by construction would be allowed to regenerate to natural habitat. Use of existing ROW and road corridors to the maximum extent practicable would minimize the impact to undisturbed communities and wildlife.

> Mitigation: If one of the Bruinsburg alternatives is selected, DOE would coordinate with the National Park Service to obtain the proper ROW easements through the Natchez Trace Parkway and ensure that important natural resources are avoided to the maximum extent practicable.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat such as wetlands or habitat for special status species. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct problems that are identified.

Essential Fish Habitat

No EFH exists in or near the pipeline and power line ROWs.

3.7.3.2.3 Raw Water Intake

Plants, Wetlands, and Wildlife

Section 3.7.2 describes potential construction impacts associated with the RWI structure. The clearing and grading associated with construction of the RWI structure would affect 16 acres (6.5 hectares) of forested and wetlands habitat. The proposed RWI would use T-screen cylindrical screens that are located in the water column. The RWI would have an air-backflow system to clean debris off the screens.

If one of the Bruinsburg alternatives is selected, DOE would complete a wetlands delineation, secure a jurisdictional determination from the USACE, and refine the conceptual site plan to avoid filling in wetlands to the maximum extent practicable. DOE would submit a Joint Permit Application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for wetlands impacts to wetlands. DOE would implement the mitigation measures in accordance with the Section 404 permit and Section 401 Water Quality Certificate from the USACE and the Mississippi Department of Environmental Quality. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetlands impacts.

As presented in chapter 2, erosion would be minimized with the use of best management practices. An erosion and sediment control plan and NPDES stormwater permit issued by the Mississippi Department of Environmental Quality for construction activities would be secured, which would require the use of best management practices to minimize the impact to water bodies.

As discussed in section 3.7.2, some wildlife species would be displaced to similar vegetative and wetlands communities surrounding the RWI structure. Dredging required for construction of the RWI structure would affect some aquatic organisms and temporarily increase suspended sediment in the water column. Mobile species could move away from the construction area. The Mississippi River, in the area of the RWI structure, is a heavily traveled corridor for large barges and other vessels. Most aquatic species would be tolerant of noise and human activity.

Operations and maintenance of the RWI structure would produce noise during cavern solution mining (4 to 5 years) and after construction and during maintenance and drawdown. Noise may preclude sensitive terrestrial and aquatic wildlife from using habitat in the immediate vicinity of the RWI structure. During water withdrawal activities and operation of the RWI structure, some aquatic organisms would become entrained or impinged by the intake, especially larval forms, juveniles, and dispersed fish eggs.

The planned 1.2 MMBD (50 million gallon per day) water withdrawal would be a small fraction of the total flow, and the potential for entrainment and impingement would be minimized by equipping the RWI with appropriate screen diameter, intake velocities, and orienting the cylindrical screens parallel to river flow to maximize the sweeping velocity along the screens.

Section 3.7.2 provides a description of other potential operations and maintenance impacts including artificial lighting and increased human activity that could affect migratory birds and other wildlife.

> Mitigation: As described in section 3.7.2, DOE would use down-shielding and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. DOE, in cooperation with USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. As described in chapter 2, DOE would use noise attenuation measures such as use of a concrete enclosure for the pump station to minimize noise impacts.

> Mitigation: DOE would use a RWI design that reduces the potential for impingement by using a relatively low intake velocity (0.5 ft/sec) and placing the intake screens in the water column and orienting the cylindrical screens parallel to the flow to maximize the sweeping velocity. DOE would use a relatively small mesh size (0.5 inches) to minimize the potential for entrainment.

Special Status Species

Construction of the RWI on the Mississippi River would not likely cause an adverse effect on the federally endangered pallid sturgeon and would not affect designated critical habitat. Construction activities would temporarily disturb a small area of the Mississippi River bottom and resuspend sediments; however, impacts on water quality would be negligible because of the large size and flow rate of the Mississippi in this area. Similarly, impacts on habitat characteristics would be inconsequential because of the small size of the area affected. Any potential construction impacts would be minimized with the use of onshore erosion barriers, instream silt curtains or cofferdams, postconstruction restoration, and other measures.

Operation of the RWI would have the potential to entrain and impinge juvenile and larval sturgeon and their prey. If one of the Bruinsburg alternatives is selected, DOE would initiate formal Section 7 Consultation with the USFWS and NOAA Fisheries. DOE would prepare a Biological Assessment, if required, and implement any conditions of a Biological Opinion. In addition, DOE would work with USFWS and NOAA Fisheries to design the RWI with appropriate mesh size, intake velocity, and other technologies to avoid adverse impacts. Because the planned 1.2 MMBD (50 million gallons per day) raw water withdrawal would be a small fraction of the daily flow of the Mississippi, there would be no significant changes in the water conditions or flow regime due to operation of the RWI.

Special Status Areas

No special status areas are near the proposed RWI site.

Essential Fish Habitat

No EFH is in or near the proposed RWI structure.

3.7.3.2.4 Peetsville Terminal

Plants, Wetlands, and Wildlife

The clearing, grading, and construction of the tank farm associated with the Peetsville terminal would affect about 71 acres (28 hectares) as follows:

- 10 acres (4 hectares) of evergreen (pine) forest,
- 18 acres (7 hectares) of hardwood forest,
- 35 acres (14 hectares) of grassland scrub-shrub habitat,
- 3 acres (1 hectare) of disturbed or managed land, and
- 5 acres (2 hectares) of other land.

If one of the Bruinsburg alternatives is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible, although the entire footprint would be cleared of trees for security reasons. The placement of fill in the wetlands would cause a permanent loss of wetland functions and values. DOE would secure permits from the USACE and Mississippi Department of Environmental Quality for the impact to jurisdictional wetlands and provide compensation for the unavoidable wetland impacts. Section 3.7.2 describes the effects of clearing and filling wetlands in detail. DOE would implement best management practices and comply with permits for erosion and stormwater control during construction and operation of the facility to reduce impacts to aquatic species.

After the security fencing is constructed, wildlife use of the site would be limited; however, some mobile species and birds would probably still visit the site.

The operations and maintenance activities, described in section 3.7.2, may preclude wildlife sensitive to human disturbance from entering the area. These activities at the terminal would be infrequent and similar to activities occurring at the oil pump station adjacent to the proposed terminal. This area has already been disturbed by past construction and habitat fragmentation.

Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts and impacts to forests.

Special Status Species

No federally or state-listed threatened or endangered species would be affected by the construction of the Peetsville terminal (see appendix I).

Special Status Areas

The Peetsville terminal would not affect the Homochitto National Forest, which is located 2 miles (3 kilometers) to the west.

Essential Fish Habitat

No EFH exists in or near the boundaries of the proposed Peetsville terminal.

3.7.3.2.5 Anchorage Terminal

Plants, Wetlands, and Wildlife

The clearing and grading associated with the Anchorage terminal would affect about 71 acres (28 hectares). As described in section 3.7.3.1.5, the proposed facility would be located entirely within actively managed agricultural land; therefore, no natural habitat or wildlife would be affected. No wetlands would be disturbed by clearing and grading activities. Rodents and common organisms living in the fields could find available habitat in other fields near the proposed facility. After the security fencing is constructed, wildlife use of the site would be limited. Some mobile species and birds would probably still visit the site, however.

The operations and maintenance activities described in section 3.7.2 would preclude wildlife sensitive to human disturbance from entering the area. The efforts to operate and maintain the terminal would be similar to activities occurring at other industrial facilities located near the proposed site. Although these construction, operations, and maintenance activities may affect individual organisms, they would not alter the regional population or species viability.

Special Status Species

No federally or state-listed threatened, endangered, or candidate species would be affected by the proposed terminal (see appendices G and I).

Special Status Areas

No special status areas exist in or near the boundaries of the proposed facility.

Essential Fish Habitat

EFH is not present at the proposed Anchorage terminal site.

3.7.3.2.6 Brine Injection Wells

Plants, Wetlands, and Wildlife

Construction of the brine injection wells would result in clearing all vegetation at those sites. The following habitats would be affected according to Mississippi GAP Analysis Program data (USGS 2003):

- 2 acres (1 hectares) of evergreen (pine) forest,
- 31 acres (12.5 hectares) of deciduous forest,
- 8 acres (3 hectares) of grassland and scrub-shrub habitat,
- 21 acres (8 hectares) of disturbed or managed habitat,
- 11 acres (5 hectares) of open water and emergent wetlands, and
- < 1 acre (< 0.04 hectare) of other land categories that could not be determined with available data.

GAP Analysis Program data do not accurately classify wetlands areas, particularly forested wetlands. DOE used National Wetlands Inventory data to determine that the brine injection wells would affect the following wetlands:

- 17 acres (7 hectares) of palustrine forested wetlands, and
- 9 acres (4 hectares) of palustrine scrub-shrub wetlands.

Clearing and grading the palustrine forested wetlands would permanently fill about 9 acres (4 hectares). The impacts associated with clearing and filling wetlands are described in section 3.7.2. If one of the Bruinsburg alternatives is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible, although the entire footprint would be cleared of trees for security reasons. DOE would secure permits from USACE and Mississippi Department of Environmental Quality for the impact to wetlands and provide compensation for unavoidable wetland impacts. After security fencing is constructed, wildlife use of the site would be limited, though some mobile species and birds would probably still visit the area enclosed near the brine injection wells.

Operation of the brine injection wells would produce some continuous noise during the 3 year period of cavern construction and may thus preclude wildlife sensitive to human disturbance from entering the area. These organisms would either adapt to the disturbance or move to new habitat. Most common species (e.g., deer and armadillo) could tolerate noise and activities associated with the brine injection wells.

> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts and impacts to forests.

Special Status Species

The proposed Bruinsburg brine injection wells would not affect any federally or state-listed threatened, endangered, or candidate species (see appendices G and I).

Special Status Areas

No special status areas exist in or near the proposed brine injection wells.

Essential Fish Habitat

No EFH exists in or near the proposed brine disposal injection wells.

3.7.4 Chacahoula Storage Site

This section addresses the following areas:

- The proposed Chacahoula storage site, associated facilities, and access roads;
- Four pipelines and four power lines:
  - a crude oil distribution pipeline to St. James,
  - a crude oil distribution pipeline to Clovelly,
  - a brine disposal pipeline to the Gulf,
  - an RWI pipeline to the ICW,
  - a power line from Thibodaux substation to the site,
  - a power line from Terrebonne substation to the site, and
  - two power lines from existing power lines north of Highway 90 to the RWI;
- The RWI structure and access road; and
- The offshore pipeline and the brine diffusion system.

3.7.4.1 Affected Environment

3.7.4.1.1 Chacahoula Storage Site and Access Roads

Plants, Wetlands, and Wildlife

The proposed Chacahoula storage site is located to the west of Route 309 in southwestern Lafourche Parish, LA, in the Sub-tropical Division, Outer Coastal Plain Mixed Forest Province (Bailey 1995). The proposed site would encompass 230 acres (92 hectares) with a two access roads, 1.5 miles (2.4 kilometers) and 0.5 miles (0.8 kilometers) respectively. The habitat consists of cypress-tupelo swamp, classified by National Wetlands Inventory data as palustrine-forested wetlands. This swamp is associated historically with Bayou Lafourche and locally with the Bubbling Bayou and other canal-like bayous. The site is located within a large continuous patch of a cypress-tupelo swamp, which has limited areas of oil and gas development, but remains largely undisturbed.

The entire site is typically flooded, and it has interspersed hammocks of dry or seasonally flooded land formed by sediment deposits. The National Wetlands Inventory data classify the entire site as palustrine, semi-permanently flooded, broadleaf deciduous or needle-leaf deciduous wetlands. The swamp is dominated by bald cypress and water tupelo. Other tree species include ash, maple, black willow, and water oak. Understory vegetation includes greenbriar, palmetto, blackberry, trumpet vine, Virginia creeper, holly, and grape. Deep water areas are devoid of living trees and are covered by a vegetated mat.

The cypress-tupelo swamp is an important fresh-water ecosystem that was once common throughout the southeastern United States. Logging and development pressures have destroyed much of this ecosystem. In Lafourche and Terrebonne Parishes, many of the swamps have been drained and converted to agricultural, residential, or industrial use. The remaining swamps are a critical part of the natural landscape. Generally, their functions include nutrient transformation, flood storage, wildlife habitat, and timber production. Locally, forested wetlands can mitigate the negative impacts of nonpoint source pollution, protect adjacent land from flood waters, and provide economic benefit to local communities through recreational and commercial uses. The forested wetlands of Louisiana are a stopover for millions of migrating birds. The wetlands provide important resources to dozens of species of wading birds. They also serve as a carbon sink, which is a natural environment that absorbs and stores more carbon dioxide from the atmosphere than it releases offsetting greenhouse gas emissions (Coastal Wetlands Forest Conservation and Use Science Working Group 2006).

The area supports numerous bird species that are regulated by the Migratory Bird Treaty Act. The site provides habitat for a large number of terrestrial and aquatic wildlife species including rabbit, squirrel, raccoon, nutria, mink, deer, woodcock, wood duck, crayfish, and various species of fish. The area also provides important resources for wide-ranging predators such as bobcats and coyotes.

Many of the fish species found at or near the site are common throughout the Gulf Coast region. Typical species include fresh-water eels, suckers, minnows, sunfishes and basses, mullet, perch and darters, and fresh-water catfish. Invertebrate species found in the bayous and sloughs are typical of any fresh-water system along the Louisiana swampland. Reptiles such as turtle, American alligator, water moccasin, and western diamondback rattlesnake are often observed in the swamps around the Chacahoula site.

Special Status Species

A literature review identified that the following federally listed species may be present within the parish where the proposed storage site would be located: bald eagle, brown pelican, peregrine falcon, piping plover, and the gulf sturgeon. However, a review of the conditions at the proposed site and consultations with USFWS and the Louisiana Department of Wildlife and Fisheries revealed that there may be suitable habitat for the bald eagle at the proposed storage site. As discussed in appendix F, USFWS and Louisiana Department of Wildlife and Fisheries confirm a recorded bald eagle nesting site within 1 mile (2 kilometers) of the proposed storage site (Lester 2006). The bald eagle is a federally listed threatened species. Much of the habitat surrounding the site and associated infrastructure is cypress-tupelo swamp that could serve as potential habitat for bald eagles, which are known to nest in bald cypress trees near fresh to brackish marshes (estuarine emergent wetlands) or open water in the southeastern parishes (Carloss 2005). The USFWS has proposed removing the bald eagle from the ESA list.

Special Status Areas

There are no special status areas in or near the proposed Chacahoula storage site.

Essential Fish Habitat

No EFH is located in or near the boundaries of the proposed site.

3.7.4.1.2 Chacahoula Rights-of-Way

Four pipelines and three power line ROWs would be required for the Chacahoula storage site. To reduce the impacts from this infrastructure DOE would co-locate many pipelines and power lines and place them adjacent to existing utility corridors where feasible.

Pipeline ROWs

- The proposed crude oil pipeline to St. James would share an ROW for 1 mile (1.6 kilometers) with the crude oil pipeline to Clovelly. Then, it would follow existing ROWs to the north/northeast for 20 miles (32 kilometers) to the existing terminal at St. James.

- The proposed crude oil pipeline to Clovelly would share an ROW for 1 mile (1.6 kilometers) with the crude oil pipeline to St. James. It would then continue east on a new ROW for 23 miles

(37 kilometers), joining an existing ROW southeast for 30 miles (48 kilometers) to the LOOP underground storage facility at Clovelly.

- The proposed RWI pipeline would share a new ROW for 0.4 miles (0.7 kilometers) with the brine disposal pipeline. It would be co-located with the brine disposal pipeline on an existing ROW for another 6.7 miles (11 kilometers), heading south before turning to the RWI located 5.3 miles (8.6 kilometers) to the southwest.

- The proposed brine disposal pipeline would share a new ROW for 0.4 miles (0.7 kilometers) with the RWI pipeline and share an existing ROW with the RWI pipeline for another 6.9 miles (11.0 kilometers) heading south. It would then continue on a new ROW for 4.3 miles (6.8 kilometers) before joining an existing ROW for 26.8 miles (43 kilometers). The final 2.3 miles (3.7 kilometers) of the route to the beach would be through a new ROW before heading offshore 17 miles (28 kilometers) to the diffuser.

Power Lines ROWs

- A proposed 7.1-mile (11-kilometer) power line from Thibodaux substation would join a 15-mile (24-kilometer) power line from Terrebonne station, and then follow the proposed pipeline ROW to the site for 2.5 miles (4.1 kilometers).

- A proposed power line would extend 4.5 miles (7.3 kilometers) south to the RWI.

Plants, Wetlands, and Wildlife

About 50 percent of the proposed corridor for pipelines, power lines, and access roads would follow existing utility corridors; therefore, the habitat is already disturbed and fragmented. The dominant vegetation community crossed by the proposed Chacahoula ROWs is wetlands, comprising 73 percent of the affected vegetation communities. These wetlands include palustrine forested (37 percent), palustrine emergent (14 percent), and estuarine wetlands (16 percent). The wetlands transition from forested to emergent to estuarine as the pipelines transition from the storage site toward the ocean. More than 58 percent of the ROW corridor for the brine discharge pipeline follows existing canals or pipeline corridors, which are maintained and offer reduced habitat value. The wetlands in the proposed ROW protect upland areas from storm and flood surges, convert and store important ecological nutrients and nonpoint pollutants, and serve as habitat for important commercial and recreational species such as fur bears, crayfish, marine fish, and shellfish. Upland areas along the ROWs are disturbed or managed lands such as agriculture and low-density residential. Three-quarters of the upland areas are crossed by the crude oil distribution pipelines to Clovelly and St. James.

Mammals found in and around the fresh-water wetlands include otter, mink, raccoon, muskrat, and nutria. Major avian groups include waterfowl, herons, egrets, ibises, and shorebirds. Amphibians and reptiles include the American alligator, snapping turtles, red-eared turtles, water snakes, southern leopard frogs, and bullfrogs.

The estuarine emergent wetlands are a highly diverse community supporting both saltwater and fresh-water vegetation. They are tidally influenced, with most of the water receding from the vegetated area during low tides. These areas are important nurseries for juvenile species of fish, **crustaceans**, and other invertebrates. The vegetation provides protection and shelter from larger predators and provides food production for wildlife and aquatic organisms. Many of these species, such as shrimp, crab, oysters, trout, flounder, and redfish, are commercially important.

Special Status Species

A literature review identified that the following federally listed species may be present within the parishes where the proposed ROWs cross: bald eagle, brown pelican, peregrine falcon, piping plover, gulf sturgeon, pallid sturgeon, red wolf, and several marine mammals and sea turtles. As discussed in appendix F, the proposed pipeline ROWs would cross within 1 mile (2 kilometers) of a recorded bald eagle nest (Lester 2006). The proposed ROWs to Clovelly, St. James, and the RWI pass within 1,500 feet (460 meters) of a bald eagle nesting site.

According to USFWS, brown pelicans may roost in coastal areas crossed by the proposed Chacahoula pipeline ROWs. The brine disposal pipeline ROW and the crude oil pipeline ROW to Clovelly would pass through or near coastal areas including barrier islands, sandbars, and wetlands that provide potentially suitable habitat for the brown pelican.

Special Status Areas

There are no special status areas in or near the proposed Chacahoula ROWs.

Essential Fish Habitat

Thirty miles (48 kilometers) of the proposed crude oil pipeline to Clovelly and 27 miles (43 kilometers) of the brine disposal pipeline to the Gulf of Mexico pass through estuarine emergent and scrub shrub wetlands and tidal waters (water column and substrate) which are considered EFH.

3.7.4.1.3 Raw Water Intake and Access Road

The proposed RWI would be located on the ICW south of the project site. A 2.5-mile (3.9-kilometer) access road would be built to access the RWI from Highway 90.

Plants, Wetlands, and Wildlife

The ICW is a heavily traveled corridor that is frequently maintained for navigational depth. The RWI access roads would pass through 6 acres (2 hectares) of palustrine forested wetlands and 3 acres (1.2 hectares) of palustrine emergent wetlands. The proposed RWI location is characterized by the same type of palustrine forested wetland community as described at the proposed storage site. Terrestrial species would be similar to those found at the storage site. More than 130 species of fish may inhabit the ICW, including representatives from 40 families (Page and Burr 1991; Froese and Pauly 2006; Hoese and Moore 1998). These organisms are common throughout the Gulf Coast region.

Special Status Species

A literature review identified that the following federally listed species may be present within the parish where the proposed RWI and associated infrastructure would be located: bald eagle, brown pelican, peregrine falcon, piping plover, gulf sturgeon, red wolf, and several marine mammals and sea turtles. The area around the proposed RWI has been identified by the USFWS as an area with a large number of bald eagle nests (Watson 2005). Two nests are located within 1,500 feet (460 meters) of the proposed RWI site.

Special Status Areas

There are no special status areas in or near the proposed Chacahoula RWI site.

Essential Fish Habitat

The proposed RWI would be constructed on the north bank of the ICW. The ICW is the northern reach of tidally-influenced waters that would be considered EFH. The wetland area within the proposed RWI boundary and access road is palustrine-forested wetlands which is not considered EFH.

3.7.4.1.4 Offshore Brine Disposal

Plants, Wetlands, and Wildlife

The offshore brine disposal pipeline would extend 17 miles (28 kilometers) from the shore directly south through the Gulf of Mexico. Unlike the other brine diffusion sites, which are located on relatively flat seabed, Chacahoula's brine diffusers are located next to Ship Shoal. Ship Shoal is a large, natural sand bank that is an important habitat for fish and other marine organisms.

Special Status Species

A literature review identified that the following federally listed species may be present within the parishes where the proposed offshore brine disposal pipeline and diffuser would be located: bald eagle, brown pelican, peregrine falcon, piping plover, gulf sturgeon, red wolf, and several marine mammals and sea turtles. As discussed in appendix F, DOE determined that no threatened, endangered, or candidate species would be affected by the proposed brine disposal pipeline or brine discharge.

Special Status Areas

No special status areas are located near the proposed offshore and brine diffuser system.

Essential Fish Habitat

The offshore area for the proposed brine disposal pipelines would include areas that are designated EFH. The composition of managed species and type of EFH differ based on distance offshore. For nearshore, estuarine environments, the managed species include cobia, greater amberjack, king mackerel, red drum, Spanish mackerel, red grouper, gray snapper, lane snapper, red snapper, stone crab, brown shrimp, pink shrimp, and white shrimp. All of the above species are also located at the proposed offshore brine diffusion site, along with two additional species—yellowtail snapper and spiny lobster.

3.7.4.2 Impacts

3.7.4.2.1 Chacahoula Storage Site and Access Roads

Plants, Wetlands, and Wildlife

Development of the site would require clearing about 230 acres (93 hectares) of vegetation within the cypress-tupelo swamp. To support the construction of buildings, roads, well heads, and the security perimeter, about 120 acres (49 hectares) of wetlands would be filled. Construction of the access roads would fill about 7.6 acres (3 hectares) leading to the site. Another 120 acres (49 hectares) surrounding the site would be cleared of trees and dense vegetation to establish the 300-foot (91-meter) security buffer. Areas not filled in the site boundary probably would re-establish with the dense floating vegetation found in naturally occurring openings in the cypress-tupelo swamp. DOE would place culverts in the security perimeter road to retain the hydrological regime of the wetlands.

The placement of fill in the wetlands would cause a permanent loss of wetland functions and values; however, the clearing of forested wetlands in the security buffer would represent a wetland conversion and some wetland functions would be preserved. The removal of trees and other vegetation would create a large open area in the otherwise continuous forested wetlands. Although the impact to this relatively rare and important type of forested wetland may be an adverse effect, it would be mitigated somewhat by the compensation plan for wetland impacts.

If one of the Chacahoula alternatives is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from the USACE. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to wetlands. DOE would implement the mitigation measures described in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O. Specifically, DOE would preserve, restore, or create forested wetlands or contribute to a mitigation bank in the region to compensate for impacts to wetlands.

The development of the Chacahoula storage site would change wetland species composition and have long-term impacts on surrounding plant and animal communities by introducing edge habitat within a relatively large continuous flooded forested area. Generally, any displaced organisms could find sufficient habitat in the surrounding area. After the security fencing is constructed, wildlife use of the site would be limited, though some mobile species and birds would still visit the site. The operational and maintenance activities described in section 3.7.2 could affect migration of birds due to night lighting, noise, and human activity.

The fill of inundated wetland areas would temporarily increase erosion and could affect aquatic species such as fish, amphibians, and invertebrates as described in section 3.7.2. As described in chapter 2, DOE would minimize erosion by complying with permit requirements. DOE would develop an erosion-and sediment-control plan and secure a Louisiana Pollutant Discharge Elimination System stormwater permit issued by the Louisiana Department of Environmental Quality for construction activities, which would require the use of best management practices to minimize the impact to water bodies.

> Mitigation: DOE would continue to refine the concept plan to avoid and minimize impacts to wetlands and comply with state and Federal regulations on wetlands.

> Mitigation: DOE would use low-mast, down-shielded lights to minimize the impact on migratory birds. DOE would mitigate impacts to migratory birds and sensitive species in coordination with the USFWS. If one of the Chacahoula alternatives is selected, DOE would conduct a survey of raptor nests and secure any necessary permits in accordance with the requirements of the Migratory Bird Treaty Act.

Special Status Species

Construction of the Chacahoula storage site would remove all trees in the 320-acre (130-hectare) site and security buffer. This would be a large area of potential nesting, roosting, and foraging habitat within 1 mile (1.6 kilometers) of a recorded bald eagle nesting area. Because of the complexity of this site and duration of construction (8 to 10 years), DOE could not avoid all construction activities during bald eagle nesting periods. DOE has determined this may affect the bald eagle. Therefore, if one of the Chacahoula alternatives is selected, DOE would initiate formal Section 7 Consultation with USFWS and work with the Louisiana Department of Wildlife and Fisheries to avoid, minimize, or mitigate the effects to bald eagles. DOE would prepare a Biological Assessment if it was determined that the project may adversely affect the bald eagle and implement any conditions of a Biological Opinion.

Operations and maintenance activities at the site may affect the bald eagle because noise, human activities, and lights near nesting and perching sites can disturb normal behavior or render sites unsuitable for continued use by this species. DOE would use low-mast and down-shielded lights to minimize the impacts of photopollution.

Special Status Areas

No special status areas would be affected by the proposed Chacahoula site.

Essential Fish Habitat

No EFH is located in or near the boundaries of the proposed Chacahoula site.

3.7.4.2.2 Chacahoula Pipeline Rights-of-Way

Plants, Wetlands, and Wildlife

Construction in the pipeline and power line ROW would result in clearing all the vegetation in the ROW. The ROWs would affect the following upland habitats:

- 4 acres (0.6 hectare) of deciduous forest,
- 490 acres (198 hectares) of disturbed or managed habitat, and
- 2 acres (0.8 hectare) of other habitat.

Using the USFWS National Wetlands Inventory maps and proposed construction easements, construction would affect the following wetland types:

- 978 acres (396 hectares) of palustrine forested wetlands,
- 371 acres (150 hectares) of palustrine emergent wetlands,
- 410 acres (166 hectares) of estuarine wetlands,
- 46 acres (19 hectares) of palustrine scrub-shrub wetlands,
- 59 acres (24 hectares) of lacustrine wetlands,
- 15 acres (6 hectares) of riverine wetlands ,
- 6 acres (2 hectares) of palustrine aquatic bed wetlands,
- 13 acres (5 hectares) of palustrine unconsolidated bottom wetlands, and
- 3 acres (1 hectare) of marine wetlands.

About 50 percent of the proposed ROW would follow existing corridors, which means habitat has already been fragmented and disturbed for a large percentage of the proposed ROW.

As discussed in section 3.7.2.1, approximately 33 to 40 percent of this footprint would be a permanent impact because it is located within the permanently maintained easement. The vegetation in the construction easement would be cleared, but DOE would regrade to preconstruction contours and reseed with native species in this area to re-establish native habitat. The area within the permanent easement would be permanently maintained, but some wetland functions would be restored because the area would be returned to preconstruction conditions and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands and the nature and amount of wetland impact from the permanent and construction easements.

If one of the Chacahoula alternatives is selected, DOE would complete wetland delineations and secure a jurisdictional determination from USACE. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for wetland impacts. DOE would implement the mitigation measures accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts.

The potential operations and maintenance impacts within the ROWS in wetlands are described in section 3.7.2.

As stated in section 3.7.2, construction in the ROWs would displace or kill some aquatic and terrestrial wildlife. Noise and human activity may temporarily preclude some organisms from using nearby habitat. The duration of construction in these areas would be short (6 to 10 weeks at any one location) and ample habitat would be available nearby for most species. The aboveground portion of the power lines to the site and RWI represents a potential strike hazard that could affect resident and migratory birds as described in section 3.7.2.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat such as wetlands or habitat for special status species. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct problems that are identified.
>
> DOE would use low power line poles (less than 75 feet [23 meters]) and would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Power lines: the State of the Art in 1996* (APLIC 1996).

Special Status Species

All proposed ROWs have at least one documented bald eagle nesting site within 1 mile (1.6 kilometers). The USFWS and the Louisiana Department of Wildlife and Fisheries recommend against construction activities that would occur during nesting periods (i.e., October to mid-May) within 1 mile (1.6 kilometers) of nest sites. The agencies also recommend that large trees be saved for potential roost and perch trees (Carloss 2005). During preconstruction surveys, DOE would map all bald eagle nests located within 1 mile (1.6 kilometers) of a proposed ROW. DOE would coordinate with the USFWS and Louisiana Department of Wildlife and Fisheries to avoid adverse impacts by shifting the alignment, adjusting the construction schedule, and implementing a large tree preservation plan (where practicable). Most trees within the ROW easement would be cleared, but DOE would reseed with native species in this area to re-establish native habitat.

Along the pipeline ROWs, maintenance activity would be restricted during the nesting season; therefore, operations and maintenance activities would have no effect on the bald eagle. Most of the pipelines would be built along existing ROWs and operations and maintenance of the proposed widening of the ROW would be similar to existing conditions; and therefore, they should have no effect on the bald eagle.

If nesting brown pelicans are located near the crude oil pipeline ROW to the storage facility at Clovelly, they may be affected by the construction of these ROWs. The crude oil pipeline, however, would be built along an existing ROW, which would minimize the potential for an adverse effect. Brown pelicans can be disturbed by human noise and activity nearby, especially if activity is closer than 2,300 feet (700 meters) to nests (NatureServe 2005). If brown pelican roosts or nests are identified in or near a pipeline ROW, construction would be scheduled to occur during periods when nesting is not active, if possible. Bird nests and roosts would be left undisturbed, and all activity would be restricted near them.

If any portion of the project may adversely affect the bald eagle or brown pelican, DOE would initiate formal Section 7 Consultation with the USFWS and coordinate with the Louisiana Department of Wildlife and Fisheries to develop a plan to avoid adverse impacts. A Biological Assessment would be completed by the DOE if required. DOE would implement any conditions included in the Biological Opinion.

Special Status Areas

There are no special status areas in or near the proposed Chacahoula pipeline ROWs.

Essential Fish Habitat

Construction of the proposed onshore ROWs would affect about 1033 acres (418 hectares) of EFH. During construction, vegetation would be removed and the water column disturbed from suspended sediments. Mature fish would be expected to leave the area during construction, but benthic organisms, fish eggs, and fish larvae that lie directly in the construction path would suffer mortality. Section 3.7.2.1.5 and Appendix E provides detailed information about the potential effects of pipeline construction in onshore EFH. Following construction, the EFH would be restored to emergent estuarine wetlands and the water column and sediment would return to pre-existing conditions. Potential operation and maintenance impacts to wetlands are described in section 3.7.2.2. These activities would cause temporary, periodic disturbance to the EFH within the maintained ROW.

3.7.4.2.3 Raw Water Intake

Plants, Wetlands, and Wildlife

Construction of the proposed RWI would require clearing of about 15 acres (6 hectares) of palustrine forested wetlands and 1 acre of palustrine emerged and riverine wetlands at the intake site. Six acres (2 hectares) of palustrine forested wetlands and 3 acres (1.2 hectares) of palustrine emergent wetlands for the access road. Fill would be required for the facility footprint and some construction staging areas. The footprint of the structure would occupy approximately half of the area needed for site construction. The access road would be built on pilings. The 9 acres (3.6 hectares) of land affected by the access road would not be filled, but would lose some wetland functions because the species composition would be indirectly affected from shading of the roadway, which would be on pilings.

If one of the Chacahoula alternatives is selected, DOE would secure a jurisdictional determination from USACE. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for wetland impacts to wetlands. DOE would implement the mitigation in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. These measures are discussed briefly in section 3.7.2.1.3 and in greater detail in appendix O. Specifically, DOE would preserve, restore, or create forested and emergent wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for wetland impacts.

This area of the ICW is frequently disturbed by traffic and dredging. Although species that forage or nest in the immediate area would be tolerant of frequent human activity and noise, construction and operation of the RWI would add to this disturbance and may displace sensitive species.

The RWI would withdraw about 1.2 MMB (50 million gallons per day) from the ICW for a period of 4 to 5 years during cavern solution mining and periodically afterwards for drawdown or cavern maintenance. The ICW has a relatively stable and abundant flow of water due to the tidal influence from the Gulf of Mexico. The proposed water withdrawal would not affect the stream flow in the ICW nor diminish the Minimum Instream Flow necessary to sustain aquatic organisms. The withdrawal could change the salinity gradient in the ICW by causing an upstream migration of more saline brackish water.

Operations and maintenance of the RWI would produce noise during cavern solution mining, for a period of 4 to 5 years, and postconstruction during periods of oil fill and drawdown. Noise may preclude sensitive terrestrial and aquatic wildlife from using habitat in the immediate vicinity of the RWI. During water withdrawal, some aquatic organisms would become entrained or impinged by the intake, especially juveniles, larval stages, and dispersed fish eggs. The RWI would be equipped with screens, an intake velocity, a traveling screen, and fish bypass that would minimize entrainment and impingement.

Section 3.7.2 provides a description of other operations and maintenance impacts including artificial lighting and increased human activity that could affect migratory birds and other wildlife.

> Mitigation: As described in section 3.7.2, DOE would use down-shielded and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. DOE, in cooperation with the USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. As described in chapter 2, DOE would use noise attenuation measures such as a concrete enclosure for the pump station to minimize noise impacts.

Special Status Species

Data provided by the Louisiana Department of Wildlife and Fisheries indicates that bald eagle nests exist within 1,500 feet (460 meters) of the proposed RWI. The USFWS and the Louisiana Department of Wildlife and Fisheries recommend against any activity taking place within this 1,500 foot (460 meter) buffer area of an active nesting site (Carloss 2005; Watson 2005b). DOE would have a biologist survey the area to identify the exact locations of nests near the proposed RWI. Where feasible, DOE would adjust proposed locations to avoid disturbance within 1,500 feet (460 meters) of a nest tree. If nests and the recommended buffer zone cannot be avoided, DOE would initiate formal Section 7 Consultation with the USFWS, coordinate with the Louisiana Department of Wildlife and Fisheries, and prepare a Biological Assessment if required. DOE would follow all recommendations provided in the Biological Opinion from the USFWS.

DOE would enclose the raw water pump station to minimize noise impacts on wildlife including the bald eagle. Normal operations and maintenance activities at the RWI would be completed outside nesting seasons to the extent possible. Operation activities associated with a drawdown of oil and water withdrawal may happen at any time of the year, but the noise from that activity would not likely adversely affect bald eagles near the RWI.

Special Status Areas

There are no special status areas in or near the proposed Chacahoula RWI.

Essential Fish Habitat

The ICW is an actively dredged navigational waterway and the EFH within the waterway is frequently disturbed by these activities. The RWI would impact a small amount of water column and substrate but would not impact wetlands. The water column would not be considered high quality habitat. Construction of the RWI would cause increased sedimentation and turbidity within the ICW. Mature fish would be expected to leave the area during construction, but benthic organisms, fish eggs, and fish larvae that lie in the construction area would suffer increased mortality.

Operation of the RWI would not reduce water quantity within the ICW, but may affect the salinity gradient. Small aquatic organisms would be entrained by the RWI operation and the habitat would be disturbed by the noise of the pumps. Impingement and entrainment of some managed species (red drum and brown and white shrimp) may occur. Impacts would be localized and affect a habitat that is already highly degraded by dredging and boat traffic.

3.7.4.2.4 Offshore Brine Disposal

Plants, Wetlands, and Wildlife

Section 3.7.2 describes impacts to common species found in the Gulf of Mexico from offshore pipeline construction and brine disposal.

Special Status Species

Several species of sea turtles as well as the manatee may travel through the area of the offshore pipeline and brine diffuser; however, none of these species would be adversely affected by the proposed action because they are highly mobile and relatively tolerant of salinity changes, and the brine discharge would affect only a very small portion of their habitat.

Special Status Areas

There are no special status areas located in or near the offshore brine diffusion system.

Essential Fish Habitat

Because the bottom currents are parallel to Ship Shoal, it is possible that the Chacahoula discharge plume would be constrained by the decrease in depth of 14 to 18 feet (4.3 to 5.5 meters) near the shoal. The plume would also likely be confined due to the shallower water depth to the west. Therefore, the plume is expected to elongate and move to the north and east. Under certain oceanic conditions, the plume could move to the southeast along the Ship Shoal boundary. However, under most ocean conditions, the higher salinity concentrations would be located off the Ship Shoal area.

The location of the diffusers and proximity to the shallow Ship Shoal may limit the dilution and mixing capacity of the brine discharge. The presence of the shoal could create a more concentrated brine plume that could potentially have a greater impact on species that are less tolerant of higher salinity. DOE would secure a Louisiana Pollutant Discharge Elimination System permit for the discharge from the Louisiana Department of Environmental Quality, which would establish discharge limits that protect water quality and aquatic resources. Given the temporary nature of the discharge, relatively limited size of the salinity plumes, and the salinity tolerances of most organisms, the overall impacts to managed species are not expected to be significant.

Mitigation: DOE would evaluate the mixing capacity of the brine discharge during the application process for a Louisiana Pollutant Discharge Elimination System permit. During the LPDES permit process, DOE would model the discharge using EPA's CORMIX discharge model to better refine the design and location of the diffusers. The design and orientation of the diffusers could be modified to ensure that mixing and dilution are maximized to minimize the potential for affecting the ship shoal fisheries. DOE would coordinate with the Louisiana Department of Environmental Quality, NOAA Fisheries, USACE, and U.S. Coast Guard to minimize impacts to navigation, recreational fisheries, managed fisheries, and marine organisms by the brine disposal pipeline and discharge.

3.7.5 Richton Storage Site

This section addresses the following areas:

- Storage site and site access road;
- Five proposed ROW segments: an ROW that contains all the pipelines and power lines leaving the proposed new site, a crude oil pipeline ROW to Liberty Station, a crude oil pipeline and a brine disposal pipeline ROW to Pascagoula, a raw water pipeline and power line to the RWI structure, and power line ROW from the RWI to existing lines south of the Leaf River;
- RWI structure and access road at the Leaf River;
- RWI structure and power line at Pascagoula;
- Terminal in Pascagoula, MS;
- Terminal in Liberty, MS; and
- Offshore pipeline and brine diffuser.

In addition, due to these similarities among the proposed storage sites, the discussion of EFH is contained in section 3.7.2 and appendix E.

3.7.5.1 Affected Environment

3.7.5.1.1 Richton Storage Site and Access Road

Plants, Wetlands, and Wildlife

The proposed Richton storage site is located in a transition area between the Outer Coastal Plain Forest Province and the Southeastern Mixed Forest Province (Bailey 1995). The ecological characteristics of the site and surrounding area represent the general characteristics of the Southeastern Mixed Forest Province, which is comprised of mixed deciduous and evergreen forests.

The proposed site encompasses about 346 acres (140 hectares) and is located north of Highway 42. This area includes the approximately 238-acre (96-hectare) storage site with a 109-acre, 300-foot (44-hectare, 91-meter) security buffer. The site is an actively managed slash pine plantation stands from 10 to 20 years of age. Some areas of the site have been harvested within the last 5 years and are at various stages of regrowth. During DOE's site visit in October 2005, trees were being harvested. The most recently logged areas are devoid of vegetation and covered in dried and rotting woody material. Older logged areas are revegetated with various herbaceous plants, grasses, bushes, and tree saplings such as blackberry, trumpet creeper, thistle, goldenrod, and Chinese tallowtree—an invasive tree species. The plant communities at the site were not affected by the hurricanes of 2005.

The site has a small intermittent stream channel that drains its center and is bordered by forested and emergent palustrine wetlands. The wetlands and intermittent stream are the headwaters of Pine Branch, which flows south out of the site and through a culvert under Highway 42. A manmade pond occupies approximately 6.0 acres (2.4 hectares) at the western boundary of the proposed site and is surrounded by palustrine forested and emergent wetlands. The species in forested wetlands areas include red maple, sweet gum, tupelo, and Chinese tallowtree. A variety of sedges, rushes, bulrush, and pitcher plants comprise the dominant species in the emergent wetlands adjacent to the stream channel and manmade pond.

The terrestrial wildlife observed in the vicinity of the Richton site during the site visit include white-tailed deer, armadillo, raccoon, opossum, black vulture, and red-tailed hawk, which are common, fairly mobile species adapted to living in disturbed habitat areas.

The manmade pond located near the central western boundary of the Richton site probably supports a small fish population, including minnows, sunfish, bass, and catfish. Because of the lack of permanent water in Pine Branch Creek, it probably does not support a permanent fish population. The permanent surface water bodies outside the boundaries of the proposed Richton site are fresh water systems and have species that are typical of these communities in the southern United States.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the proposed Richton storage site would be located: red-cockaded woodpecker, gulf sturgeon, pearl darter, Camp Shelby burrowing crayfish, gray myotis, Louisiana quillwort, black pine snake, Eastern indigo snake, gopher tortoise, and the yellow-blotched map turtle. After a review of the conditions at the proposed Richton storage site and consultations with the USFWS and the Mississippi Natural Heritage Program, DOE determined that the federally listed black pine snake (candidate species) and gopher tortoise (federally threatened) may be affected. The Richton site does not have suitable habitat for any state-listed species and the Mississippi Natural Heritage Program confirmed no occurrences of state-listed species within 2 miles (3 kilometers) of the proposed site.

The black pine snake is a candidate species for Federal listing under the ESA and has been documented within 2 miles (3 kilometers) of the Richton site in Perry County (Clark 2005; MNHP 2006). Its preferred habitat is sandy, well-drained soils with an **overstory** of longleaf pine, a fire-suppressed midstory, and a dense herbaceous ground cover (Duran 1998b). It is rarely found in riparian areas, hardwood forests, or closed **canopy** conditions (Duran 1998a).

The federally threatened gopher tortoise prefers locations with dry sandy soils, abundant ground cover, and a sparse canopy. Although seldom seen above ground, the presence of large conspicuous burrows is indicative of its presence.

Special Status Areas

No special status areas exist within or near the boundaries of the proposed Richton site.

Essential Fish Habitat

No EFH occurs in or near the proposed Richton storage site.

3.7.5.1.2 Richton Rights-of-Ways

The proposed Richton storage site would require a 10-mile (17-kilometer) RWI pipeline to the Leaf River, a 88-mile (142-kilometer) multi-purpose crude oil, raw water, and brine pipeline to Pascagoula, a 100-mile crude oil and brine discharge pipeline to Pascagoula, a 116-mile (186-kilometer) crude oil pipeline to Liberty, two 138-kilovolt power lines, and one 110-kilovolt power line in the following ROWs:

- The proposed RWI pipeline to the Leaf River would share the ROW with the rest of the pipelines for 5.8 miles (9.3 kilometers) and then continue south for 4.6 miles (7.3 kilometers) to the RWI structure on the Leaf River.
- The proposed crude oil pipeline to Liberty terminal would share an ROW for 5.8 miles (9.3 kilometers) with the power lines, RWI, brine disposal, and crude oil pipeline to Pascagoula, and then continue west 110 miles (177 kilometers) to the terminal at Liberty.
- The proposed multi-use pipelines to Pascagoula would share the 5.8 mile (9.3 kilometers) ROW with other pipelines, and then join an existing pipeline ROW for 72 miles (116 kilometers) to Pascagoula City. The pipelines would continue for 9.5 miles (15 kilometers) to the terminal on Singing River Island. The proposed brine disposal pipeline would then continue into the Gulf of Mexico to the brine diffuser located about 13 miles (20 kilometers) offshore.
- The proposed 138-kilovolt power lines would follow the RWI pipeline and connect to existing power lines 1 mile (0.6 kilometers) south of the Leaf River RWI structure. The proposed 110-kilovolt power line for the Pascagoula RWI begin at a substation in Pascagoula and extend southwest for 1.6 miles (2.6 kilometers) to the Pascagoula terminal on Singing River Island.

Plants, Wetlands, and Wildlife

Approximately 30 percent of the ROWs for the proposed pipelines follow existing ROW corridors. These easements have been disturbed by previous construction and periodic maintenance activities. The crude oil pipeline, RWI pipeline, brine disposal pipeline, and power lines would share an exit ROW for 5.8 miles (9.3 kilometers) south from the Richton storage site. This proposed ROW would cross 62 percent pine and hardwood forested habitat and approximately 27 percent grassland habitat. Seven percent of the proposed ROW would cross palustrine wetlands. The grassland category includes natural areas of low herbaceous cover, but also includes range or pasture areas. The classification of pine forests in the Gap Analysis Program data does not distinguish between natural evergreen forests and pine plantations. In Mississippi, roughly one-third of evergreen forests are pine plantations that are subject to frequent thinning and application of fertilizers and herbicides.

The main wetland type within the ROWs are palustrine forested wetlands or bottomland hardwood forests. This habitat type used to be common throughout the Southeast. Agriculture, flood control, and land development have drained, converted, or fragmented large areas of these forests; thus, Mississippi recognizes this habitat type as vulnerable (MMNS 2002).

The proposed RWI ROW continues south from the end of the shared exit ROW to the RWI structure at the Leaf River. The majority of this proposed ROW is forested with 57 percent pine forest and 15 percent hardwood. The remaining area consists of palustrine forested wetlands associated with the floodplain of the Leaf River. The proposed power line ROW would cross similar habitat types and wetlands as the ROW for the RWI.

The proposed crude oil pipeline to Liberty continues from the end of the exit ROW west for 110 miles (177 kilometers) to Liberty Station. Ninety-seven percent of this proposed ROW contains upland habitats of pine forest, hardwood forest, grasslands, and disturbed areas. Palustrine forested wetlands are the dominant wetland category found in the proposed corridor. A proposed pump station for the crude oil pipeline would require approximately 1.7 acres (0.7 hectares) of land. The proposed site for the pump station includes mostly grassy or open areas with approximately 13 percent of the area comprised of mixed pine and hardwood forests.

The proposed crude oil and raw water pipeline ROW to Pascagoula would follow an existing 72-mile (116-kilometer) pipeline ROW to the City of Pascagoula. Nine miles (15 kilometers) of the proposed pipeline would cross through the City of Pascagoula in a new ROW to the terminal on Singing River Island. The dominant vegetation present along the corridor is pine forest. Approximately 13 percent of the proposed ROW contains wetlands, mostly palustrine forested wetlands in the interior sections of the ROW. As the proposed ROW approaches the coast, it crosses estuarine wetlands. The proposed power line to the Pascagoula terminal is almost entirely in open water and crosses a small area of developed land near the substation and terminal.

Based on the various land classification types and the wetlands present along the ROWs, several common mammals, birds, amphibians, and reptiles may use the existing habitats within the ROWs. These species would be similar to those described under the Richton storage site description. The ROWs would cross fresh-water systems that include common species of fish such as fresh-water eels, minnows, mullet, catfish, suckers, sunfish, bass, perch, and darters—all of which are common throughout the Gulf Coast region, and adapt well to changes in the environment.

Special Status Species

A literature review indicated that the following federally listed species may be present within the counties where the proposed Richton ROWs would cross: bald eagle, brown pelican, Mississippi sandhill crane, piping plover, red-cockaded woodpecker, Gulf sturgeon, pearl darter, Camp Shelby burrowing crayfish, gray myotis, Louisiana black bear, Louisiana quillwort, Alabama red-belly turtle, black pine snake, Eastern indigo snake, gopher tortoise, Kemp's ridley sea turtle, loggerhead sea turtle, yellow-blotched map turtle, and several marine mammals. A review of the conditions at the Richton pipeline ROWs and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that areas included in the pipeline ROWs may provide suitable habitat for several of these federally listed threatened or endangered species.

The pearl darter (a Federal candidate species) has been documented throughout the Leaf River to the lower Pascagoula drainage, but little is known about their specific habitat requirements or spawning behavior (Slack et al. 2005). The Leaf River is designated critical habitat for the Gulf sturgeon, which is a federally recognized threatened species. Proposed ROWs that would cross this drainage system include the pipeline ROW from Richton to Pascagoula and the pipeline ROW from Richton to Liberty Station. The proposed pipeline ROW from Richton to Liberty Station would cross the Leaf River in Forrest County. The pipeline ROW from Richton to Liberty station would also cross Black Creek in Lamar County and Tallahala Creek in Perry County. Candidate species are not regulated under the ESA unless they are listed as threatened or endangered by the USFWS or NOAA Fisheries before the proposed action is undertaken. The DOE has agreed to consider the pearl darter as a "listed species" under the ESA and would consult with the USFWS under Section 7 if any part if the selected action may adversely affect the species.

The black pine snake and gopher tortoise are both found on well-drained sandy soils with sparse forest canopy. Data from Mississippi Natural Heritage Program confirms populations of gopher tortoises within 2 miles (3 kilometers) of all proposed ROWs and the black pine snake within 5 miles (8 kilometers).

The brown pelican is found exclusively in coastal areas. Nests are usually built on coastal islands on the ground or in small bushes and trees. The brown pelican forages in shallow estuarine waters close to the shore. The proposed power line ROW to the Pascagoula terminal would cross potential feeding habitat of the brown pelican.

Species that are listed as threatened or endangered by Mississippi but are not federally listed are summarized in appendix I for the counties containing parts of the Richton development. Table 3.7.5-1 lists the species that the Mississippi Natural Heritage Program has confirmed within 2 miles (3 kilometers) of the proposed ROWs.

Table 3.7.5-1: State-listed Species Within 2 miles of Richton ROWs

Common Name	State Status	Global Status[a]	Potentially Suitable Habitat at Site
Dark gopher frog	Endangered	Critically imperiled	Pine and upland hardwood forest mixed with wetlands forests
Crystal darter	Endangered	Vulnerable	Pearl River
Frecklebelly madtom	Endangered	Vulnerable	Pearl River
Rainbow snake	Endangered	Secure	Streams, marshes (emergent wetlands), and sandy fields

Notes:

[a] Secure is defined by NatureServe and the Mississippi Natural Heritage Program as common, widespread, and abundant. Apparently secure is defined as uncommon, but not rare. Vulnerable is defined as at moderate risk of extinction due to range restrictions and relatively few populations (80 or fewer). Critically imperiled is defined as a species at a very high risk of extinction due to very few populations or other factors.

There are no known occurrences of these species within the proposed ROWS; however, no comprehensive survey or habitat assessments have been conducted.

Special Status Areas

The proposed crude oil, raw water, and brine disposal pipeline to the Pascagoula terminal would be located about 1 mile (1.6 kilometers) from the Grand Bay National Estuarine Research Reserve. Approximately 0.5 mile (0.7 kilometer) of the proposed ROW to Liberty would pass through Percy Quin State Park.

Essential Fish Habitat

The proposed crude oil, raw water, and brine disposal pipeline ROW would pass through estuarine wetlands and waters that are considered EFH.

3.7.5.1.3 Raw Water Intake and Access Road

Plants, Wetlands, and Wildlife

The Richton alternative would have two RWI structures.

The primary RWI structure would be located along the shoreline of the Leaf River. The area is characterized by mixed hardwood forest that is periodically flooded. When DOE visited the location in October 2005, the area was significantly affected by Hurricane Katrina. Only about 20 percent of the surrounding forest remained intact. In the next few years, this area will experience a successional transition that will probably increase species diversity and the density of understory vegetation. The terrestrial wildlife present at the proposed RWI structure includes mammals, birds, and reptiles that are common throughout the southeast. The likely change in the vegetation post-hurricane would attract more birds and wildlife as the increase of shrubby vegetation and other early successional species provides more food resources.

The proposed access road to the RWI structure would be 2.3 miles (3.7 kilometers) long. From the existing road, the access road would cross pine forest and then mixed hardwood forest, which includes the palustrine forested wetlands adjacent to the Leaf River.

The Leaf River is part of the Pascagoula drainage system and supports a wide variety of aquatic species. It has a sand and gravel bottom and does not support SAV. At the proposed location of the intake structure, the river has a steep bank on one side and a wide sandy beach on the other. A diverse fish assemblage is present in the Leaf River, including 17 families (e.g., Centrarchidae, Clupeidae, Cyprinidae, Ictaluridae, Percidae) and over 75 species of fish (Ross 2001; MMNS 2006). In addition, the American eel and gulf sturgeon are seasonally present in the Leaf River and may live in the river during early stages of their life cycle.

A second RWI at Pascagoula would withdraw water from the Mississippi Sound in the Gulf of Mexico. The Pascagoula RWI would be located near an existing pier and ship terminal on the north end of the island. This area of the Mississippi Sound/Gulf of Mexico supports a variety of marine fish, mammals, and macroinvertebrates. The island was manmade through dredge spoils and has been used as a naval base and operations center for the U.S. Coast Guard. The Navy facility was included in the 2005 list of military facilities to be closed under the Base Realignment and Closure Act in November 2006. The proposed RWI location is already developed and disturbed by boat traffic, maintenance dredging, and the original construction of the pier. Specifically, the Pascagoula RWI would be built on a platform added to the western portion of the existing docks on Singing River Island.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the proposed Leaf River RWI would be located: red-cockaded woodpecker, gulf sturgeon, pearl darter, Camp Shelby burrowing crayfish, gray myotis, Louisiana quillwort, black pine snake, Eastern indigo snake, gopher tortoise, and the yellow-blotched map turtle. A review of the conditions at the Leaf River RWI and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that the area may affect several federally listed threatened or endangered species.

The black pine snake, which is a Federal candidate species, reportedly occurs in the vicinity of the proposed RWI intake in Perry County. Some areas near the RWI contain potentially suitable habitat of sandy, well-drained soils with an overstory of longleaf pine, a fire-suppressed midstory, and a dense herbaceous ground cover (Duran 1998b).

The gopher tortoise has been recorded in the vicinity of the proposed location of the RWI structure (MNHP 2006). Habitat suitable for the gopher tortoise may be found at this location (i.e., locations with dry sandy soils, abundant ground cover, and a sparse canopy). Although seldom seen aboveground, the presence of gopher tortoises is indicated by large conspicuous burrows. No burrows were observed at the proposed RWI site; however, a comprehensive survey of the site has not been completed.

The range of the yellow-blotched map turtle includes the Leaf River in the general area where the proposed RWI structure would be sited. The yellow-blotched map turtle is a federally threatened species. This species prefers habitats with sand, clay, or rocky bottoms with limestone ledges along banks (McCoy and Vogt 1987). It also uses oxbow lakes, semipermanent ponds, or temporary flooded pools (Jones 1996). Nesting occurs on sandbars or in small clearings along the bank of a river such as on a clay bank with a steep slope (Horne et al. 2003).

The gulf sturgeon is found in the proposed location of the RWI for the Richton site on the Leaf River in Perry County. This segment of the Leaf River is designated as critical habitat for this federally threatened species. Although the entire potentially affected segment of this river is designated critical habitat, spawning generally occurs only in areas where the streambed is hard clay, rubble, gravel, or shell (68 CFR Part 13370). Adult sturgeons are anadromous fish that inhabit the fresh-water river for spawning. However, juvenile sturgeons may be found year-round because young sturgeons spend their first 2 years in the river in which they were spawned (68 CFR Part 13370).

The pearl darter, which is a Federal candidate species, is believed to exist only in the Pascagoula River drainage system that includes the Leaf River (NatureServe 2005). The only area where pearl darter spawning has been documented in recent decades is in the Leaf River near Hattiesburg, MS, which is located upstream from the proposed RWI. The pearl darter has been documented throughout the Leaf River to the lower Pascagoula drainage.

The proposed Pascagoula RWI structure would be located in waters that support the Gulf sturgeon. The waters of Pascagoula Bay and the Mississippi Sound are designated as critical habitat for the Gulf sturgeon. This general area supports adult and sub-adult individuals and is reported to be important feeding grounds for individuals returning from breeding activity in inland waters. The island was created by dredge spills, and has been used as a military installation. The proposed site for the RWI is on a pier in an area that has been regularly dredged and visited by large ships. Therefore, it is unlikely that the proposed site offers important habitat for the Gulf sturgeon. The proposed RWI at Pascagoula would be located in waters that are visited by loggerhead and green sea turtles. However, the proposed site lacks SAV, is disturbed by dredging and large boat traffic, is already developed with a pier, and would not offer valuable habitat for the turtles. Singing River Island probably does not provide habitat for any other federally listed species, although the bald eagle, brown pelican, Louisiana black bear, Louisiana quillwort, Eastern Indigo snake, gopher tortoise, and Kemp’s ridley sea turtle have been reported in the county in which the island is located.

After a review of the conditions at the proposed RWI in Richton and Pascagoula and consultations with the Mississippi Natural Heritage Program, DOE determined that the proposed RWIs would not affect any state-listed special status species (see appendix I).

Special Status Areas

No special status areas exist at the proposed locations of the RWI structures at the Leaf River or Pascagoula. The closest special status area is the DeSoto National Forest, which is located about 1.6 miles to the south of the proposed RWI on the Leaf River.

Essential Fish Habitat

No EFH exists within or near the proposed RWI at the Leaf River. The Pascagoula RWI would be located along the developed shoreline of Singing River Island within designated EFH in the Pascagoula Bay/Mississippi Sound. The managed species that inhabit this area include cobia, greater amberjack, king mackerel, red drum, Spanish mackerel, red grouper, gray snapper, lane snapper, red snapper, stone crab, brown shrimp, pink shrimp, white shrimp, spiny lobster, and yellowtail snapper. The area is designated as EFH for the spiny lobster.

3.7.5.1.4 Terminal in Pascagoula

Plants, Wetlands, and Wildlife

The proposed marine terminal in Pascagoula would be a 49-acre (20-hectare) facility located on Singing River Island. Singing River Island is a 440-acre (180-hectare) manmade island composed of deposited dredged materials. The proposed terminal would be located adjacent to the site of the Pascagoula Naval Station, which was selected for closure in November 2006 by the Commission on Base Realignment and Closure in 2005. The proposed site for the SPR terminal would occupy about 49 acres (20 hectares). Nearly all of the proposed site (43 acres [17 hectares]) is identified as estuarine wetlands by the National Wetlands Inventory map. This area supports shore birds, rabbits, alligator, snakes, and nutria. The Naval Station had problems with overpopulation and overgrazing by rabbits and nutria and released two spayed bobcats in 1995 to help control the rodent population.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the proposed Pascagoula terminal would be located: bald eagle, brown pelican, Mississippi sandhill crane, piping plover, red-cockaded woodpecker, gulf sturgeon, pearl darter, Louisiana black bear, several marine mammals, Louisiana quillwort, Eastern indigo snake, gopher tortoise, Kemp's ridley sea turtle, loggerhead sea turtle, and the yellow-blotched map turtle. However, after a review of the conditions at the proposed Pascagoula terminal and consultations with USFWS and the Mississippi Natural Heritage Program, DOE determined that the proposed terminal would not affect any federally or state-listed listed threatened, endangered, or candidate species (see appendices G and I).

Special Status Areas

The proposed terminal site is located more than 6 miles (9.7 kilometers) from the Grand Bay National Estuarine Research Reserve (NOAA 2005a, 2005b).

Essential Fish Habitat

The proposed terminal would affect approximately 43 acres (17 hectares) of estuarine wetlands that are considered EFH.

3.7.5.1.5 Terminal at Liberty Station

Plants, Wetlands, and Wildlife

The 66 acre (27 hectare) proposed terminal at Liberty Station would be located adjacent to another oil tank farm in an otherwise rural area east of Liberty, Mississippi. The entire site is disturbed upland habitat comprised mostly of pasture with fragmented pine and hardwood forests. According to the National Wetlands Inventory data, no wetlands exist on the site.

Wildlife that inhabits this area includes common, mobile species such as the nine-banded armadillo and white-tailed deer, which are adapted to living in somewhat disturbed habitat areas.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the proposed Liberty terminal would be located: red-cockaded woodpecker and the Louisiana black bear. However, after a review of the conditions at the proposed Liberty terminal and consultations with USFWS and the Mississippi Natural Heritage Program, DOE determined that the proposed terminal would not affect any federally or state-listed listed threatened, endangered, or candidate species (see appendices G and I).

Special Status Areas

There are no special status areas located within or near the proposed terminal at Liberty Station.

Essential Fish Habitat

No EFH exists hear or within the boundaries of the proposed terminal.

3.7.5.1.6 Offshore Brine Disposal

Plants, Wetlands, and Wildlife

The proposed offshore brine disposal pipeline would extend directly south 13 miles (20 kilometers) from the Pascagoula terminal. The proposed pipeline passes through the Mississippi Sound, past the barrier islands of GUIS, and into the Gulf of Mexico. Seagrass beds are known to occur on the northern, wave-protected side of the GUIS in water under 10 feet (3 meters).

Special Status Species

A literature review identified that the following federally listed species may be present near the offshore area where the proposed offshore brine disposal pipeline and diffuser would be located: brown pelican, piping plover, Gulf sturgeon, Atlantic spotted dolphin, bottlenose dolphin, West Indian manatee, green sea turtle, and loggerhead turtles. All federally listed species in the offshore area are described in appendix G. The offshore area between Pascagoula and the GUIS, known as the Mississippi Sound, is designated critical habitat for the Gulf sturgeon. The GUIS is designated critical habitat for the piping plover. Brown pelicans are known to roost on GUIS. Biologists at GUIS also noted that the green sea turtle and loggerhead turtle are the only sea turtles known to visit the area around the islands (Spencer 2006). The bottlenose dolphin is highly mobile and has been observed offshore of GUIS.

Special Status Areas

The proposed offshore brine disposal pipeline would pass through the offshore area managed by the GUIS. The GUIS includes islands and beaches stretching along 160 miles (257 kilometers) of the Gulf Coast from Florida to Mississippi. The managed area of the GUIS in Mississippi extends one mile (2 kilometers) from the high tide line on the islands. The brine disposal ROW would pass in between the barrier islands of Horn Island and Petit Bois west of the shipping channel, in an area known as Horn

Island Pass, east of Horn Island. The entire area, excluding a ship channel, is managed by GUIS. DOE would have to receive consent from GUIS for a ROW easement through this area. Horn and Petit Bois Islands were designated as wilderness through the establishment of the Gulf Islands Wilderness Area in 1978 (Spencer 2006). Hurricane Katrina removed almost 1 mile (1.6 kilometers) of the eastern tip of Horn Island, and buried interior marshes of Petit Bois in sand (www.nps.gov/guis/pphtml/planyourvisit.html, accessed July 30, 2006).

Essential Fish Habitat

The offshore area for the proposed brine disposal pipeline and diffuser would include areas that are designated EFH. The composition of managed species and type of EFH differ based on distance offshore. The managed species in this area includes cobia, greater amberjack, king mackerel, red drum, Spanish mackerel, red grouper, gray snapper, lane snapper, red snapper, stone crab, brown shrimp, pink shrimp, white shrimp, spiny lobster and yellowtail snapper. Appendix E discusses each of these managed species and provides a map of the offshore habitat areas.

Seagrasses, a type of SAV, may also be present in the project area. SAV is a habitat determined to be EFH. The species of seagrasses that may exist near the proposed ROW are shoalgrass and wigeongrass, and the north shore of Petit Bois Island is reported to contain the last areas of turtle grass and Manatee grass in the Mississippi Sound (see appendix D for scientific names) (Spencer 2006). The seagrass beds are located in water shallower than 10 feet (3 meters), most often on the North side of the Mississippi barrier islands and other wave protected habitats. Appendix E provides more detail about EFH and seagrasses.

3.7.5.2 Impacts

3.7.5.2.1 Richton Storage Site

Plants, Wetlands, and Wildlife

The development of the proposed Richton storage site would affect about 346 acres (140 hectares), which includes a 109-acre (44-hectare), 300-foot (91-meter) buffer cleared for security purposes. The proposed construction would affect the following:

- 3 acres (1 hectare) of palustrine emergent wetlands,
- 6 acres (2 hectares) of palustrine forested wetlands,
- 312 acres (126 hectares) of pine plantation, and
- 25 acres (10 hectares) of clear cut and field.

The proposed access road would be 990-feet (300 meters) long and extend from Highway 42 to the site. The area of the proposed road would affect about 0.5 acres (0.2 hectares) of pine forest. The pine forest and logged areas are actively managed and disturbed by timber harvesting. These areas are low quality habitat for plants and animals. The palustrine forested wetlands within the security buffer would be permanently converted to emergent wetlands as DOE would not allow trees to regrow in this area. The proposed construction footprint would avoid the manmade pond, which would reduce the hydrological modification of the site and preserve some fringe wetlands and their associated functions.

If one of the Richton alternatives is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would refine the conceptual site plan to avoid filling in wetlands and would preserve onsite to the maximum extent practicable. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid and minimize and compensate for wetland impacts. DOE would implement the mitigation measures in accordance with the 404 permit and 401 Water Quality Certificate from the USACE and the Mississippi Department of Environmental Quality. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts.

Because the habitats present at the proposed Richton storage site are actively disturbed by logging and do not represent regionally unique habitats, there would be little affect to terrestrial wildlife. Some wildlife would be killed and some would be displaced by the construction activities. Fencing would exclude most wildlife from the site, though some mobile species and birds would probably still visit the site. As discussed in section 3.7.2, the wildlife species would be displaced to similar vegetative and wetlands communities surrounding the proposed site. Though these impacts may affect individual organisms, construction, operations, and maintenance of the facility would not alter the regional population or species viability.

Aquatic species in the manmade pond would not be affected by construction because DOE would not alter the pond. The intermittent streams located within the site would be affected as the natural flow would be altered and the runoff associated with the clearing and grading would temporarily degrade their water quality. As described in section 2.3, an erosion- and sediment-control plan and the Mississippi Pollutant Discharge Elimination System stormwater permit for construction activities would be secured, which would require the use of construction best management practices to minimize the impact to water bodies.

Potential operational and maintenance impacts on migratory birds, such as the affect of artificial lighting on migration, are described in section 3.7.2.

> Mitigation: DOE, in cooperation with the USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. DOE would use down-shielded and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. If one of the Richton alternatives is selected, DOE would conduct a survey of raptor nests and secure any necessary permits in accordance with the requirements of the Migratory Bird Treaty Act.

> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize impacts to wetlands and forests.

Special Status Species

Because the black pine snake has been confirmed within 2 miles (3 kilometers) of the site, DOE would survey the site for evidence of black pine snakes or suitable habitat. DOE would consult with the USFWS if suitable habitat or individuals were found on the site.

DOE would have a biologist survey moderately well-drained to excessively well-drained sandy soils for gopher tortoise burrows. If gopher tortoises or their burrows are found, DOE would contact the Mississippi Department of Wildlife, Fisheries, and Parks and the USFWS. DOE would initiate formal Section 7 Consultation if development of the storage site may adversely affect the gopher tortoise. As part of formal consultation, DOE would prepare a Biological Assessment and implement the conditions of a Biological Opinion. Gopher tortoises and/or black pine snakes would be relocated only with concurrence of the USFWS and the Mississippi Department of Wildlife, Fisheries, and Parks; according to strict protocols; and within seasonal windows specified by these agencies (MNHP 2006).

Special Status Areas

There are no special status areas located within or near the proposed storage site.

Essential Fish Habitat

No EFH is located within or near the proposed site.

3.7.5.2.2 Richton Pipeline Rights-of-Way

Plants, Wetlands, and Wildlife

Construction in the pipeline and power line ROWs would result in clearing all the vegetative within the ROW. The ROW clearing would affect the following areas:

- 822 acres (333 hectares) of grasslands,
- 521 acres (211 hectares) of disturbed, managed, or urban land,
- 481 acres (195 hectares) of hardwood forest,
- 1024 acres (414 hectares) of pine forest, and
- 271 acres (110 hectares) of water and emergent wetlands.

As described under the affected environment, the majority of the pine forests that would be affected are pine plantations. Because DOE aggregated the Mississippi GAP Analysis Program to identify upland habitat, some of the acreage listed above under hardwood forest or grasslands may include wetlands. DOE used USFWS National Wetlands Inventory data to determine that the following wetlands would be affected by the proposed ROW:

- 786 acres (318 hectares) of palustrine forest,
- 183 acres (74 hectares) of palustrine scrub-shrub,
- 156 acres (63 hectares) of estuarine,
- 40 acres (16 hectares) of palustrine emergent,
- 19 acres (8 hectares) of lacustrine,
- 15 acres (6 hectares) of palustrine open water,
- 32 acres (13 hectares) of palustrine unconsolidated bottom,
- 12 acres (5 hectares) of riverine,
- 3 acres (1 hectare) of estuarine scrub-shrub, and
- 2 acres (1 hectare) of palustrine (aquatic bed).

Permanent impacts from the maintained ROW would be about 33 to 40 percent of the acreage reported above. The vegetation within the construction easement would be cleared, but DOE would regrade to preconstruction contours and reseed with native species within this area to re-establish native habitat. The area within the permanent easement would be permanently maintained, but some wetland functions would be restored because the area would be regraded to preconstruction conditions and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands, and the nature and amount of potential wetland impacts from the permanent and construction easements. Within the permanent ROW easement, the open water, emergent and riverine wetlands would be allowed to return to preconstruction conditions. Section 3.7.2 describes potential ROW operations and maintenance effects in more detail.

DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would use or directional drilling to avoid sensitive wetland areas or large water bodies greater than 100 feet (30 meters). DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid and minimize and compensate for wetland impacts. To limit impacts to aquatic habitats, DOE would implement appropriate best management practices to minimize erosion and runoff as described in chapter 2. Moreover, about 20 percent of the pipeline ROWs would be located along an existing ROW. Use of existing ROW corridors to the maximum extent practicable would minimize the impact to undisturbed communities and wildlife. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in accordance with the Section 404/401 permit conditions, which would compensate for the wetland impacts.

As stated in section 3.7.2, construction in the ROWs would displace or kill some aquatic and terrestrial wildlife. The impacts would not alter the state population or the species viability. Noise and human activity may temporarily preclude some organisms from using nearby habitat. The duration of construction through these areas would be short (6 to 10 weeks at any one location) and ample habitat would be available nearby for most species. The elevated portion of the power lines could represent a strike hazard that could impact resident and migratory birds. However, the maximum tower height is expected to be 75 feet (23 meters), which would greatly reduce the hazard. Though these impacts may affect individual organisms, construction, operations, and maintenance of the pipeline and power line ROWs would not alter the regional populations of wildlife or species viability.

The potential impacts associated with the operations and maintenance of the ROWs are described in section 3.7.2.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat such as wetlands and habitat for special status species. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct problems identified. For the proposed power lines, DOE would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Power lines: the State of the Art in 1996* (APLIC 1996).

Special Status Species

Construction of the proposed pipeline to Liberty Station would not affect the pearl darter because directional drilling would be used to place the pipeline beneath the Leaf River, Black Creek, and Tallahala Creek without instream activity. If directional drilling was not feasible, DOE would use conventional open-ditch excavation. Conventional construction methods may affect the pearl darter; thus, DOE would consult with the USFWS to develop a construction plan that would not adversely affect the species.

The proposed ROWs may affect the black pine snake if it inhabits the site. These snakes live in burrows underground. DOE would conduct habitat assessments of the proposed ROWs to determine if surveys for black pine snakes are necessary. If suitable habitat exists or black pine snakes inhabit the ROW, DOE would consult with the USFWS and Mississippi Natural Heritage Program to identify methods to avoid adverse effects. The black pine snake is a mobile species and would generally be expected to avoid construction activities. Individuals identified during construction would be relocated to nearby suitable habitat under guidance of USFWS. Operations and maintenance of pipeline ROWs would not affect the black pine snake. Mowing of the ROW would maintain the ROW as habitat preferred by the black pine snake.

DOE would conduct surveys for gopher tortoise burrows on moderately well-drained to excessively well-drained sandy soils of the ROWs. If burrows or gopher tortoises are identified within the ROW, DOE would initiate formal Section 7 Consultation with the USFWS. DOE would prepare a Biological Assessment if the proposed activity had the potential to adversely affect the gopher tortoise. All burrows identified during preconstruction field assessments would be marked and cogon grass—an invasive species that destroys tortoise habitat (Van Loan et al. 2002)—would be mapped and treated with chemicals approved for use around tortoises. Where possible, clearing and construction activities would be precluded within a 25-foot (8-meter) radius around each burrow. The proposed crude oil pipeline to Liberty terminal, RWI pipeline, and power lines do not, for the most part, follow an existing ROW. Alignments may be adjusted to avoid relatively large clusters of burrows. When burrows cannot be avoided, tortoises would be relocated only with concurrence of the USFWS and the Mississippi Department of Wildlife, Fisheries, and Parks; according to strict protocols; and within seasonal windows specified by these agencies.

Because moderately to excessively well-drained sandy soils of the maintained pipeline and power line ROWs would provide potential habitat for the gopher tortoise, these areas may attract more tortoises than their preconstruction condition. DOE would monitor these areas for the presence of gopher tortoise mounds and control the invasion and spread of cogon grass using only herbicides approved for use around tortoises to avoid poisoning food resources (MNHP 2006). With proper monitoring and procedures, operations and maintenance activities may improve habitat quality for gopher tortoises.

The proposed power line to the Pascagoula terminal crosses industrial and estuarine water. Construction of the power line would not affect the brown pelican. It would not disturb suitable nesting habitat areas and would only temporarily affect a small area of potential feeding habitat. Operation and maintenance of the power lines to the Pascagoula terminal would not affect the brown pelican. Brown pelicans fly along the shoreline and feed in estuarine waters. The power lines would be slight obstruction to flight, but would affect an area only 1.6 miles (2.6 kilometers) long.

The state-listed species confirmed to exist within 2 miles (3.2 kilometers) of the proposed Richton ROWs are the dark gopher frog, crystal darter, frecklebelly madtom, and rainbow snake. Based on the data available, DOE does not expect the proposed ROWs to affect these species. The crystal darter and frecklebelly madtom are known to inhabit the Pearl River. The proposed crude oil pipeline to Liberty would be directionally drilled under the Pearl River so there would be no changes in the instream environment. The occurrence of the rainbow snake is recorded along Priests Creek, which would not be crossed by any ROW. The dark gopher frog population is located more than 1 mile (1.6 kilometers) from the proposed ROW. At this distance, DOE would not expect construction, operation, or maintenance to affect the species.

Special Status Areas

The proposed Pascagoula crude oil and raw water pipeline would not affect the Grand Bay National Estuarine Research Reserve because it is located about 1 mile (1.6 kilometers) away. The proposed ROW to Liberty terminal would pass through Percy Quin State Park. The proposed alignment does not follow an existing ROW through the park. If one of the Richton alternatives is selected, DOE would consult with the Park to identify a corridor that avoids sensitive resources in the park. DOE may be able to realign the pipeline ROW to follow one of the existing ROW corridors to minimize affects to natural resources.

Essential Fish Habitat

Construction of the proposed onshore ROWs would affect about 159 acres (64 hectares) of EFH. During construction, vegetation would be removed and the water column disturbed from suspended sediments. Mature fish would be expected to leave the area during construction, but benthic organisms, fish eggs, and fish larvae that lie directly in the construction path would suffer mortality. Section 3.7.2.1.5 and Appendix E provides detailed information about the potential effects of pipeline construction in EFH. Following construction, the EFH would be restored to emergent estuarine wetlands and the water column and sediment would return to pre-existing conditions. Potential operation and maintenance impacts to wetlands are described in section 3.7.2.2. These activities would cause temporary, periodic disturbance to the EFH within the maintained ROW.

3.7.5.2.3 Raw Water Intake

Plants, Wetlands, and Wildlife

About 16 acres (6.5 hectares) of palustrine forested wetlands would be cleared to construct the RWI structure at the Leaf River. The access road to the structure would permanently remove 3 acres (1 hectare) of palustrine forested wetlands and 7 acres (3 hectares) of pine forest. As discussed in section 3.7.2, construction activities would cause displacement of terrestrial and aquatic species to adjacent undisturbed areas of similar habitat.

The RWI at Pascagoula would be built in on a 1.5-acre (0.6-hectare) platform extending from a pier. The water under the proposed RWI is identified as an estuarine wetland that does not support aquatic vegetation according to NWI data. This area is frequently disturbed by dredging and boat activity. Construction activities would temporarily disturb the aquatic habitat and sediments.

If one of the Richton alternatives is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from the USACE. In addition, DOE would refine the conceptual site plan to avoid filling in wetlands to the maximum extent practicable. DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for wetland impacts. DOE would submit an application for a Beneficial Use of Public Waters permit from the Mississippi Department of Environmental Quality for the proposed water withdrawal. DOE would implement the mitigation measures in accordance with the 404 permit, 401 Water Quality Certificate from the USACE, and a stream diversion permit from the Mississippi Department of Environmental Quality. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendices B and O. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts. As discussed in chapter 2, erosion would be minimized with the use of best management practices. An erosion- and sediment-control plan and NPDES stormwater permit issued by the Mississippi Department of Environmental Quality for construction activities would be secured, which would require the use of best management practices that minimize the impact to water bodies.

The operation of the RWI structures would affect some terrestrial species that would avoid the area due to human activity and noise from the pumps. The aquatic communities in the Leaf River at the site and downstream would potentially be impacted by the withdrawal of water. During normal flow conditions in the Leaf River, up to 1.2 MMBD (50 million gallons per day) would be withdrawn from the Leaf River during construction/cavern development and periodically afterwards for drawdown or cavern maintenance after construction is completed. During periods of low-flow in the Leaf River, the withdrawal would be supplemented by a secondary source, the Pascagoula RWI structure, which withdraws water from the Gulf of Mexico. Up to 0.5 MMBD of water for cavern construction or drawdown could come from the

Gulf of Mexico during periods of low-flow conditions in the Leaf River. DOE would consult with the USFWS, NOAA Fisheries, Mississippi Natural Heritage Program to establish a Minimum Instream Flow that protects aquatic resources. If established Minimum Instream Flows are reached in the Leaf River during the construction, then the Leaf River withdrawal would be terminated and the Gulf would provide the water for solution mining and drawdown. During drawdowns for a national emergency, water may have to be withdrawn from the Leaf River, regardless of flow conditions, in order to achieve the proposed 1.0 MMBD drawdown rate for the Richton site. This strategy of using a secondary water source and implementing a Minimum Instream Flow would help during low-flow conditions to reduce the impact to the downstream aquatic communities as the decrease in flow, lowered water depth, reduced width of the stream channel, and change in the currents would be less severe. Such impacts would stress aquatic organisms by exposing once submerged nesting and feeding areas, altering vegetative communities, potentially changing the temperature regime, and impairing water quality.

Withdrawal from the Leaf River during periods of low-flow could affect riverine wetlands and aquatic organisms. It would also affect species that rely on aquatic prey species for food. The severity of these impacts would depend on the length and frequency of low-flow rates in the Leaf River during the years of cavern solution mining and during cavern drawdown. Operation of the RWI structure for drawdown during low-flow conditions may result in an adverse impact on aquatic species, and a moderate impact on other species that depend on Leaf River water resources.

During water withdrawal activities and operation of the RWI, some small aquatic organisms would become entrained or impinged—especially larval stages, juveniles, and dispersed fish eggs as described in section 3.7.2. The entrainment and impingement would be minimized by equipping the RWI with appropriate mesh sizes, and using the reduced intake velocities. The cylindrical mesh screens would be equipped with a compressed air backwash system to remove impinged organisms and clear debris off the screens.

Special Status Species

Construction or operation of the RWI structure on the Leaf River may affect federally listed threatened or endangered species or their designated critical habitat as described below. If DOE determines that the project may *adversely* affect any listed species or their designated critical habitat, DOE would initiate formal consultation under Section 7 of the ESA with the USFWS or NOAA Fisheries, as appropriate, and coordinate with the Mississippi Department of Wildlife, Fisheries, and Parks, Mississippi Natural Heritage Program. As part of formal consultation, DOE would prepare a Biological Assessment and provide it to USFWS or NOAA Fisheries. DOE would implement any conditions included in the Biological Opinion prepared by USFWS or NOAA Fisheries.

Operation of the RWI on the Leaf River during cavern development, maintenance, or drawdown would withdraw up to 1.2 MMBD (50 million gallons per day). However, during low-flow conditions in the Leaf River, DOE would withdraw up to 0.5 MMBD (21 million gallons per day) from the Gulf of Mexico via the Pascagoula RWI. During cavern development and maintenance, DOE would cease withdrawing water from the Leaf River if the flow reaches Minimum Instream Flow. Instead, DOE would withdraw water via the Pascagoula RWI, which withdraws from the Gulf of Mexico. During National Emergency drawdown events, DOE may need to withdraw water from the Leaf River, even during periods of Minimum Instream Flow, to reach the proposed 1.0 MMBD drawdown capacity (see section 3.6.5.1.2).

Construction of the RWI structure on the Leaf River may affect the black pine snake and gopher tortoise. DOE would survey well-drained sandy soils for gopher tortoise burrows and evidence of the black pine snake or suitable habitat. Before construction, individuals living on the proposed site would be relocated, if approved by and under strict guidance of USFWS. DOE would also consider moving the location of the RWI on the Leaf River to avoid the black pine snake and gopher tortoise if they were found to be present. Operations and maintenance activities at the RWI structure involve infrequent human disturbance and would not affect black pine snakes or gopher tortoises near the site.

Construction of the RWI on the Leaf River may adversely affect the yellow-blotched map turtle. If approved by USFWS, any turtles in the work zone would be moved to an adjacent undisturbed area upstream each day prior to the start of work. Best management practices, such as the use of a cofferdam, would be employed to minimize water quality and sedimentation impacts. Upon completion of the RWI structure, the streambed would be restored to the extent possible to minimize long-term impacts of construction. Although there may be short-term effects, in the long-term, construction would not likely jeopardize the species continued existence or adversely modify designated critical habitat.

Water withdrawal from the Leaf River would alter flow especially during low-flow periods in the late summer and early fall. Reduced flow would degrade water quality by reducing the capacity of the river to assimilate wastes from nonpoint pollution sources and permitted discharges. Impaired water quality has contributed to the decline of the yellow-blotched map turtle through adverse effects on its food resources. In addition, withdrawal of water may affect the species by entraining or impinging small turtles or their invertebrate prey. Impinged turtles may suffer bodily harm which could lead to death. During normal to above average flows, the entrainment or impingement of yellow-blotched map turtle prey food resources would not adversely affect the turtles. During low-flow periods, entrainment or impingement of prey species and degradation of water quality may adversely affect the yellow-blotched map turtle.

The RWI structure on the Leaf River would be located in Perry County and the power lines for this RWI structure and site would cross the Leaf River. Construction of the RWI at Leaf River may affect the designated critical habitat for the Gulf sturgeon at this location and the area immediately downstream. For example, excavation would disturb the Leaf River streambed, remove vegetation, and temporarily raise turbidity while reducing dissolved oxygen levels. These potential effects would be mitigated with the use of erosion barriers, cofferdams, postconstruction restoration, and other measures. Construction would be scheduled to avoid spawning periods (mid-February to April) and limited to high-water periods. Construction of the power lines across the Leaf River is not expected to have any additional effect on the Gulf sturgeon because no instream work would occur.

Operations and maintenance of the RWI on the Leaf River may have an adverse effect on the Gulf sturgeon, especially during low-flow periods. DOE has conducted informal consultation with the USFWS and Mississippi Natural Heritage Program on the proposed withdrawal. Both agencies expressed serious concerns about water flow and the Gulf sturgeon. The Mississippi Natural Heritage Program (2006) stated that "because of the importance of the Leaf River near Hattiesburg to spawning and juvenile sturgeon, it is recommended that water withdrawals be discontinued if discharge from the Leaf River reaches 30 percent of the mean daily discharge." DOE reviewed the daily average streamflow data for the Leaf River for a 21-year period from 1983 through 2004 and determined that the mean daily discharge was 3,770 cubic feet (107 cubic meters) per second and 30 percent of that flow was 1,131 cubic feet (32 cubic meters) per second. During the same 21-year period, the daily discharge was less than the 30 percent Minimum Instream Flow recommended by the Mississippi Natural Heritage about 27 percent of the time.

Decreased flow caused by the withdrawal may adversely modify the designated critical habitat by reducing water depth and width, increasing pollutant concentrations, and altering water temperatures and water quality. These changes may expose breeding areas, limit adult migration movements, and/or increase mortality of eggs, larval and juvenile sturgeon. Intake of water during low-flow periods would affect water flow downstream and lower water depth in pools at the confluence of the Leaf and

Chickasawhay Rivers where adult sturgeon rest with nonspawning individuals until fall when they return to saltwater (Heise et al. 2004).

The intake of water may impinge young Gulf sturgeon. Impingement could cause bodily harm that may result in mortality. The intake velocity would be 0.5 feet per second. The intake would have cylindrical screens that would be oriented parallel to the river flow and located in the water column. Such a design reduces the potential for impingement of fish by using the sweeping velocity of the river. The intakes would also be equipped with an air compression backwash system for clearing the screens. The intake may entrain Gulf sturgeon eggs and very small young fish. The intake would be equipped with a mesh size of 0.5 inches (1.3 centimeters). See 3.7.2.2.2 for a discussion of the modified RWI structure for the Leaf River.

The pearl darter has been documented throughout the Leaf River to the lower Pascagoula drainage, but little is known about their specific habitat requirements or spawning behavior (Slack et al. 2005). Construction of the RWI may temporarily increase water turbidity. Increased turbidity has the potential to adversely affect pearl darters and other fish species downstream by making the habitat less suitable for feeding and reproduction (USFWS 2001). These temporary impacts would be mitigated with erosion and sedimentation best management practices, use of a cofferdam for instream work, as well as habitat restoration. DOE has determined that the construction of the RWI may affect the pearl darter.

Operation of the RWI may have an adverse effect on the pearl darter. The water withdrawal would be expected to have negligible impacts on the river while it is flowing near or above its overall average flow rate of 4,100 cubic feet (116 cubic meters) per second. During periods of low-flow, however, the withdrawal may constitute up to 11 percent of the river's flow. The reduction in flow would alter water depth, channel width, water temperatures, water quality, and pollutant concentrations downstream. These types of alterations are identified as a major threat to pearl darter populations (USFWS 2001).

The water intake would also cause entrainment and impingement of pearl darters. The RWI would have a maximum intake velocity of 0.5 feet (0.15 meters) per second with 0.5 inch (40 mm) mesh screen. Standard length of the adult pearl darter ranged from one inch (30 mm) to two inches (50 mm) in sampling of the Leaf River in 2004 (Slack et al. 2005). Due to their small size, impingement on the screens or entrainment through the screens would occur and would cause bodily harm that would lead to death of individuals.

The construction of the RWI at Pascagoula would not affect the green or loggerhead sea turtles because there are no known beds of SAV in the area, construction would be completed within a cofferdam, and the area is already disturbed. Operation of the RWI would not affect the species since their mobility would allow them to avoid the intake, and these species are probably infrequent visitors.

The RWI structure at Pascagoula would be located adjacent to an existing pier on Singing River Island. The water surrounding the pier is designated critical habitat for the Gulf sturgeon. The aquatic habitat in this area is low quality due to frequent disturbance by boat and dredging activity. Construction of the RWI structure would disturb and suspend sediments, temporarily raising turbidity and reducing dissolved oxygen levels. Construction would take place within a cofferdam to reduce these impacts. Additionally, construction would be timed to take place during the summer months when the Gulf sturgeons have migrated to inland rivers and estuaries. Construction impacts are not expected to adversely affect the Gulf sturgeon although it would temporarily affect designated critical habitat.

Operation and maintenance of the Pascagoula RWI may affect the Gulf sturgeon and its designated critical habitat because of impingement and entrainment of sturgeon and its prey. An adult or sub-adult Gulf sturgeon would be able to escape the intake velocity of 0.5 feet (0.15 meters) per second. If a sturgeon were to be impinged by the withdrawal of water, the intake structure is equipped with traveling screens that would return the fish back to the water. The impingement of a Gulf sturgeon may cause bodily harm that may result in mortality. The withdrawal of water from the Mississippi Sound would have no effect on the designated critical habitat of the Gulf sturgeon. The Mississippi Sound is tidally influenced so withdrawal of water would not lower water levels or change water quality.

After a review of the conditions at the proposed RWI and consultations with the Mississippi Natural Heritage Program, DOE determined that the proposed RWI would not affect any state-listed threatened, or endangered species (see appendix I).

DOE would develop a Water Conservation Plan for the Leaf River withdrawal. To help mitigate the impacts to the Gulf sturgeon, pearl darter, and the yellow-blotched map turtle from the RWI on the Leaf River. DOE would coordinate with the USFWS, NOAA Fisheries, and Mississippi Natural Heritage Program/ Mississippi Wildlife, Fisheries and Parks to establish a Minimum Instream Flow for the Leaf River. Preliminary discussions indicate the Minimum Instream Flow may be set at 30 percent of the mean daily discharge, which DOE estimated to be 1,131 cubic feet per second (32 cubic meter per second).

If Leaf River flows reach the Minimum Instream Flow, withdrawal from the Leaf River would be terminated and all water for solution mining would be withdrawn from the Gulf of Mexico via the Pascagoula RWI. During high and normal flows in the Leaf River, only the Leaf River withdrawal would be used. During low-flow in the Leaf River, withdrawal could come from both sources to ensure the Minimum Instream Flow is maintained. The RWI from the Gulf of Mexico would be designed to handle up to 0.50 MMB (21 million gallons per day) of water. Water withdrawal for maintenance and drawdown would also follow the same procedure, except that during a National Emergency drawdown, DOE may need to withdraw from the Leaf River in order to reach the proposed 1.0 MMBD drawdown rate.

To reduce the potential impacts related to impingement and entrainment at the Leaf River, DOE would use a revised intake design (see figure 2.4.3-3 and section 3.7.2.2.2) that uses cylindrical screens oriented parallel to the river flow and placed in the water column to maximize the sweeping velocity. The low intake velocity (0.5 feet per second) and relatively small mesh size (0.5 inch) would help to reduce the potential for impingement and entrainment.

DOE would prepare a Biological Assessment for impacts to the pearl darter, Gulf sturgeon, and yellow blotched map turtle and consult with the USFWS, NOAA Fisheries, and the Mississippi Natural Heritage Program to refine the Minimum Instream Flow, Water Conservation procedures, consider other supplemental water sources, and refine the conceptual plan for the Leaf River RWI. DOE would consider the pearl darter as a listed species under ESA. DOE would implement any conditions established by the Biological Opinion prepared by USFWS and NOAA Fisheries.

> Mitigation: DOE would schedule construction of the Pascagoula RWI during the period when adult sturgeon are typically inhabiting inland waters. DOE would construct the RWIs at Pascagoula and the Leaf River within cofferdams. DOE would develop a water conservation plan that mitigates for the impacts of the Leaf River withdrawal during the low-flow conditions.

Special Status Areas

No special status areas would be impacted by the proposed RWI or access road location at the Leaf River or Singing River Island. The DeSoto National Forest is nearly two miles away from the Leaf River RWI.

Essential Fish Habitat

No EFH occurs within or near the proposed RWI at the Leaf River or access road location. The RWI at Pascagoula would be built on a platform and would temporarily affect the water column and sediment component of EFH during construction. Operation of the RWI would not reduce water quantity in the Mississippi Sound, but may affect the salinity gradient. Small aquatic organisms would be entrained by the RWI operation and the habitat would be disturbed by the noise of the pumps. Impingement and entrainment of some managed species may occur. Impacts would be localized and affect a habitat that is already highly degraded by dredging and boat activity.

3.7.5.2.4 Terminal in Pascagoula

Plants, Wetlands, and Wildlife

The proposed Pascagoula terminal would involve redevelopment of a heavily disturbed portion of Singing River Island. The construction of the facility would remove approximately 43 acres (17 hectares) of estuarine wetland habitat and 6 acres (2 hectares) of a grass covered upland area that serves as one of the dikes on the island. Because wildlife on the island is accustomed to frequent disturbance by human activity, operations and maintenance of the terminal would not add further disturbance to surrounding communities.

If one of the Richton alternatives is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible. The placement of fill in the wetlands would cause a permanent loss of wetland functions and values. DOE would secure permits from USACE and the Mississippi Department of Environmental Quality for the impact to wetlands and would provide compensation for the unavoidable wetland impacts. Section 3.7.2 describes the effects of clearing and filling wetlands in detail.

DOE would implement best management practices and comply with permits for erosion and stormwater control during construction and operation of the facility to reduce impacts to aquatic resources. These are described in chapter 2.

> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.

Special Status Species

DOE determined that Pascagoula terminal would not affect any federally or state-listed threatened, endangered, or candidate species (see appendices G and I).

Special Status Areas

The proposed construction and operation of the Pascagoula terminal would not affect the Grand Bay National Estuarine Research Reserve because it is located more than 6 miles (9.7 kilometers) away from the proposed site.

Essential Fish Habitat

Construction of the terminal would permanently remove 43 acres (17 hectares) of estuarine wetlands that are considered EFH. During construction, vegetation would be removed and there would be an increase of suspended sediments to the water column. Appendix E provides further discussion on the potential effects of construction on EFH.

3.7.5.2.5 Terminal at Liberty Station

Plants, Wetlands, and Wildlife

The clearing and grading associated with the Liberty Station terminal would affect approximately 66 acres (27 hectares) of the following vegetation types:

- 31 acres (13 hectares) of grasslands,
- 15 acres (6 hectares) of hardwood forest,
- 12 acres (5 hectares) of pine forest, and
- 7 acres (3 hectares) of disturbed or managed land.

According to National Wetlands Inventory data, one small area of approximately 2 acres (1 hectare) of palustrine open-water wetlands are located within the proposed terminal boundary. Small mammals living in the open areas could be displaced during construction, but would return to the area after construction is complete. The forested areas are fragmented and not likely to support large mammals other than deer. Once security fencing is constructed, larger mammals would be precluded from entering facility boundaries. Birds that utilized the forested areas for nesting or foraging would be permanently displaced to similar forested patches that are common in the area. Some mobile wildlife species and birds would use the site after construction is complete even though a security fence would surround the site.

If one of the Richton alternatives is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible. The entire footprint would be cleared of trees for security reasons. The placement of fill in the wetlands would cause a permanent loss of wetland functions and values. DOE would secure permits from USACE and the Mississippi Department of Environmental Quality for the impact to wetlands and would provide compensation for the unavoidable wetland impacts. Section 3.7.2 describes the potential effects of clearing and filling wetlands in detail. DOE would implement best management practices and comply with permits for erosion and stormwater control during construction and operation of the facility to reduce impacts to aquatic species and resources.

The common operations and maintenance efforts, described in section 3.7.2, would preclude wildlife sensitive to human disturbance from entering the area. These efforts to operate and maintain the terminal would be similar to activities occurring at other industrial facilities located near the proposed site.

> <u>Mitigation</u>: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.

Special Status Species

DOE determined that the Liberty Station terminal would not affect any federally or state-listed threatened, endangered, or candidate species (see appendices G and I).

Special Status Areas

There would be no impacts to special status areas by constructing or operating the terminal at Liberty Station.

Essential Fish Habitat

No EFH occurs within or near the proposed terminal at Liberty Station.

3.7.5.2.6 Offshore Brine Disposal

Plants, Wetlands, and Wildlife

Section 3.7.2.1.4 describes impacts in the Gulf of Mexico common to multiple sites from pipeline construction and brine disposal in open coastal waters and section 3.7.2.1.5 on Essential Fish Habitat.

Special Status Species

DOE has determined that the construction and maintenance of the offshore brine pipeline and diffuser would not affect highly mobile species such as dolphins or manatees. These highly mobile species would not be affected by the proposed action if present as they are able to avoid disturbed areas and the disturbance from the pipeline construction would be temporary.

The green and loggerhead sea turtles are known to feed in the seagrass beds near the GUIS. The location of seagrass beds in the Mississippi Sound can change yearly in response to strong storms, hurricanes, or prolonged drought conditions. If the Richton alternative were selected, DOE would survey the proposed pipeline route for seagrass beds. DOE would work with USFWS, NOAA Fisheries, and GUIS to identify a pipeline route that would avoid direct impacts to seagrass beds (if practicable) and minimize indirect impacts. The sea turtles are highly mobile species able to search out additional food resources during the temporary impacts of pipeline construction or periodic maintenance (see Essential Fish Habitat discussion in this section). Seagrass beds can be found on the north shores of many barrier islands throughout the Gulf of Mexico including the other Mississippi barrier islands located to the west of the proposed ROW. DOE has determined that the green and loggerhead sea turtles would not be affected by the pipeline construction. The brine diffuser would be located 5 miles (8 km) south of GUIS and the area of influence of the brine plume (defined as the isoconcentration of +1 parts per thousand salinity increase) would be about 2 miles (3 kilometers) south of the GUIS and Mississippi Sound. The seagrass beds are located on the wave protected, north side of the barrier islands. The area of influence of the brine disposal plume would not reach the GUIS shore and would not affect the sea grass beds on the north side of the islands.

The brown pelican and piping plover are known to roost on GUIS. Both Horn Island and Petit Bois Island are designated critical habitat for the piping plover. If the Richton alternative were selected, DOE would conduct surveys for brown pelican roosting areas and piping plover habitat. DOE would work with USFWS and GUIS to identify a pipeline route outside of the sensitive nesting area for these birds. If it was determined that the project may have an adverse effect on a listed species, DOE would enter formal consultation with USFWS, prepare a Biological Assessment, and follow all recommendations of a Biological Opinion, including adjusting construction schedules to avoid roosting times.

The adult Gulf sturgeon spends winters and springs in the offshore waters of the Mississippi Sound. This area is designated critical habitat for the Gulf sturgeon. To avoid effects to the Gulf sturgeon during construction, DOE would schedule construction of the brine discharge pipeline during times of the year when the Gulf sturgeon has migrated to inland rivers. The area of influence of the brine discharge plume (defined as the isoconcentration of +1 parts per thousand salinity increase) would be about 2 miles (3 kilometers) south of GUIS and the Mississippi Sound. Therefore, the proposed offshore brine pipeline and salinity changes resulting from the brine diffuser would not adversely affect the Gulf sturgeon or its designated critical habitat.

Mitigation: DOE would schedule construction of the brine discharge pipeline when adult sturgeon are typically inhabiting inland waters to minimize the potential for impacts to water quality.

Special Status Areas

The proposed brine disposal pipeline ROW passes through the boundary of the GUIS managed area. The easement for the pipeline ROW would require a permit/consent from GUIS. Construction of the offshore portion of the brine disposal pipeline would cause temporary disturbance of the water column through increased sedimentation and turbidity. DOE would work with GUIS to ensure construction and maintenance of the brine disposal pipeline would not disturb GUIS resources, such as seagrass beds, or the wilderness integrity of the island.

Brine discharge from cavern construction at the Richton site may persist for longer than 4 to 5 years if low-flow conditions in the Leaf River limit the water available for solution mining and DOE withdraws water from the Gulf of Mexico via the Pascagoula RWI. The length of cavern creation and the associated brine discharges could be longer for two reasons: (1) the rate of withdrawal from the available water sources may be smaller than the planned rate of withdrawal from the Leaf River, and (2) each barrel of saltwater from the Gulf of Mexico has less capacity than each barrel of freshwater from the Leaf River to dissolve salt and therefore a larger volume of saltwater would be needed to create the 160 MMB of storage capacity at Richton. If the total rate of water withdrawal for solution mining is reduced, the rate of brine discharged into the Gulf of Mexico would be lower and the size of the brine plume would also be slightly smaller. During brine refill events, after emergency drawdown or maintenance, brine discharge may be slightly longer if water is withdrawn from the Gulf of Mexico, as compared to water from the Leaf River.

Mitigation: For pipeline construction that is near seagrass beds or through the managed area of the GUIS, DOE would employ silt curtains to contain sedimentation and minimize the potential for sediment transportation to the sensitive seagrass beds and coastal resources in the GUIS. If DOE selects one of the Richton alternatives in the ROD, DOE would also examine the feasibility of shifting the pipeline further to the east to move it farther offshore from the sensitive shoreline and shallow water habitat.

Essential Fish Habitat

Section 3.7.2.1.5 discusses the general impacts of offshore pipeline construction and maintenance and brine diffusion to EFH. Appendix E provides a detailed evaluation of the potential impacts to EFH.

Seagrass beds, which are a type of SAV and considered EFH, are located on the north, wave protected side of Mississippi barrier islands in water less than 10 feet (3 meters) in depth (Hoggard 2006). DOE would survey the proposed pipeline route for seagrasses and other SAV. DOE would continue consultation with NOAA Fisheries and NPS to identify a pipeline route that would avoid direct impacts to seagrass beds (if practicable) and minimize indirect impacts. DOE's consultation with NOAA Fisheries would also include a plan to compensate/mitigate for permanent impacts to EFH.

The Richton brine plume would typically increase the salinity by 4 parts per thousand for 0.9 square nautical miles surrounding the brine discharge (1.7 square km), 3 parts per thousand for 1.6 nautical miles (3.0 square km), 2 parts per thousand for 3.2 nautical miles (5.9 square km), and 1 parts per thousand for 5.9 nautical miles (11 square km), as described in appendix C, section C.5.1 in greater detail. The proposed brine diffuser would be located 5 miles (8 km) south of Horn Island and the Mississippi Sound.

Seagrass beds are located on the north side of the island outside of the extent of the brine plume and would not be affected. DOE would secure a Mississippi Pollution Discharge Elimination System Permit for the discharge from the Mississippi Department of Environmental Quality, which would establish discharge limits that protect water quality and aquatic resources. Given the temporary nature of the impact from the brine discharge, the relatively limited size of the salinity plumes, and the salinity tolerances of most organisms, the overall impacts to managed species are not expected to be significant.

Brine discharge from cavern construction at the Richton site may persist for longer than 4 to 5 years if low-flow conditions in the Leaf River limit the water available for solution mining and DOE withdraws water from the Gulf of Mexico via the Pascagoula RWI. The length of cavern creation and the associated brine discharges could be longer for two reasons: (1) the rate of withdrawal from the available water sources may be smaller than the planned rate of withdrawal from the Leaf River, and (2) each barrel of saltwater from the Gulf of Mexico has less capacity than each barrel of freshwater from the Leaf River to dissolve salt and therefore a larger volume of saltwater would be needed to create the 160 MMB of storage capacity at Richton. If the total rate of water withdrawal for solution mining is reduced, the rate of brine discharged into the Gulf of Mexico would be lower and the size of the brine plume would also be slightly smaller. During brine refill events, after emergency drawdown or maintenance, brine discharge may be slightly longer if water is withdrawn from the Gulf of Mexico, as compared to water from the Leaf River.

> Mitigation: DOE would evaluate the brine discharge in greater detail during the application process for a Mississippi Pollution Discharge Elimination System Permit. During the permit process, DOE would model the discharge using EPA's CORMIX discharge model to better refine the design and location of the diffusers. In addition, DOE would survey the brine disposal ROW and try to avoid seagrass beds. DOE would coordinate with the GUIS, Mississippi Department of Environmental Quality, NOAA Fisheries, USACE, and U.S. Coast Guard to ensure that navigation, recreational fisheries, managed fisheries, and marine organisms are not impacted adversely by the brine disposal pipeline and discharge.

3.7.6 Stratton Ridge Storage Site and Associated Infrastructure

This section addresses the proposed Stratton Ridge site and infrastructure areas, including the following:

- Storage site and site access road;
- Four proposed ROW segments: RWI pipeline, brine disposal pipeline, and power line ROW from Stratton Ridge to the RWI on the ICW; the brine disposal pipeline ROW from the RWI to the Gulf of Mexico; the crude oil pipeline ROW from Stratton Ridge to Texas City; and the crude oil pipeline connecting the terminal to local refineries;
- RWI; and
- Terminal and dock refurbishment in Texas City.

Because of the similarity among the proposed SPR facilities in offshore environment, offshore pipeline construction methods, and operations and maintenance of the brine diffuser, the discussion of the offshore pipeline and brine diffusion system for proposed storage facilities is covered in section 3.7.2 and appendix E. Also due to these similarities among the proposed storage sites, the discussion of EFH is contained in section 3.7.2 and appendix E.

3.7.6.1 Affected Environment

3.7.6.1.1 Stratton Ridge Storage Site

Plants, Wetlands, and Wildlife

The proposed 370-acre (150-hectare) Stratton Ridge storage site, including a 102-acre (41-hectare), 300-foot (91 meter) buffer is in the Oak-Prairie Wildlife District within the Texas Gulf Coast Prairie Parkland Province (see appendix B) (TPWD 2005b; Bailey 1995). The Oak-Prairie Wildlife District includes some of the most ecologically diverse ecosystems in the state, historically characterized by savannas comprised of bluestem and browsed paspalum grasses intermixed with clusters of post-oak-dominated forests. As observed at the Stratton Ridge site, the Oak-Prairie Wildlife District vegetation also includes other tree species such as blackjack oak, live oak, water oak, winged elm, hackberry, and yaupon (TPWD 2005b). Although it remains forested, the Stratton Ridge site has been disturbed and fragmented by human activities and introduced animals and plants. Cattle and feral pigs roam throughout the site and their presence and activities, including grazing and burrowing, have long influenced the vegetative communities. Chinese tallowtrees are present throughout the site. Two large ROWs for large power lines and a multiple pipeline ROW flank the northeastern border of the site. Another pipeline ROW passes through the central portion of the site.

The proposed site consists of palustrine forested wetlands with patches of deciduous forest and palustrine emergent wetlands. The site visit revealed that the proposed site includes about 260 acres (105 hectares) of palustrine forested wetlands that are not included in the National Wetlands Inventory data. DOE used the estimated wetland acreage from the site visit in the impact calculations because this approach provides a more accurate assessment than the NWI data. Live oak trees that characterize the forested wetlands are sometimes greater than 4 feet (1.2 meters) in diameter. Other canopy species include water oak and Chinese tallowtree, while greenbrier, trumpet creeper, pigweed, smart weed, and blackberry are present in the understory. Signs of periodic inundation, such as the prevalence of water-tolerant organisms and watermarks on trees, occur throughout the forest. Small pockets of upland islands are dispersed throughout the evergreen forest and occupy approximately 15 percent of land within the site. General species composition on the upland islands is similar to the composition on periodically inundated portions of the evergreen forest. Winged elm and Chinese tallowtree are the dominant species in the deciduous forest.

The forested wetlands on the Stratton Ridge site are categorized as a bottomland hardwood habitat, which is a diverse and greatly threatened ecosystem in the United States. These ecosystems provide habitat and play important roles in maintaining water quality and retaining flood waters. Bottomland hardwood forests are also important sources of organic material for aquatic ecosystems. Only 180,000 acres (72,000 hectares) of this type of ecosystem remain along the Texas Gulf Coast (TPL 2005). Despite its disturbed condition, the bottomland hardwood forest at the Stratton Ridge storage site is ecologically important because it represents one of the only contiguous patches of this habitat type within several miles. The land immediately surrounding Stratton Ridge is used for industrial facilities or pasture.

Four areas of permanent and semipermanent standing water with emergent vegetation are located on the proposed Stratton Ridge site. These emergent wetlands, which are located on the western edge of the proposed site boundary, span from 1 acre (0.4 hectares) to 7 acres (3 hectares) in size. They are characterized by sedges, rushes, legumes, and rattlebush. Chinese tallowtree is prevalent along the perimeter of the wetlands. No perennial streams are located within the site; however, ephemeral channels were observed in association with the site’s wetlands.

Bottomland hardwood forests and emergent wetlands along the Texas Gulf Coast provide permanent or temporary habitat for hundreds of species of birds, including neotropical migratory songbirds. The proposed Stratton Ridge site is located in the center of the Central Flyway (Birdnature.com 2005). The Texas Gulf Coast is the primary wintering site for ducks and geese that use the Central Flyway. The area probably supports numerous bird species that are regulated by the Migratory Bird Treaty Act.

Oyster Creek and Stubblefield Lake are two fresh-water water bodies located less than 0.6 miles (1 kilometer) from the proposed Stratton Ridge storage site. These systems support common aquatic fish species such as bluegill, pugnose minnow, and gizzard shad. Neither Oyster Creek nor Stubblefield Lake have SAV. The vegetation is limited to the shoreline, emergent wetland, and other wetland areas.

The wildlife observed in the project area are common, mobile species such as the nine-banded armadillo and white tailed deer, which have adapted to living in somewhat disturbed habitat areas. Several bird species, such as spoonbills and great blue herons, were observed near the emergent wetlands. The water bodies associated with the wetlands onsite do not appear capable of supporting a fish community year-round because of periodic drying and low oxygen conditions. These systems likely support a variety of invertebrate organisms, reptiles, and amphibians.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the proposed Stratton Ridge storage site would be located: bald eagle, brown pelican, piping plover, whooping crane, and several marine mammals and sea turtles. A site visit to Stratton Ridge and consultations with USFWS and the Texas Parks and Wildlife Department revealed that the area may provide suitable habitat for the bald eagle, which is a federally listed threatened species, although USFWS has proposed delisting the bald eagle (see appendix H) (Aycock 2005; TPWD 2005a; Woodrow 2005). Brazoria County in eastern Texas has breeding and wintering bald eagles (TWPD 2005a; Woodrow 2005). No known bald eagle nests are located at the proposed Stratton Ridge site; however, the bottomland hardwood forest (palustrine forested wetlands) and emergent wetland habitat at the site is suitable for nesting or roosting bald eagles. A pair of bald eagles is known to nest near Ash Lake about 1.8 miles (2.7 kilometers) northwest of the proposed Stratton Ridge site. No other federally listed species is known to inhabit the site.

Appendix I identifies species listed as threatened or endangered by the State of Texas (but not listed federally) in counties in the proposed Stratton Ridge SPR development area. Table 3.7.6-1 shows a comparison of the habitat preferences of threatened or endangered species on the state list and habitat present in the proposed Stratton Ridge site.

None of these species is known to inhabit the site, but a survey or habitat assessment has not been conducted.

Special Status Areas

There are no special status areas in or adjacent to the proposed Stratton Ridge storage site. The Brazoria National Wildlife Refuge is located 3.5 miles (5.6 kilometers) from the site; the Peach Point Wildlife Management Area is located 10 miles (16 kilometers) from the site; and the San Bernard National Wildlife Refuge is located 11 miles (17 kilometers) from the site. These protected areas provide coastal habitat to migratory birds, reptiles, and amphibians.

Table 3.7.6-1: State-Listed Species With Potentially Suitable Habitat at Stratton Ridge Storage Site

Species Common Name	State Status	Global Status[a]	Potentially Suitable Habitat at Site
Swallow-tailed kite	Threatened	Secure (G5)	Tall, easily accessible trees; open areas for foraging
White-faced ibis	Threatened	Secure (G5)	Bayous and palustrine wetlands
Wood stork	Threatened	Apparently secure (G4)	Bayous and palustrine wetlands
Black bear	Threatened	Secure (G5)	Mixed deciduous-coniferous forest with thick understory
Smooth green snake	Threatened	Secure (G5)	Grasslands, forest, meadows, grassy marshes, moist grassy fields at forest edge, and abandoned farmland

Notes:

[a] Secure is defined by NatureServe and the Texas Natural Diversity Database as common, widespread, and abundant. Apparently secure is defined as an uncommon species, but not rare. There is some cause for long-term concern.

Source : NatureServe 2005

Essential Fish Habitat

No EFH is located near or within the boundaries of the proposed storage facility.

3.7.6.1.2 Stratton Ridge Rights-of-Way

Three pipeline and power line ROWs would be required for the Stratton Ridge storage site. The proposed ROWs would include the following:

- A proposed shared 6.2-mile (10-kilometer) ROW for an RWI pipeline, a brine disposal pipeline, and two (34.5-kilovolt) power lines. The shared ROW would leave the site and terminate at the RWI.
- A proposed 3.8-mile (6.1-kilometer) brine disposal pipeline would continue in an ROW from the RWI to the Gulf of Mexico, and then proceed to the offshore brine diffuser.
- A proposed 37-mile (60-kilometer) crude oil pipeline would parallel the existing Bryan Mound pipeline ROW to a terminal in Texas City, TX.
- A 2.7-mile (4.3-kilometer) crude oil pipeline that would connect the Texas City terminal to the British Petroleum and GAP Analysis Program facilities.

Plants, Wetlands, and Wildlife

Over 80 percent of the proposed 45 miles (72 kilometers) of ROWs for the pipelines and power line corridor follow existing utility easements. These easements have been disturbed by previous construction and periodic maintenance activities. Sand flats, which include estuarine emergent wetlands, is the dominant Texas GAP Analysis Program (plant community) classification crossed by the proposed shared 6.2-mile (10-kilometer) ROW to the RWI. Most of the estuarine wetlands crossed by the ROW are in the Brazoria National Wildlife Refuge. These wetlands are characterized by salt meadow cordgrass and mudflats.

The proposed 0.8-mile (1.2-kilometer) brine pipeline ROW from the RWI to the Gulf of Mexico would cross estuarine emergent wetlands, sand flats, and beach habitat.

The proposed 37-mile (60-kilometer) crude oil pipeline ROW would be located along an existing and maintained corridor, with approximately 75 percent of the ROW surrounded by hardwood forested habitat. The remaining habitat is a mixture of disturbed or managed areas, grassland, and beach or bare soil habitat. Wetlands are present in about 21 percent of the proposed ROW, with the majority being palustrine emergent wetlands.

The proposed 2.7-mile (4.3-kilometer) connecting pipeline from the Texas City terminal to the British Petroleum and GAP Analysis Program facilities would follow an existing road and drainage canal through disturbed habitat. Approximately 23 acres (9.2 hectares) have been identified by the National Wetlands Inventory data as palustrine unconsolidated bottom wetlands.

Based on the various land classification types and the wetlands present along the proposed ROWs, several common mammals, birds, amphibians, and reptiles may use the habitats within the ROWs. Such species would be similar to those described under the Stratton Ridge storage site description. Organisms observed at the Brazoria National Wildlife Refuge include alligators, other reptiles, salamanders, other amphibians, coyotes, and bobcats (USFWS 2003). More than 200 species of birds have been observed at the refuge.

The typical species of fish found in southern fresh-water systems reside in streams and open water bodies crossed by the existing and new ROWs. Many of the fish species are common throughout the Gulf Coast region, adapt well to moderate environmental change, and include the following: fresh-water eels, suckers, minnows, sunfish and bass, mullet, perches and darters, and fresh-water catfish.

Special Status Species

A literature review indicated that the following federally listed species may be present within the counties where the proposed Stratton Ridge ROWs would be located: Attwater's greater prairie chicken, bald eagle, brown pelican, Eskimo curlew, piping plover, whooping crane, and several marine mammals and sea turtles. A review of the conditions along the ROWs and consultations with USFWS and the Texas Parks and Wildlife Department revealed that the proposed ROW from the Stratton Ridge site to the RWI may include suitable foraging habitat for the bald eagle, which is on the Federal and state threatened species list (see appendix H). The bald eagle has been proposed for delisting from the Federal ESA list by USFWS. No known bald eagle nests are located along the ROW, but emergent wetland habitat along the ROW may be suitable for foraging bald eagles that nest in the surrounding area. The closest known nest is located 2 miles (3.2 kilometers) from the crude oil pipeline to Texas City.

Appendix I identifies species listed as threatened or endangered by Texas, but not by the Federal government, in the counties in the proposed Stratton Ridge area. Table 3.7.6-2 shows a comparison of the habitat preferences of threatened or endangered species on the state list and habitat present in the proposed Stratton Ridge ROWs.

Table 3.7.6-2: State-Listed Species With Potentially Suitable Habitat Along Stratton Ridge ROWs

Common Name	State Status	Global Status[a]	Potentially Suitable Habitat at Site
Arctic peregrine falcon	Threatened	Apparently secure (G4)	Estuarine wetlands and beaches
Eastern brown pelican	Endangered	Apparently secure (G4)	Estuarine wetlands and beaches
Reddish egret	Threatened	Apparently secure (G4)	Estuarine wetlands and beaches
Sooty tern	Threatened	Secure (G5)	Estuarine wetlands and beaches
Swallow-tailed kite	Threatened	Secure (G5)	Tall, easily accessible trees with open areas for foraging
White-faced ibis	Threatened	Secure (G5)	Bayous and palustrine wetlands
White-tailed hawk	Threatened	Apparently secure (G4)	Estuarine wetlands dominated by salt meadow cordgrass and beaches
Wood stork	Threatened	Apparently secure (G4)	Bayous and palustrine wetlands
Alligator snapping turtle	Threatened	Vulnerable (G3)	Water bodies, particularly slow moving, deep rivers and canals; shallow tributaries; and brackish waters near river mouths
Smooth green snake	Threatened	Secure (G5)	Grasslands, forest, meadows, grassy marshes, moist grassy fields at forest edge, and abandoned farmland

Notes:

[a] Secure is defined by NatureServe and the Texas Natural Diversity Database as common, widespread, and abundant. Apparently secure is defined as an uncommon species, but not rare. There is some cause for long-term concern. Vulnerable is defined as at moderate risk of extinction due to range restrictions and relatively few populations (80 or fewer).

Source: NatureServe 2005

None of these species is known to inhabit the site, but a survey or habitat assessment has not been conducted.

Special Status Areas

Approximately 3 miles (5 kilometers) of the co-located RWI pipeline, brine disposal pipeline, and power line ROW would cross the southwestern edge of the Brazoria National Wildlife Refuge, which is part of the Texas Mid-Coast National Wildlife Refuge Complex. In addition, 4.7 miles (7.6 kilometers) of the proposed pipeline along the existing Bryan Mound pipeline ROW would cross the refuge along its northern border. The brine disposal pipeline ROW from the ICW to the Gulf of Mexico would not be located in the national wildlife refuge.

Created in 1966, the Brazoria National Wildlife Refuge was established to provide habitat for migratory waterfowl and other birds. Currently, the refuge provides 44,000 acres (18,000 hectares) of coastal wetlands. The Texas Mid-Coast National Wildlife Refuge Complex is an important zone of coastal wetlands that serves as an endpoint of the Central Flyway for waterfowl in the winter. Neotropical migratory songbirds also use the refuges as stopovers during migration. These birds are in decline due in part because of loss of stopover habitat, as discussed in section 3.7.2. The wildlife refuge also provides habitat for alligators, turtles, small mammals, and other wildlife.

Essential Fish Habitat

The proposed crude oil and brine disposal pipeline ROW would pass through estuarine and scrub-shrub wetlands and tidal waters (water column and substrate) that would be considered EFH.

3.7.6.1.3 Raw Water Intake

The proposed RWI structure would be located on the coastal side of the ICW across the waterway from the Brazoria National Wildlife Refuge (see figure 2.4.6-3). The RWI structure is located about 6 miles (9.6 kilometers) southeast of the proposed storage site. DOE also would construct a 1,000-foot (300-meter) long new access road from Bay Street to the RWI.

Plants, Wetlands, and Wildlife

The ICW is a heavily traveled maritime corridor that is dredged regularly by USACE to maintain a proper depth for navigation. It is a tidally influenced and channelized system. The vegetation near the proposed structure is estuarine wetlands, dominated by saltmeadow cordgrass and other salt-tolerant emergent wetland species. Typical vegetation in this area includes saltgrass, seamyrtle, glasswort, and spikerush. No SAV grows along the ICW in the vicinity of the proposed RWI. Estuarine wetlands provide habitat for a variety of birds, mammals, and reptiles, including herons, spoonbills, swamp rabbits, mice, and various turtles.

The aquatic fauna found near the proposed RWI is similar in composition to the animals described for the RWI pipeline, brine disposal pipeline, and power line ROW. Over 130 species may inhabit the ICW, which includes representatives from 40 families that are common throughout the Gulf Coast region (Page and Burr 1991; Froese and Pauly 2006; Hoese and Moore 1998; McGowan et al. 1998). Two species of commercially important shrimp are found in the estuarine systems along the ICW and the area in and around the proposed RWI.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the proposed RWI would be located: bald eagle, brown pelican, piping plover, whooping crane, and several marine mammals and sea turtles.

A review of the conditions at the proposed RWI structure and access road and consultations with the USFWS and the Texas Parks and Wildlife Department revealed that the area may provide some suitable habitat for the Federal and state-listed threatened bald eagle (see appendix H). There are no known bald eagle nests located near the proposed RWI site and access road, but open water and emergent wetland habitat in the area may be suitable for foraging bald eagles.

Appendix I identifies the species listed as threatened or endangered by the State of Texas (but are not on the Federal list) in the counties in the proposed Stratton Ridge development area. Table 3.7.6-3 shows a comparison of the habitat preferences of threatened or endangered species on the state list and habitat present at the proposed Stratton Ridge RWI. None of these species is known to inhabit the site, but a survey or habitat assessment has not been conducted.

Table 3.7.6-3: State-Listed Species With Potentially Suitable Habitat At Stratton Ridge RWI

Common Name	State Status	Global Status[a]	Potentially Suitable Habitat at Site
Arctic peregrine falcon	Threatened	Apparently secure (G4)	Estuarine wetlands
Eastern brown pelican	Endangered	Apparently secure (G4)	Estuarine wetlands
Reddish egret	Threatened	Apparently secure (G4)	Estuarine wetlands
Sooty tern	Threatened	Secure (G5)	Estuarine wetlands
White-faced ibis	Threatened	Secure (G5)	Bayous and palustrine wetlands
White-tailed hawk	Threatened	Apparently secure (G4)	Estuarine wetlands dominated by saltmeadow cordgrass
Wood stork	Threatened	Apparently secure (G4)	Bayous and palustrine wetlands
Alligator snapping turtle	Threatened	Vulnerable (G3)	Water bodies, particularly slow moving, deep rivers and canals; shallow tributaries; and brackish waters (estuarine) near river mouths

Notes:

[a] Secure is defined by NatureServe and the Texas Natural Diversity Database as common, widespread, and abundant. Apparently secure is defined as an uncommon species, but not rare. There is some cause for long-term concern. Vulnerable is defined as at moderate risk of extinction due to range restrictions and relatively few populations (80 or fewer).

Source note: Natureserve 2005

Special Status Areas

The proposed RWI site would be located along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. The refuge is described in detail in section 3.7.2.

Essential Fish Habitat

The proposed RWI would be constructed on the bank of the ICW. The proposed RWI would affect approximately 17 acres (7 hectares) of estuarine wetlands and a small amount of water column and substrate that are considered EFH.

3.7.6.1.4 Texas City Terminal

Plants, Wetlands, and Wildlife

The proposed 39-acre (16-hectare) terminal would be adjacent to an existing terminal owned by TEPPCO and southwest of larger refineries owned by British Petroleum, MAP, and VALERO. The site currently contains fields that do not appear to be actively managed, although they appear to have been used for row-crop agriculture in the past. Highways flank the western and southeastern borders of the proposed site. Row-crop agriculture, pasture fields, and residential neighborhoods are the other land uses surrounding the proposed terminal site. National Wetlands Inventory data identified 12 acres (5 hectares) of palustrine emergent, forested, and scrub-shrub wetland habitat at the proposed site. These wetlands are associated with a drainage channel that originates northwest of the proposed site boundary and flows east through the site. Because of the disturbed nature of the site and of the surrounding area, the site likely provides marginal quality habitat for wildlife.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the proposed Texas City terminal would be located: Attwater's greater prairie chicken, brown pelican, Eskimo curlew, piping plover, and several marine mammals and sea turtles. A review of the conditions at the Texas City terminal revealed that the proposed site that would be disturbed does not provide suitable habitat for any federally or state-listed threatened or endangered species, species proposed for listing, or candidate species (see appendices H and I).

Special Status Areas

No special status areas are located within the boundary of the proposed Texas City terminal. An active interior least tern and foster's tern rookery is located about 1.6 miles (2.7 kilometers) southeast of the proposed terminal site (USFWS 2004—Texas Colonial Waterbird Database).

Essential Fish Habitat

No EFH is located near or within the boundaries of the proposed Texas City terminal.

3.7.6.2 Impacts

3.7.6.2.1 Stratton Ridge Storage Site and Associated Infrastructure

Plants, Wetlands, and Wildlife

The clearing, filling, and grading associated with the proposed construction of the Stratton Ridge storage site would affect approximately 370 acres (150 hectares), including the 270-acre (110-hectare) storage site and a 300-foot (91-meter) cleared security buffer surrounding the site. Trees would be removed within the 300-foot security buffer; however, emergent wetland vegetation would be allowed to regrow postconstruction. The construction would affect the following:

- 258 acres (104 hectares) of palustrine-forested wetlands,
- 35 acres (14 hectares) of deciduous forest,
- 23 acres (9 hectares) of palustrine-emergent wetlands,
- 12 acres (5 hectares) of palustrine scrub and shrub, and
- 45 acres (18 hectares) of old field and roads.

Clearing and grading the palustrine forested wetlands would permanently remove and fill about 192 acres (78 hectares) of forested wetlands onsite and convert 66 acres (27 hectares) within the security buffer to emergent wetlands or open water. If one of the Stratton Ridge alternatives is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible, although the entire footprint would be cleared of trees for security reasons. The placement of fill in the wetlands would cause a permanent loss of wetlands functions and values; however, clearing forested wetlands outside the facility footprint would represent only wetland conversion and some wetland functions would be preserved. Section 3.7.2 and appendix B describe the effects of clearing and filling wetlands in detail. Although the area is disturbed by cattle and feral pigs and contains tallowtrees, the palustrine forested wetlands remain an important ecological resource for the region. Palustrine emergent wetlands occur more frequently in the region than forested wetlands; however, because the emergent wetlands are associated within the forested wetlands, the habitat combination is more ecologically valuable for the region.

If one of the Stratton Ridge alternatives is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would refine the conceptual site plan to avoid filling in wetlands and would preserve onsite emergent wetlands to the maximum extent practicable. DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to wetlands. DOE would implement the mitigation measures in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Texas Commission on Environmental Quality. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts. If one of the Stratton Ridge alternatives is selected, the impact to this ecologically important and relatively rare wetland type would be an adverse effect, which would be mitigated somewhat by DOE's compensation plan for wetland impacts.

As discussed in section 3.7.2, some wildlife would be killed or displaced to surrounding areas during construction. Because the forested wetland habitat is uncommon in the region, some wildlife species may be unable to find suitable habitat, including migrating neotropical birds that use the palustrine forested wetlands—specifically bottomland hardwood forests—as stopover habitat. Although some individuals would be affected, the impact would not alter the state population or species viability. Construction of the Stratton Ridge storage facility would reduce the quantity of forested habitat available to these birds, which would add to the stress of annual migration. Generally, common animals such as white-tailed deer and nine-banded armadillo would be able to find suitable habitat in the surrounding area. After the security fencing is constructed, wildlife use of the facility would be limited. Some mobile species and birds would probably still visit the site.

The potential operations and maintenance effects, described in section 3.7.2, would preclude wildlife sensitive to human disturbance from entering the area. These would either adapt to the disturbance or move to new habitat; however, only a small amount of the forested wetland habitat would remain near the proposed Stratton Ridge site. The remaining forested wetland habitat would probably not support all the displaced wildlife species that are sensitive to human disturbances. Most common species (e.g., deer, armadillo, and feral pigs) could tolerate noise and activities created by the SPR facility.

The common operational and maintenance effects on migratory birds described in section 3.7.2 could hinder migration due to night lighting, noise, and new structures; however, the proposed Stratton Ridge site already is traversed by large power lines and is adjacent to a cellular telephone tower.

With the removal of semipermanent water bodies and temporary increases in erosion, the proposed construction of the Stratton Ridge site facilities could affect aquatic species such as amphibians, reptiles, and invertebrates, described in section 3.7.2. Although some individuals would be affected, the state population and species viability would not be altered.

As described in section 2.3, DOE would minimize erosion by using best management practices. An erosion- and sediment-control plan and a Texas Pollutant Discharge Elimination System stormwater permit issued by the Texas Commission on Environmental Quality for construction activities would be secured, which would require the use of best management practices to minimize the impact to water bodies.

> Mitigation: DOE would implement a plan to control Chinese tallowtree invasion on the site. DOE would control invasive species by using seed mixes devoid of exotic and invasive species and through postconstruction monitoring of the disturbed areas. If the monitoring detected problems with invasive species, DOE would implement corrective

action. DOE would continue to refine the conceptual site plan to avoid and minimize impacts to the maximum extent practicable.

Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.

Mitigation: DOE, in cooperation with USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. DOE would use down-shielded and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. If one of the Stratton Ridge alternatives is selected, DOE would conduct a survey for raptor nests and secure any necessary permits in accordance with USFWS requirements under the Migratory Bird Treaty Act.

Special Status Species

A pair of bald eagles is known to nest near Ash Lake, located approximately 1.8 miles (2.7 kilometers) northwest of the proposed Stratton Ridge site. The bald eagle is federally listed as threatened but has been proposed for delisting by the USFWS. Research has shown that most nests are not disturbed by development activities that are farther than 0.25 miles (0.4 kilometers) away. Although this nest location is farther than 0.25 miles from the proposed site and the site is not designated critical habitat, these bald eagles may be affected by the Stratton Ridge development because some habitat at the proposed site may provide suitable foraging area. DOE has determined that the bald eagle would not likely be adversely affected by the proposed site. Although there are no known bald eagle nests in the Stratton Ridge site, the bottomland hardwood forest and wetland habitat at the site may be suitable for nesting, foraging, or roosting habitat. Bald eagles are particularly sensitive to human activity when they nest in Texas from October to July; their peak egg laying occurs in December and eggs hatch in January (Wiener 2005).

Operations and maintenance activities at the site would not affect foraging bald eagles even though bald eagles are highly sensitive to human noise and interference (USFWS 1983; USFWS 1995). Once construction is complete, the SPR storage sites would not generate significant noise or activity; therefore, the facility should not interfere with roosting or foraging activity.

If one of the Stratton Ridge alternatives is selected for development, a biologist would survey the site for bald eagle nests and any state-listed species that are deemed to have suitable habitat or potential to inhabit the area. DOE would coordinate with USFWS and the Texas Parks and Wildlife Department if any protected species are observed or suitable habitat is determined to be present onsite. DOE would conduct formal Section 7 Consultation if any part of the project was determined to adversely affect the bald eagle.

Special Status Areas

The special status areas near the proposed storage site—Brazoria National Wildlife Refuge, Peach Point Wildlife Management Area, and San Bernard National Wildlife Refuge—are all located more than 3.5 miles (5.6 kilometers) from the proposed storage site boundaries. Because the impacts associated with Stratton Ridge construction and operations and maintenance would be localized, DOE does not expect any impacts on special status areas.

Essential Fish Habitat

No EFH exists within or near the boundaries of the proposed site and no impact to EFH would occur.

3.7.6.2.2 Stratton Ridge Rights-of-Way

Plants, Wetlands, and Wildlife

Construction in the proposed pipeline and power line ROWs would result in clearing all the vegetative habitats in the ROW and would affect the following:

- 373 acres (151 hectares) of hardwood forest,
- 40 acres (16 hectares) of grassland and scrub and shrub habitat,
- 11 acres (4 hectares) of water and emergent wetlands,
- 124 acres (50 hectares) of sand flats and beach habitat, or bare soil, and
- 140 acres (56.7 hectares) of disturbed or managed land.

Using the USFWS National Wetlands Inventory maps and proposed ROW footprints, construction could affect the following:

- 85 acres (34 hectares) of estuarine,
- 169 acres (68 hectares) of palustrine-emergent wetlands,
- 25 acres (10 hectares) of palustrine-unconsolidated bottom wetlands,
- 2 acres (1 hectare) of palustrine-scrub shrub wetlands,
- 3 acres (1 hectare) of lacustrine wetlands, and
- 3 acres (1 hectare) of riverine wetlands.

About 78 percent of these corridors would follow existing ROW corridors, which have already been disturbed by previous construction and ongoing maintenance activities.

As discussed in section 3.7.2, approximately 33 to 40 percent of this footprint would be a permanent impact because it would be located within the permanently maintained easement. The vegetation within the construction easement would be cleared, but DOE would regrade to pre-construction contours and reseed with native species within this area to re-establish native habitat. The remaining area within the permanent easement would be permanently maintained, but some wetland functions would be restored because the area would be regraded to preconstruction conditions and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands, and the nature and amount of potential wetland impacts from the permanent and construction easements. In addition, many of these wetlands would be avoided by directional drilling from the adjacent uplands. Moreover, about 80 percent of the pipeline ROWs is within or parallel to an existing ROW. Use of existing ROW corridors to the maximum extent practicable would minimize the impacts to undisturbed communities and wildlife.

Because DOE aggregated the Texas GAP Analysis Program information to identify upland habitat, some of the National Wetlands Inventory acreage is included under other land classifications, such as hardwood forest and scrub and shrub vegetation.

DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in accordance with the Section 404/401 permit conditions, which would compensate for the wetland impacts. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O.

As stated in section 3.7.2, construction in the ROWs would displace or kill some aquatic and terrestrial wildlife. Noise and human activity may temporarily preclude some organisms from using nearby habitat. The duration of construction in these areas would be short (6 to 10 weeks at any one location), and ample habitat would be available nearby for most species. The aboveground portion of the power lines to the RWI, from the site to the Brazoria National Wildlife Refuge, represents a potential strike hazard that could affect resident and migratory birds (as described in section 3.7.2). The buried portion of the power lines through the refuge to the RWI would not affect resident or migratory birds.

The potential impacts associated with the operations and maintenance of the ROWs are described in section 3.7.2.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters] wide) or in areas containing sensitive habitat such as wetlands or habitat for special status species. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct problems that are identified.
>
> DOE would bury the power lines through the Brazoria National Wildlife Refuge. In areas outside the refuge, DOE would use low power line poles (less than 75 feet [23 meters]) and would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Powerlines: the State of the Art in 1996* (APLIC 1996).

Special Status Species

The construction of the RWI and brine disposal pipelines and power lines leading to the RWI structure may affect habitat that is potentially suitable for foraging and nesting bald eagles; however, no known nests have been identified along the proposed ROW. It is also possible that habitats may exist for bald eagle nesting and foraging along the existing pipeline ROW to Texas City; however, the ROW currently exists and is actively managed by DOE.

Construction activities along the ROWs may affect potential habitat for species that are listed as threatened or endangered by Texas, but that are not on Federal lists. Although arctic peregrine falcons may feed along the RWI and brine disposal ROWs that cross through estuarine wetlands, they should be able to find other areas of potential habitat adjacent or nearby. The estuarine wetlands and beach habitat along the ROWs are potentially suitable to reddish egrets, sooty terns, and white-tailed hawks. The forested habitat along the ROWs is potentially suitable habitat for nesting and foraging swallow-tailed kites; the fresh-water marsh (palustrine emergent wetlands) and other wetland habitats are potentially suitable to nesting white-faced ibis and wood storks. Construction could affect potential habitat for the smooth green snake, although most of the corridors are already disturbed. Pipeline construction could disturb alligator snapping turtle habitat located near the ICW, though the footprint of the RWI and pipeline would be small and disturbance temporary.

As described in section 3.7.2, ROW operations and maintenance activities would occur infrequently and should not impact state-listed species.

If DOE selects the Stratton Ridge site for development, a biologist would survey the area for eagles and suitable eagle habitat along the ROWs. If a nest is identified, DOE would initiate formal Section 7 Consultation with USFWS and consult with the Texas Parks and Wildlife Department. DOE would prepare a Biological Assessment if any portion of the project may adversely affect the bald eagle. DOE would implement appropriate mitigation strategies to avoid adverse effects. For example, construction of the pipeline could be completed to avoid nesting times where bald eagles are particularly sensitive to human activity. DOE would directionally drill under the sand beaches along the coast to avoid potential habitat for the brown pelican.

Mitigation: DOE would minimize construction activities during nesting periods to the extent practicable to minimize the impact on local nesting bird populations.

Special Status Areas

Approximately 3 miles (5 kilometers) of the proposed ROW containing the RWI and brine disposal pipelines and the two power lines to the RWI would cross the Brazoria National Wildlife Refuge. In addition, 4.7 miles (7.6 kilometers) of the crude oil pipeline to Texas City would cross the refuge along its northern border adjacent to the existing Bryan Mound pipeline ROW. As described earlier, the construction through the refuge would temporarily affect wildlife and vegetation present in the refuge. After construction, the emergent wetlands and upland plant communities within the temporary construction easement would be allowed to revegetate and wildlife could move back into the ROW.

As described in section 3.7.2, ROW operations and maintenance activities such as mowing, clearing, and grubbing would occur infrequently and would result in temporary impacts on vegetation and wildlife.

Mitigation: Because the Brazoria National Wildlife Refuge contains important habitat for migrating birds and waterfowl, DOE would avoid or minimize pipeline construction during spring or fall migration. As described in section 2.3, DOE would bury the power lines through the refuge to the RWI to further minimize long-term impacts on vegetation and wildlife. DOE would use the existing Bryan Mound ROW as much as possible for pipeline and staging areas to minimize the footprint of the crude oil pipeline through the refuge. DOE would coordinate with USFWS for the easement through the wildlife refuge and would reseed ROWs with seeds of native herbaceous, shrub, and/or tree species to promote regeneration of habitat in the temporary construction easement and restore the permanent easement to preconstruction contours. Disturbed areas would be restored with herbaceous species.

Essential Fish Habitat

Construction of the proposed onshore ROWs would affect 92 acres (37 hectares) of EFH. During construction, vegetation would be removed and the water column disturbed from suspended sediments. Mature fish would be expected to leave the area during construction, but benthic organisms, fish eggs, and fish larvae that lie directly in the construction path would suffer mortality. Section 3.7.2.1.5 and Appendix E provide detailed information about the potential effects of pipeline construction in onshore EFH. Following construction, the EFH would be restored to emergent estuarine wetlands and the water column and substrate would return to pre-existing conditions. Potential operation and maintenance impacts to wetlands are described in section 3.7.2.2. These activities would cause temporary, periodic disturbance to the EFH within the maintained ROW.

3.7.6.2.3 Raw Water Intake

Plants, Wildlife, and Wetlands

Section 3.7.2 describes construction impacts associated with the proposed RWI. The clearing and grading associated with construction of the RWI and access road would affect approximately 17 acres (7 hectares) of estuarine emergent wetlands. The RWI structure itself would occupy an area of 16 acres (6.5 hectares). DOE would secure permits from USACE and the Texas Commission on Environmental Quality for the impact to wetlands and would provide compensation for the unavoidable impacts. This would include an

Industrial Water Conservation Plan from Texas Commission on Environmental Quality for the proposed use of surface water.

As discussed in section 3.7.2, some wildlife species would be displaced to similar vegetative and wetland communities surrounding the RWI and the access road. Dredging required for construction of the RWI may affect some aquatic organisms and temporarily increase suspended sediment in the water column. Mobile species could move away from the construction area. Because the ICW is an artificial navigation channel that is regularly dredged by USACE to maintain sufficient depth and width for boat traffic, most aquatic species would be tolerant of noise and human activity. Prior to construction, DOE would conduct surveys for raptor nests as typically required by the Migratory Bird Treaty Act.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would refine the conceptual site plan to avoid filling in wetlands to the maximum extent practicable. DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid and minimize and compensate for impacts to wetlands. DOE would implement the mitigation measures in accordance with the 404 permit and 401 Water Quality Certificate from USACE and Texas Commission on Environmental Quality. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts. As presented in chapter 2, erosion would be minimized with the use of best management practices. An erosion- and sediment-control plan and TPDES stormwater permit issued by Texas Commission on Environmental Quality for construction activities would be secured, which would require the use of best management practices to minimize the impact to water bodies.

The RWI would withdraw about 1.0 MMBD (42 million gallons per day) from the ICW for a period of 4 to 5 years during solution mining and afterwards for periodic drawdown or cavern maintenance. Because the ICW is a tidal channel, the withdrawal would not affect the river depth or flows; however, it would cause impingement and entrapment of some fish and other small aquatic organisms. The RWI would be equipped with intake screens, a relatively low intake velocity, and a traveling screen and fish bypass system to return impinged fish back to the waterway. Entrained organisms would not have an outlet or bypass. Operations and maintenance of the RWI would produce constant noise from the pumps during the cavern solution mining and periods of fill and drawdown. Noise from the RWI is estimated to be audible up to 0.7 miles (1.2 kilometers) away if noise attenuation is not used and would dissipate with increasing distance from the structure. Noise could preclude sensitive terrestrial and aquatic wildlife from using habitat in the immediate vicinity of the RWI. The proximity of the Brazoria National Wildlife Refuge to the RWI is of particular concern to the USFWS because the refuge contains habitat for hundreds of wildlife species and provides important stopover habitat for migratory birds. Because the noise produced by the RWI would be constant, however, some organisms might adapt to the background operations of the facility.

Section 3.7.2 describes other potential operations and maintenance impacts, including artificial lighting and increased human activity, that could affect migratory birds and other wildlife.

> <u>Mitigation</u>: As described in section 3.7.2, DOE would use down-shielded lights and low-mast security lighting to minimize the impacts of artificial lighting on migratory birds and other wildlife. DOE, in cooperation with USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year.
>
> Because the wildlife refuge would be in close proximity to the RWI, DOE would mitigate the noise impacts by using noise attenuation measures. These measures would include

building a concrete enclosure for the pumps and install quieter pump equipment. The use of these strategies would decrease the noise impact and may achieve up to 10 **A-weighted decibel (dBA)** noise reduction.

Special Status Species

Operations and maintenance activities at the RWI may affect foraging bald eagles because they are sensitive to human noise and interference (USFWS 1983, 1995).

No known brown pelican nests are located near the proposed location for the RWI structure; therefore, the construction, operations, and maintenance of the RWI structure would not affect brown pelicans.

Construction of the RWI could affect potential habitat for species that are listed as threatened or endangered by the State of Texas, but are not on Federal lists. Although nesting sites are not likely to be adjacent to the busy ICW, the habitat near the RWI may be suitable for feeding arctic peregrine falcons, reddish egrets, sooty terns, white-tailed hawks, white-faced ibis, and wood storks. As described in section 3.7.2, construction noise and activities may displace these species or affect their behavior. During construction, alligator snapping turtles may be displaced and forced to use suitable adjacent habitat. DOE does not expect that the proposed construction or operation of the RWI would cause a taking of a state-listed species.

Operations and maintenance of the RWI during cavern fill and drawdown activities would produce constant noise that may affect nearby threatened and endangered birds on state lists (e.g., arctic peregrine falcons, eastern brown pelicans, reddish egrets, sooty terns, white-tailed hawks, white-faced ibis, wood storks). These species could move to similar habitat in the wildlife refuge. Operation of the RWI is not expected to affect the threatened alligator snapping turtle species on the state list because the intake pipe would be equipped with screens and have intake flow velocities that are sufficiently slow that will allow larger organisms such as the turtles to escape.

> Mitigation: To the extent practicable, DOE would minimize impacts by constructing the RWI outside important nesting periods and spring and fall bird migration.

> Mitigation: Section 3.7.2 describes how DOE would use down-shielding and low-mast security lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. DOE also would use noise attenuation measures, such as pump enclosures, and low-noise pumps to minimize impacts on wildlife.

Special Status Areas

As described in section 3.7.2, construction noise and activities may affect sensitive wildlife species that use the Brazoria National Wildlife refuge. These impacts may displace sensitive species and may affect foraging and breeding behavior of other organisms. Mobile species may move away from the disturbance to suitable, available habitat elsewhere in the refuge.

Noise from operations and maintenance of the RWI during and following cavern construction could affect wildlife within the refuge. These impacts may displace some sensitive species and may affect foraging and breeding behavior in others. Mobile species would move away from the disturbance to suitable, available habitat elsewhere in the refuge.

> Mitigation: Because the Brazoria National Wildlife Refuge provides important habitat for migratory birds, DOE would minimize or avoid construction of the RWI during

nesting periods and spring and fall migration. DOE would down-shield lights to minimize the impacts of artificial light on migratory birds and other wildlife. DOE would use noise attenuation for the pump station to minimize impacts on wildlife.

Essential Fish Habitat

The ICW is an actively dredged navigational waterway and the EFH within the waterway is frequently disturbed by these activities. The water column would not be considered high quality habitat. Construction of the RWI would cause increased sedimentation and turbidity within the ICW. Mature fish would be expected to leave the area during construction, but benthic organisms, fish eggs, and fish larvae that lie in the construction area would suffer increased mortality.

Operation of the RWI would not reduce water quantity within the ICW, but may affect the salinity gradient. Small aquatic organisms would be entrained by the RWI operation and the habitat would be disturbed by the noise of the pumps. Some individuals that are managed species may be impinged or entrained by the RWI. Impacts would be localized and affect a habitat that is already highly degraded by dredging and boat traffic.

3.7.6.2.4 Texas City Terminal

Plants, Wetlands, and Wildlife

The clearing, grading, and construction of the Texas City terminal would affect about 39 acres (16 acres). Almost 100 percent of the proposed site contains disturbed habitat. The following wetlands would be removed during construction:

- 4 acres (2 hectares) of palustrine emergent wetlands,
- 2 acres (1 hectare) of palustrine forested wetlands,
- 4 acres (2 hectares) of palustrine scrub-shrub wetlands, and
- 1 acre (0.4 hectares) of palustrine unconsolidated bottom.

If this alternative is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible, although the entire footprint would be cleared of trees for security reasons. The placement of fill in the wetlands would cause a permanent loss of wetland functions and values. DOE would secure permits from USACE and the Texas Commission on Environmental Quality for the impact and would provide compensation for the unavoidable wetland impacts. Section 3.7.2 describes the potential effects of clearing and filling wetlands in detail.

After the security fencing is constructed, wildlife use of the site would be limited, though some mobile species and birds would probably still visit the site.

The operations and maintenance activities, described in section 3.7.2, may preclude wildlife sensitive to human disturbance from entering the area. The operational and maintenance activities at the terminal would be infrequent and similar to activities at the adjacent terminal to the proposed terminal and the refineries nearby. Therefore, this area has already been disturbed by past construction and habitat fragmentation.

Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.

Special Status Species

A review of the conditions at the Texas City terminal revealed that the proposed site that would be disturbed does not provide suitable habitat for any federally or state-listed threatened or endangered species, species proposed for listing, or candidate species (see appendices H and I).

Special Status Areas

No special status areas are located within the boundaries of the proposed Texas City terminal. Construction and operations and maintenance activities would not affect the least tern rookery because the proposed facility is located more than 1.5 miles (2.4 kilometers) away from the nesting area.

Essential Fish Habitat

No EFH exists near or within the boundaries of the proposed Texas City terminal.

3.7.7 Bayou Choctaw Expansion Site

This section addresses the following areas:

- The proposed Bayou Choctaw expansion and associated facilities;
- One proposed pipeline ROW from the existing brine injection wells to the proposed new brine injection well field; and
- The proposed six new brine injection wells and associated infrastructure.

The brine disposal system would be upgraded by installing 3,000 feet (900 meters) of brine pipeline to connect six new injection wells to the existing brine injection wells located south of the property boundary. The existing RWI on Cavern Lake would be used and would operate within the capacity of the existing system. The use of RWI would not change the existing condition or affect biological resources and is not considered in this analysis.

3.7.7.1 Affected Environment

3.7.7.1.1 Bayou Choctaw Expansion Storage Site

The proposed expansion at Bayou Choctaw involves development of two new caverns as well as acquisition of an existing commercial storage cavern that is already located within the property boundary. There would be only minor changes to the current footprint or operations from the facility upgrades required for expansion. No new offsite land acquisition is required for the Bayou Choctaw expansion.

Plants, Wetlands, and Wildlife

The Bayou Choctaw storage site is located in Iberville Parish, LA. The storage site occupies 356 acres (144 hectares) of fresh-water swamp (palustrine deciduous wetlands) with open water canals that join larger bodies of water offsite (DOE 2004f). The area surrounding the site is also fresh-water swamp. Bald cypress and water tupelo are the main canopy vegetation; understory vegetation includes black willow, water ash, and pumpkin ash. Dry hummocks around tree roots are vegetated with greenbriar, palmetto, blackberry, trumpet vine, Virginia creeper, holly, and grape. One-third of the storage site property (caverns and support infrastructure) has been filled and elevated. The facility is protected from flooding by flood control levees and pumps. The remainder of the site, which includes the area where the new caverns would be placed, is a fresh-water swamp with areas of open water. The site was affected by recent hurricanes, but the plant communities were not significantly damaged.

The swamp provides habitat for a diverse wildlife population, including many kinds of birds, mammals, reptiles, and amphibians. Common bird species found in the area include herons, egrets, woodpeckers, wood duck, woodcock, thrushes, vireos, and warblers. The bald cypress trees in the area provide suitable nesting and wintering habitat for other bird species. Mammals expected to be found at Bayou Choctaw include opossum, squirrels, nutria, mink, raccoon, swamp rabbit, and white-tailed deer.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the Bayou Choctaw storage site is located: bald eagle, pallid sturgeon, and Louisiana black bear. However, following a review of conditions and consultations with USFWS and the Louisiana Department of Wildlife and Fisheries, DOE has determined that the expansion of the Bayou Choctaw site would not provide suitable habitat for any federally or state-listed threatened, endangered, or candidate species (see appendices F and I).

Special Status Areas

No special status areas are located within 2 miles (3 kilometers) of the Bayou Choctaw expansion site.

Essential Fish Habitat

No EFH occurs within or near the proposed Bayou Choctaw expansion.

3.7.7.1.2 Bayou Choctaw Rights-of-Way

Plants, Wetlands, and Wildlife

- A proposed brine disposal pipeline ROW would extend south for 0.6 miles (0.9 kilometers) from the existing Bayou Choctaw brine injection wells to the proposed new brine injection wells.

The entire proposed ROW between the existing and new brine injection wells would cross palustrine forested wetlands. The vegetative composition within the area of the proposed ROW is likely similar to that of the Bayou Choctaw facility, with bald cypress and water tupelo as the main canopy species. Similar wildlife would be present in the area of the proposed ROW as mentioned above in the description of the proposed expansion area.

The cypress-tupelo swamp is an important fresh-water ecosystem that provides important functions such as nutrient transformation, flood storage, and habitat for wildlife. Wetlands reduce the impact of nonpoint source pollution, minimize flood surges, and provide economic value to the community. Forested wetlands near the Bayou Choctaw salt dome and in other areas along the Gulf Coast provide important stopover habitat for migrating birds. The area likely supports numerous bird species that are regulated by the Migratory Bird Treaty Act.

Forested wetlands in the vicinity of the proposed brine disposal pipeline and existing brine injection wells, as in other places in Louisiana, are experiencing pressure from other land uses in the area. Abutting the proposed ROW to the east are drained fields used for row-crop agriculture. Oil and gas development also and wetland communities exist west of the proposed brine ROW.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the proposed Bayou Choctaw ROWs would cross: bald eagle, pallid sturgeon, and Louisiana black bear. However, after consultation with USFWS and the Louisiana Department of Wildlife and Fisheries, DOE has determined that the proposed ROWs would not affect any federally or state-listed threatened, endangered, or candidate species (see appendices F and I).

Special Status Areas

There are no special status areas located within or near the proposed brine disposal ROW.

Essential Fish Habitat

No EFH occurs within or near the brine disposal ROW.

3.7.7.1.3 Bayou Choctaw Brine Injection Wells

Plants, Wetlands, and Wildlife

DOE has identified a 96-acre (39-hectare) area approximately 2 miles (3.2 kilometers) south of the Bayou Choctaw storage site to construct up to six new brine injection wells and associated infrastructure. Ninety-five percent of this proposed area contains palustrine forested wetlands that likely have a similar vegetative composition as the bald cypress-tupelo swamp at the Bayou Choctaw storage site. DOE would use at most approximately 20 acres (8 hectares) for the brine injections wells and access road. This analysis assumes that all 20 acres (8 hectares) contain palustrine forested wetlands.

As stated previously, the cypress-tupelo swamp is an important fresh-water ecosystem that provides important functions such as nutrient transformation, flood storage, and habitat for wildlife. These ecosystems are experiencing serious development pressure from agriculture and the oil and gas industries near the Bayou Choctaw storage facility and in other areas within Louisiana.

This cypress-tupelo swamp in the area of the proposed brine injection wells likely supports similar wildlife as described above with the Bayou Choctaw site.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the proposed Bayou Choctaw injection wells would be located: bald eagle, pallid sturgeon, and Louisiana black bear. However, after reviewing the area and consultations with USFWS and the Louisiana Department of Wildlife and Fisheries, DOE has determined the brine injection wells would not affect any federally or state-listed threatened, endangered, or candidate species.

Special Status Areas

There are no special status areas located within or near the proposed brine injection wells.

Essential Fish Habitat

No EFH is located within or near the proposed injection wells.

3.7.7.2 Impacts

3.7.7.2.1 Bayou Choctaw Expansion Site

Plants, Wetlands, and Wildlife

The construction activities associated with the proposed site expansion would fill about 4 acres (2 hectares) of fresh-water swamp. Construction of the two proposed caverns and construction of each new and replacement road to access the caverns would fill about 4 acres (1.6 hectares). The impacts of clearing and filling wetlands are described in section 3.7.1.2. The affected area at Bayou Choctaw would be located within the previously disturbed site boundaries. The loss of vegetation and the fill of wetlands would displace wildlife that nest and forage in the surrounding area.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would refine the conceptual site plan to avoid filling in wetlands to the maximum extent practicable. Due to the engineering limitations with the cavern placement in the salt dome, under this alternative some wetlands would be affected. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to wetlands. DOE would implement the mitigation measures in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts.

Because of the small facility footprint and disturbed nature of the plant communities the expansion would cause little affect to wildlife, wetlands, plant communities, or migratory birds. Some wildlife would be killed or displaced by construction activities. These organisms would be displaced to similar areas within and surrounding the facility. Though these impacts may affect individual organisms, the construction, operations, and maintenance of the facility would not alter the regional population or species' viability.

Construction of the Bayou Choctaw site facilities would affect aquatic and terrestrial species that use the cypress swamp, such as some beavers, amphibians, small reptiles, and fish. The connecting wetlands offsite would experience sedimentation and temporary water impacts as the site's vegetation is removed and the surrounding wetlands filled. Aquatic organisms would have to find suitable aquatic habitat in the adjacent wetlands or other wetlands nearby.

Section 3.7.2.2 discusses operational and maintenance impacts common to all proposed new and expansion sites. The general operations and maintenance of the site, such as lawn maintenance, lighting, noise, and vehicular traffic in and around the facility, would be the same as current activities; therefore, there would be no impact to vegetation or wildlife communities in the area.

> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.

> Mitigation: DOE, in cooperation with USFWS, would mitigate impacts on migratory birds that frequent the area during the year. DOE would use down-shielding and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. DOE would conduct a survey for raptor nests and secure any necessary permits in accordance with USFWS requirements under the Migratory Bird Treaty Act.

Special Status Species

DOE has determined that no federally or state-listed threatened, endangered, or candidate species would be affected by the proposed site expansion.

Special Status Areas

There are no special status areas located within or near the proposed expansion area of the Bayou Choctaw storage facility.

Essential Fish Habitat

No EFH occurs within or near the proposed Bayou Choctaw expansion area.

3.7.7.2.2 Bayou Choctaw Rights-of-Way

Plants, Wetlands, and Wildlife

Construction of the brine pipeline ROW would result in clearing 10 acres (4 hectares) of palustrine forested wetlands. As discussed in section 3.7.2.1, approximately 33 to 40 percent of this footprint would be a permanent impact because it is located within the permanently maintained easement. The vegetation within the construction easement would be cleared, but DOE would regrade to pre-construction contours and reseed with native species within this area to re-establish native habitat. The area within the permanent easement would be permanently maintained, but some wetland functions would be restored because the area would be regraded to preconstruction conditions and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands, and the nature and amount of potential wetland impacts from the permanent and construction easements.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to wetlands. DOE would implement the mitigation measures in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts. In areas temporarily disturbed during construction, DOE would re-establish vegetation communities with native wetland species.

As stated in section 3.7.2, construction in the ROWs would displace or kill some aquatic organisms and terrestrial wildlife. Noise and human activity may temporarily preclude some organisms from using nearby habitat. The duration of construction through these areas would be short (6 to 10 weeks at any one location) and ample habitat would be available nearby for most species.

The potential impacts associated with the operations and maintenance of the ROWs are described in section 3.7.2.

Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. It would correct problems that are identified.

Special Status Species

DOE has determined that no federally or state-listed species would be affected by the proposed ROW.

Special Status Areas

There are no special status areas located in or near the proposed ROW.

Essential Fish Habitat

No EFH occurs within or near the proposed ROW.

3.7.7.2.3 Bayou Choctaw Brine Injection Wells

Construction of the brine injection wells would clear and fill up to 20 acres (8 hectares) of palustrine forested wetlands. The actual construction and the permanent footprint of the six brine injections wells and connecting pipelines may be smaller than the area presented in this analysis. DOE, however, is still revising the site plan for the injection well area. Placing fill in wetlands would cause a permanent loss of wetland functions and values.

The removal of trees and other vegetation for the brine injection well pads, connecting pipelines, and access roads would create open areas where there was relatively continuous forested wetlands. Clearing of forested areas for the connecting brine disposal pipelines would represent a wetland conversion because DOE would allow emergent wetland vegetation to regenerate in the area.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would refine the conceptual site plan to avoid filling in wetlands and would preserve onsite emergent wetlands to the maximum extent practicable. DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid and minimize and compensate for impacts to jurisdictional wetlands. DOE would implement the mitigation measures in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts.

The development of the site would change wetland species composition and have long-term impacts on surrounding plant and animal communities by introducing edge habitat within a relatively large continuous flooded forested area. The operations and maintenance effects, such as noise created by the brine injection wells, would preclude wildlife sensitive to human disturbance from entering the area. These effects are described in section 3.7.2. Generally, any displaced organisms would find sufficient habitat in the surrounding area. Security fencing around the well pads would limit wildlife access to the cleared habitat. Some mobile species and birds may still have access to areas surrounding the brine injection wells.

The fill of inundated wetland areas would temporarily increase erosion and could affect aquatic species such as fish, amphibians, and invertebrates as described in section 3.7.2. As described in section 2.3, DOE would minimize erosion by using best management practices.

> Mitigation: DOE would control invasive species by using seed mixes devoid of exotic and invasive species and through postconstruction monitoring of the disturbed areas. If the monitoring detects problems with invasive species, DOE would implement corrective action. DOE would continue to refine the conceptual site plan to avoid and minimize impacts to wetlands to the maximum extent practicable.

Special Status Species

DOE has determined that no federally or state-listed threatened, endangered, or candidate species would be affected by the proposed brine injection wells.

Special Status Areas

There are no special status areas located within or near the proposed brine injection wells.

Essential Fish Habitat

No EFH is located within or near the proposed brine injection wells.

3.7.8 Big Hill Expansion Site

This section addresses the following areas:

- The proposed expansion area for the existing Big Hill storage site; and
- Two proposed pipeline ROWs: the addition of an adjacent crude oil pipeline next to the existing ROW of the Big Hill to Sun Terminal in Nederland, TX, and the refurbishment of the existing brine disposal pipeline.

The Big Hill storage site has most of the infrastructure in place to facilitate construction and operation of additional caverns as described in section 2.3. The existing RWI on the ICW would be used and withdrawal would be within existing permitted limits of the Industrial Water Conservation Plan. DOE would replace two RWI pumps within the structure without expanding the facility footprint. The use of the RWI for the expansion would not change existing biological conditions of the ICW; therefore, the operation of the RWI system is not considered in this analysis. Because of the similarity among the proposed SPR facilities in offshore environment, operations, and maintenance of the brine diffuser, the discussion of the brine diffusion system for proposed storage facilities is covered in section 3.7.2 and appendix E. Also due to these similarities, the discussion of EFH is contained in section 3.7.2 and in appendix E.

3.7.8.1 Affected Environment

3.7.8.1.1 Big Hill Expansion Storage Site

Plants, Wetlands, and Wildlife

The Big Hill expansion site (see figure 2.5.2-1) is located in the Oak-Prairie Wildlife District in the Texas Gulf Coast Prairie Ecoregion (TPWD 2005); the existing site covers approximately 250 acres

(101 hectares). The proposed 210-acre (83 hectare) Big Hill expansion area would include a 59-acre (24-hectare), 300-foot (91 meter) perimeter security buffer. The area is comprised of upland habitat characterized by a hardwood forest that is in the later stages of secondary succession. Historical records indicate that most of the expansion area was agricultural as recently as two decades ago (DOE 1992a). Since then the site has been allowed to revegetate, and currently it is a low to moderate quality forest. The mixed deciduous forest contains an invasive species (Chinese tallowtree) and the area has been disturbed from activities occurring at the current SPR storage facility and adjacent industrial facilities. Hurricanes Rita and Katrina in the fall of 2005 caused no long-term effects to the biological resources in the expansion area.

The forested areas are characterized by dense forest with patches of scrub-shrub vegetation. Canopy species include live oak, Chinese tallowtree, sweet gum, and box elder. Some live oak trees present at the site are greater than 2.5 feet (0.8 meters) in diameter and are estimated to be about 150 years old. The forest understory vegetation is dense and comprised mainly of tree saplings, blackberry, greenbriar, and Virginia creeper. The proposed expansion site boundaries encompass no large surface water bodies; however, the site does contain two intermittent streams and two small ponds. Palustrine wetlands—which comprise approximately 15 acres (6.1 hectares), or 11 percent, of the proposed expansion area—are associated with the ponds and intermittent streams.

Wildlife species inhabiting the area are common to disturbed areas along the Texas Gulf Coast. These species include white-tailed deer, nine-banded armadillo, pocket gopher, coyote, and quail. The aquatic systems onsite are not large or stable enough to support fish populations; however, they could provide habitat for invertebrates, small reptiles, and amphibians.

The area surrounding the expansion site is developed and managed mostly for agriculture and some industrial facilities. Agricultural fields and oil fields border the proposed expansion site. These areas provide habitat similar to the disturbed portion of the proposed expansion site.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the Big Hill storage facility is located: piping plover, and several marine mammals and sea turtles. However, a review of the conditions at Big Hill and consultations with USFWS and the Texas Parks and Wildlife Department revealed that the expansion area does not provide suitable habitat for and would not affect any federally listed threatened or endangered species, species proposed for listing, or candidate species (see appendix H).

Species that occur in Jefferson County, which would contain the proposed Big Hill expansion site, that are listed as threatened or endangered by the State of Texas but that are not on Federal lists are identified in appendix I. Based on a comparison of the habitat preference of these species and the habitat present at the site, the species listed in table 3.7.8-1 may use the habitat at the expansion site.

Table 3.7.8-1: Species on State Lists of Threatened and Endangered Species With Potentially Suitable Habitat at the Proposed Big Hill Expansion Site

Common Name	State Status	Global Status[a]	Potentially Suitable Habitat at Site
Bachman's sparrow	Threatened	Vulnerable (G3)	Secondary succession forest with live oak trees
Swallow-tailed kite	Threatened	Secure (G5)	Tall, easily accessible trees and open areas for foraging
White-faced ibis	Threatened	Secure (G5)	Palustrine wetlands
Wood stork	Threatened	Apparently secure (G4)	Palustrine wetlands
Black bear	Threatened	Secure (G5)	Hardwood forest with thick understory
Rafinesque's big-eared bat	Threatened	Vulnerable (G3)	Hardwood forest, particularly trees with loose bark and hollows
Scarlet snake	Threatened	Secure (G5)	Hardwood, pine, or mixed forest and woodland habitat

Notes:

[a] Secure is defined by NatureServe and the Texas Natural Diversity database as common, widespread, and abundant. Apparently secure is defined as uncommon, but not rare. Vulnerable is defined as at moderate risk of extinction due to range restrictions and relatively few populations (80 or fewer).

Source: NatureServe 2005

None of these species is known to occur on the site; however, surveys or habitat assessments have not been completed.

Special Status Areas

The proposed Big Hill expansion site contains no special status areas. Special status areas in Jefferson County near the site include the McFadden National Wildlife Refuge, 5.6 miles (9 kilometers) away; Sea Rim State Park, 8.1 miles (13 kilometers) away; and the Anahuac National Wildlife Refuge, 12 miles (20 kilometers) away. No recorded bird rookeries are located within 1 mile (1.6 kilometers) of the Big Hill expansion site.

Essential Fish Habitat

No FH is located within or near the proposed Bill Hill expansion.

3.7.8.1.2 Big Hill Rights-of-Way

Under the proposed expansion, construction would occur within the following two pipeline ROWs:

- A proposed crude oil pipeline adjacent to an existing ROW for 23 miles (37 kilometers) from the site to the Sun Terminal in Nederland, TX; and
- Replacement of the first 1.3 miles (2.1 kilometers) of the existing brine disposal pipeline leaving the Big Hill site.

Plants, Wetlands, and Wildlife

The proposed crude oil pipeline and the brine pipeline ROWs are existing and maintained corridors, with approximately 79 percent of the ROWs containing disturbed or managed habitat (urban, agricultural, and industrial land uses), which include some wetlands. The vegetation within both pipeline ROWs is herbaceous species with some shrubs along the edges in forested areas. Approximately 32 percent of the ROW consists of palustrine emergent wetlands, about 3 percent consists of lacustrine wetlands. Palustrine forested, palustrine scrub-shrub, palustrine unconsolidated bottom, and riverine wetlands each consists of 1 percent or less of the ROWs.

Based on the land classification types and the types of wetlands along the crude oil ROW, several common mammals, birds, amphibians, and reptiles might use the existing habitats in the ROW. The habitat is disturbed and therefore of low to moderate quality. The wildlife types would be similar to those found at the proposed Big Hill expansion site.

The small aquatic habitats along the proposed ROW consist of bayous or gullies. Although some portions of these systems receive tidal influence the areas crossed by the ROWs are above the tidal reach. The streams and gullies crossed by the proposed ROW do not support SAV. Typical fresh-water riverine species common throughout the Gulf Coast region can be found along the proposed ROW stream crossings.

Special Status Species

A literature review indicated that the following federally listed species may be present within the county where the proposed Big Hill ROWs would be located: piping plover, and several marine mammals and sea turtles. However, a review of the conditions along the pipeline ROWs and consultations with USFWS and the Texas Parks and Wildlife Department revealed that the ROWs do not provide suitable habitat for any federally listed threatened or endangered species, species proposed for listing, or candidate species (see appendix H).

Appendix I identifies species in Jefferson County that are listed as threatened or endangered by the State of Texas, but that are not on Federal lists. Table 3.7.8-2 lists the results of a comparison of species-specific habitat preferences and the potential habitat present along the pipeline ROWs for threatened or endangered species on state lists.

Table 3.7.8-2: Threatened Species on State Lists Compared With Potentially Suitable Habitat Along Big Hill ROWs

Common Name	State Status	Global Status[a]	Potentially Suitable Habitat at Site
Bachman's sparrow	Threatened	Vulnerable (G3)	Herbaceous vegetation, shrubs, and forested areas
Reddish egret	Threatened	Apparently secure (G4)	Bayous and wetlands
Swallow-tailed kite	Threatened	Secure (G5)	Tall, easily accessible trees and open areas for foraging
White-faced ibis	Threatened	Secure (G5)	Bayous and palustrine wetlands
Wood stork	Threatened	Apparently secure (G4)	Bayous, wetlands, and brackish wetlands
Rafinesque's big-eared bat	Threatened	Vulnerable (G3)	Hardwood forest, particularly trees with loose bark and hollows
Scarlet snake	Threatened	Secure (G5)	Hardwood, pine, or mixed forest and woodland habitat

Notes:

[a] Secure is defined by NatureServe and the Texas Natural Diversity Database as common, widespread, and abundant. Apparently secure is defined as uncommon, but not rare. Vulnerable is defined as at moderate risk of extinction due to range restrictions and relatively few populations (80 or fewer).

There are no known occurrences of these species within the proposed ROW, although no comprehensive survey or habitat assessment has been completed.

Special Status Areas

The J.D. Murphee Wildlife Management Area is a diverse coastal wetland community located within 0.25 miles (0.4 kilometers) of the existing pipeline ROW to Nederland, TX (see figure 2.5.2-1). The 24,000-acre (9,800-hectare) area is in the prairie-marsh zone of the upper coast of Texas, and it supports wetland communities that range from fresh-water to saline (TPWD 2006). The area is an important nesting site for mottled ducks, blue-winged teal, and snow geese. The area also provides habitat for alligators, muskrat, coyote, river otter, armadillo, bobcat, and nutria.

The portion of the brine pipeline that would be replaced is located approximately 4 miles (6 kilometers) north of the McFadden National Wildlife Refuge.

One cattle egret rookery has been documented approximately 0.7 miles (1.1 kilometers) north of the proposed crude oil pipeline ROW.

Essential Fish Habitat

No EFH occurs within the proposed ROW for Big Hill.

3.7.8.2 Impacts

3.7.8.2.1 Big Hill Expansion Storage Site

Plants, Wetlands, and Wildlife

The clearing, grading, and filling associated with the proposed Big Hill expansion area would affect the entire 210-acre (83-hectare) site. The construction would affect the following resources:

- 180 acres (73 hectares) of previously disturbed habitat, including a small number of large live oaks and wetlands,
- 8 acres (3 hectares) of hardwood forest,
- 8 acres (3 hectares) of bare soil, and
- 10 acres (4 hectares) of evergreen (pine) forest.

Clearing and grading the mixed evergreen and deciduous forest would affect the previously disturbed plant communities. The disturbance would not affect a regionally unique habitat. These impacts are described in section 3.7.1.2. Similar transitional forest is available in abandoned agricultural areas surrounding the proposed Big Hill expansion site.

DOE would fill about 15 acres (6 hectares) of palustrine forested and emergent wetlands. Similar wetland habitat occurs in the surrounding area. DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would refine the conceptual site plan to avoid filling in wetlands and would preserve onsite emergent wetlands to the maximum extent practicable. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to wetlands. DOE would implement the mitigation measures in accordance with the 404 permit and 401 Water Quality Certificate from USACE and Texas Commission on Environmental Quality. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts.

Construction of the proposed expansion site would affect the intermittent streams there because the site would be cleared and graded. Runoff associated with clearing and grading would impact water quality temporarily. The intermittent stream could be channelized, altering the aquatic habitat available for amphibians, invertebrates, and small reptiles. If possible, DOE would avoid filling in the two small ponds in the expansion area.

As described in section 2.3, DOE would minimize erosion by using best management practices. An erosion- and sediment-control plan and TPDES stormwater permit issued by Texas Commission on Environmental Quality for construction activities would be secured, which would require use of best management practices that minimize the impact to water bodies.

The habitats present in the proposed Big Hill expansion site have been disturbed previously, and they are not regionally unique habitats. As discussed in section 3.7.2, during construction some wildlife species would be killed or displaced to similar habitat surrounding the proposed expansion site. Though these impacts may affect individual organisms, the construction, operations, and maintenance of the facility would not alter the regional population or species’ viability.

The general operations and maintenance of the storage site, including grounds maintenance, lighting, noise, and vehicular traffic in and around the facility, would be similar to activities already taking place at the SPR facility and at other nearby operations. The most common wildlife in the vicinity of the SPR facility already have adjusted to these activities, and they likely would not be disturbed as a result of operations and maintenance at the proposed expansion site. Fencing would exclude large mammals and removing trees would remove bird nesting sites, although some mobile species and birds would probably still visit the site.

Potential operational and maintenance impacts on migratory birds, such as artificial lighting hindering migration, are described in section 3.7.2.

Mitigation: DOE, in cooperation with USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. DOE would use down-shielding and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. If this candidate alternative is selected, DOE would conduct a survey of raptor nests and secure any necessary permits in accordance with requirements of the Migratory Bird Treaty Act.

Mitigation: DOE would implement a plan to control the Chinese tallowtree invasion on the site. DOE would control invasive species by using seed mixes devoid of exotic and invasive species and through postconstruction monitoring of the disturbed areas. If the monitoring detected problems with invasive species, DOE would implement corrective action. DOE would continue to refine the conceptual site plan to avoid and minimize impacts to wetlands to the extent practicable.

Special Status Species

The proposed Big Hill expansion site would not affect any federally listed threatened or endangered species, species proposed for listing, candidate species, or designated critical habitat (see appendix H).

Given the disturbed nature of the site and the surrounding industrial activity, it is unlikely the site supports any state-listed species. However, construction activities would permanently remove an area that may be suitable habitat for several species that are listed as threatened by Texas. Populations of Bachman's sparrow, swallow-tailed kite, white ibis, and wood stork that may use the habitat located at the storage site could find similar areas of potential habitat adjacent to or near the site. Potentially displaced populations of scarlet snake and Rafinesque's big-eared bat could find suitable habitat near the proposed Big Hill expansion site. If this alternative is selected, DOE would conduct a survey or habitat screening for these species and secure a permit from Texas Parks and Wildlife Department for any unavoidable taking of a state-listed species.

The operations and maintenance of the site, including grounds maintenance, lighting, noise, and vehicular traffic in and around the facility, would be similar to activities already taking place at the SPR facility and at other operations in the region. Therefore, there would be no notable change from the existing conditions and no impact to special status species (if any are present).

Special Status Areas

No special status areas would be affected by the construction or operation of the proposed Big Hill expansion site.

Essential Fish Habitat

No EFH is located within or near the proposed Big Hill expansion.

3.7.8.2.2 Big Hill Rights-of-Ways

Plants, Wetlands, and Wildlife

During construction of the proposed crude oil pipeline, the existing ROW would be expanded and the existing vegetation would be cleared. Refurbishment of the brine disposal pipeline would also require the clearing of vegetation. The construction ROW would affect the following:

- 232 acres (94 hectares) of disturbed or managed habitat,
- 48 acres (19 hectares) of evergreen (pine) forest,
- 3 acres (1 hectare) of sand bar and beach,
- 3 acres (1 hectare) of grassland and scrub-shrub habitat, and
- 1 acre (0.4 hectares) of hardwood forest.

Using the USFWS' National Wetlands Inventory maps and estimated construction footprint, the ROWs would affect the following wetlands:

- 143 acres (58 hectares) of palustrine emergent wetlands,
- 12 acres (5 hectares) of lacustrine wetlands,
- 5 acres (2 hectares) of palustrine scrub-shrub wetlands,
- 5 acres (2 hectares) of palustrine unconsolidated bottom wetlands,
- 3 acres (1 hectare) of palustrine forested wetlands,
- 3 acres (1 hectare) of riverine wetlands, and
- 1 acre (.4 hectares) of other wetlands.

Because the Texas Gap Analysis Program data use different habitat classification categories than the National Wetlands Inventory data, some of the wetland acreage is captured under other land categories (e.g., disturbed or managed habitat and scrub-shrub habitat).

The entire proposed ROW corridor follows existing pipeline corridors that already contain fragmented and disturbed plant communities. Approximately 79 percent of the existing pipeline corridor passes through disturbed or managed habitat that includes agricultural lands and industrial areas. The proposed pipeline/power line corridors would permanently affect about 33 to 40 percent of the acreage described because only a 50-foot (15.2-meter) wide easement per pipeline would be permanently maintained. The vegetation within the construction easement would be cleared, but DOE would regrade to pre-construction contours and reseed with native species within this area to re-establish native habitat. The area within the permanent easement would be permanently maintained, but some wetland functions would be restored because the area would be regraded to preconstruction conditions and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands, and the nature and amount of potential wetland impacts from the permanent and construction easements. In addition, many of these wetlands would be avoided by directional drilling from the adjacent uplands.

DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in accordance with the Section 404/401 permit conditions, which would compensate for the wetlands that were affected. These measures are described briefly in section 3.7.2.1.3 and in greater detail in appendix O.

The crude oil pipeline to Nederland, TX would be constructed adjacent to existing ROWs and the timeframe for construction at any point on the pipeline would be no more than 6 to 10 weeks. The species using the existing ROWs are tolerant of disturbances, and they would be displaced temporarily to suitable adjacent habitat.

Refurbishment of the brine disposal pipeline would take place within the existing pipeline corridor. Construction related to removing and replacing the pipeline would temporarily disturb vegetation and displace wildlife in and near the pipeline ROW. This corridor has already been disturbed, is low to moderate quality for wildlife habitat, and would not affect the regional population or overall species viability.

Section 3.7.2 discusses operations and maintenance activities such as mowing, pipeline inspections, and stump removal. These activities would be similar to activities already occurring in the existing ROWs.

Common wildlife in the vicinity of the pipelines already have adapted to these operations and maintenance activities. These organisms likely would not change their behavior as a result of the expanded ROWs. The construction, operations, and maintenance impacts may disrupt individual organisms, but would not alter the regional population or species viability.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct problems that are identified.

Special Status Species

The proposed expansion and operations and maintenance of the ROWs would not affect any federally listed threatened or endangered species, species proposed for listing, candidate species or designated critical habitat (see appendix H).

Construction activities along the ROWs temporarily would alter the palustrine emergent wetland habitat and remove small portions of forested habitat that might be used by species listed by Texas as threatened or endangered. Construction time would be short, between 6 to 8 weeks, along any portion of the ROW. An abundance of suitable habitat would be available adjacent to the affected areas. The 2.9 acres (1.2 hectares) of forested areas that would be converted along the ROWs could potentially be used by Rafinesque's big-eared bat and scarlet snake. The construction, operations, and maintenance impacts may disrupt individual organisms, but would not alter the regional population or species viability. If this alternative is selected, DOE would conduct a survey or habitat screening for these species and secure a permit from the Texas Parks and Wildlife Department (TPWD) for any unavoidable taking of a state-listed species.

Special Status Areas

No special status areas would be affected during construction or due to operations and maintenance. The construction corridor would expand only a short distance outside of the existing pipeline ROW, and it would not overlap with the J.D. Murphee Wildlife Management area or rookeries. At the nearest point, it would be located 0.25 mile (0.4 kilometers) from the management area and 0.7 mile (1.1 kilometers) from a rookery.

Essential Fish Habitat

No EFH occurs within the proposed ROW for Big Hill.

3.7.9 West Hackberry Expansion Site

This section addresses the following areas:

- The acquisition of three existing caverns and the development of a new access road, installation of security fencing, and creation of security buffer area around the expansion site.

The West Hackberry storage site has most of the infrastructure in place for the operation of additional caverns. Expansion would require only minor upgrades to the RWI, crude oil distribution system, and the brine disposal system, as described in section 2.5.3. The activities listed above would connect the acquired caverns into the SPR storage site. Because the facility upgrades to the RWI structure, crude oil distribution system, and the brine disposal system would not increase the facility footprint or significantly change the current operation, these systems are not analyzed in this section.

3.7.9.1 Affected Environment

3.7.9.1.1 West Hackberry Expansion Storage Site

Plants, Wetlands, and Wildlife

The West Hackberry storage facility is located in Cameron Parish. The existing storage site covers approximately 570 acres (230 hectares) on the West Hackberry salt dome. To expand the West Hackberry SPR site, DOE would purchase 3 existing caverns and 240 acres (97 hectares) of land. DOE would only expand the facility fence line around approximately 53 acres (21 hectares) of the site that contains the existing caverns. This area consists of previously disturbed habitat. An additional 27 acres (11 hectares) of vegetation surrounding the cavern area would be cleared of woody vegetation for a 300-foot (91-meter) security buffer.

The region where the West Hackberry storage facility is located contains numerous canals and natural waterways that bisect the landscape. This region consists of forested and emergent wetlands with natural ridges. These ridges typically support upland forested and herbaceous communities and affect water flow through the marshes (emergent wetlands). In many areas, lakes, bayous, and canals are densely packed so that the marsh may not seem to be a landmass, but rather a large region of small islands. The West Hackberry site was affected by recent hurricanes, but the plant communities were not significantly affected.

There are extensive emergent wetlands and open water areas surrounding the proposed West Hackberry expansion site. The purchased land area and the storage facility are adjacent to Black Lake. Many bird species frequent the area. Other inhabitants include common organisms such as red fox, raccoon, nutria, opossum, and white-tailed deer. The American alligator is common in this area. The emergent wetlands also support a variety of other reptiles, fish, shellfish, and mammals.

Special Status Species

A literature review indicated that the following federally listed species may be present within the parish where the West Hackberry storage site is located: bald eagle, brown pelican, piping plover, gulf sturgeon, red wolf, and several marine mammals and sea turtles. However, a review of the conditions at West Hackberry and consultations with the USFWS and the Louisiana Department of Fisheries and Wildlife revealed that the portion of the expansion area that would be disturbed does not provide suitable habitat for any federally or state-listed threatened or endangered species, species proposed for listing, or candidate species (see appendices F and I).

Special Status Areas

The Sabine National Wildlife Refuge is located about 7.0 miles (11 kilometers) south of Hackberry, LA. This refuge consists of a wide range of habitats including fresh-water impoundments, bayous, ponds, lakes, wooded islands, and manmade canals and levees. The American alligator, red-eared slider turtle, mud turtle, and garter snake are found at the refuge and 250 species of birds visit the refuge during the year. The Sabine National Wildlife Refuge also supports mammals such as the otter, mink, muskrat, mink, raccoon, and opossum. No other Federal or state special status areas are located near the West Hackberry site.

Essential Fish Habitat

Approximately 5 acres (2 hectares) of emergent wetlands occur within the proposed buffer area of the West Hackberry expansion site. These wetlands are within the reach of tidally-influenced waters and are considered EFH.

3.7.9.2 Impacts

3.7.9.2.1 West Hackberry Expansion Storage Site

Plants, Wetlands and Wildlife

The proposed expansion of the facility would affect the following:

- 53 acres (21 hectares) of disturbed or managed land,
- 19 acres (8 hectares) of grassland and scrub/shrub habitat,
- 5 acres (2 hectares) of emergent wetlands and water, and
- 3 acres (1 hectare) of other land classification categories.

Clearing and grading the grassland and managed fields would affect the previously disturbed plant communities. The disturbance would not affect a regionally unique habitat. These potential impacts are described in section 3.7.2.

The USFWS National Wetlands Inventory maps identified 5 acres (2 hectares) of palustrine scrub-shrub wetlands that would be cleared for the expansion of the site security buffer. DOE would complete a wetland delineation and secure a jurisdictional determination from USACE (USFWS 2006b). In addition, DOE would refine the conceptual site plan to avoid filling in wetlands and would preserve onsite emergent wetlands to the maximum extent practicable. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to wetlands. DOE would implement the compensation measures in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. These measures are discussed briefly in section 3.7.2.1.3 and in greater detail in appendix O. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts.

After the security fencing is constructed, wildlife use of the site would be limited. Some mobile species and birds would probably still visit the site. Noise from construction would be temporary.

The impacts of operations and maintenance activities for SPR facilities, such as increased noise, human disturbance, traffic, and light pollution, are described in section 3.7.2. Locally, the operations and maintenance activities associated with the proposed West Hackberry expansion would be comparable to existing activities. The plant communities associated with the proposed expansion have been previously disturbed and are adjacent to an active facility. The wildlife has already adapted to the disturbed areas and the ongoing operations and maintenance activities and would not likely be affected as a result of expansion site operations and maintenance.

Mitigation: DOE, in cooperation with the USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. DOE would conduct a survey of raptor nests and secure any necessary permits in accordance with the requirements of the Migratory Bird Treaty Act. DOE would use down-shielding and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife.

Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.

Special Status Species

A review of the conditions at West Hackberry and consultations with the USFWS and the Louisiana Department of Fisheries and Wildlife revealed that the portion of the expansion area that would be disturbed does not provide suitable habitat for any federally or state-listed threatened or endangered species, species proposed for listing, or candidate species (see appendices F and I).

Special Status Areas

Expansion of the West Hackberry site would have no impacts on special status areas. The nearest protected area, the Sabine National Wildlife Refuge, is located approximately 7 miles (11 kilometers) south of the site and is too distant to be affected by construction or operations and maintenance activities.

Essential Fish Habitat

Construction of the West Hackberry site and buffer would result in the removal of 5 acres (2 hectares) of emergent wetlands that are considered EFH. During construction vegetation would be removed and the water column disturbed from suspended sediments. Mature fish would be expected to leave the area during construction, but benthic organisms, fish eggs, and fish larvae that lie directly in the construction path would suffer mortality. Appendix E provides further discussion of potential construction impacts on EFH. Following construction, the wetland habitats would be restored to emergent estuarine wetlands and return to functioning habitat. Potential operation and maintenance impacts to wetlands are described in section 3.7.2.2.

3.7.10 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the Chacahoula storage site and if the proposed site could be developed by a commercial entity for oil and gas purposes some spill risk to biological resources could exist. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow Chemical, British Petroleum, Conoco, and Occidental Petroleum have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity, which could involve brine spill risk to biological resources.

For the portions of the proposed storage site pipelines that follow existing ROWs there would be some risk of a spill and consequent impact on biological resources. The risk of a spill associated with the no-action alternative would be limited to that which exists from the existing pipelines. For the portions of the pipeline in new ROWs the no-action alternative would not present any spill risk to biological resources. For the sites of terminals that are in developed petroleum storage areas it is possible that a commercial entity could develop them for storage and some spill risk to biological resources could occur.

No additional potential impacts to plants, wetlands, wildlife, threatened and endangered species, marine habitats, and protected areas, or EFH would be related to the selection of the no-action alternative.

3.8 SOCIOECONOMICS

CEQ regulations implementing NEPA state that when economic or social effects and natural or physical environmental effects are interrelated, the EIS will discuss these effects on the human environment (40 CFR 1508.14). The CEQ regulations state that the "human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." To the extent that the development of a new storage site or expansion of an existing one could affect the natural or physical environment, the socioeconomic analysis evaluates how elements of the human environment such as population, employment, housing, and public services might be affected. The analysis also assesses SPR employment needs and potential sources of those workers.

The organization of section 3.8 is different than most other sections of chapter 3. Section 3.8.1 presents the methodology. Then, instead of discussing the affected environment and potential impacts one site at time, section 3.8.2 summarizes the affected environment for each site. Section 3.8.3 presents a summary of potential construction and operations and maintenance impacts for all potential sites. This organization streamlines the discussion, presenting much of the information in several tables.

3.8.1 Methodology

> **In-migration** is the movement of people into a given geographic area.

This analysis of potential socioeconomic impacts characterizes the potentially affected areas in terms of economic activity, employment, income, population, housing, public services, and social conditions. Census, state, and local government data were evaluated to describe the baseline socioeconomic characteristics. This analysis of the SPR expansion identifies the potential economic implications such as new employment and wages, and it evaluates the subsequent effects, including **in-migration**, population changes, demand for housing and public services, and effects on local governments and traffic congestion.

The region of influence for this analysis is the potentially affected area, generally consisting of each new or expansion SPR site area plus the likely sources of workers for each site. These are the areas in which the proposed SPR activities could most influence local economic and social conditions. The socioeconomic assessment methodology recognizes that each of the potential new and expansion SPR storage sites and the associated infrastructure, while generally located in or near rural communities, is relatively close (e.g., 20 to 45 miles [32 to 72 kilometers]) to more populated urban areas. The analysis recognizes the well-established historical interaction of the oil and gas industry, including existing SPR components, with the economic conditions and characteristics of the Gulf Coast region. The population adjacent to oil- and gas-related sites evolves and adjusts in accordance with much larger, systemic relationships and trends, not merely in accordance with individual projects or industries.

The level of socioeconomic impact is largely determined by the magnitude and duration of the economic stimulus, which is primarily employment in the case of potential expansion of the SPR program. DOE has evaluated potential employment needs for each of the potential new and expansion sites. This analysis uses the peak workforce size to estimate the maximum potential socioeconomic effects of each storage site and its associated infrastructure. In all cases, the peak workforce needs would occur during construction. The operations workforce at each of the sites would be approximately 75 to 100 people, while peak construction workforces would range from about 230 to 500 people.

To assess potential changes in population resulting from the peak workforce for each site, DOE assumes that up to 40 percent of construction workers would in-migrate from outside the region of influence into the communities within the region of influence (including nearby urban areas). DOE also assumes that the average family size would be 2 people per in-migrating employee.[1] The other employees are assumed to already reside in the nearby area and commute to the SPR site.[2] SPR program workers have shown a tendency to reside in a number of communities away from the SPR sites and commute fairly long distances to their work locations. For example, workers at the three existing SPR sites that are being considered for expansion within this EIS have the following workforce residency and commuting characteristics as of early 2006:

- Of the 84-employee workforce at Bayou Choctaw, workers lived in 26 different towns, located 5 miles (8 kilometers) to over 50 miles (80 kilometers) from the Bayou Choctaw site.

- Of the 118-employee workforce at Big Hill, workers lived in 28 different towns, located from 5 miles (8 kilometers) to over 50 miles (80 kilometers) from the Big Hill site.

- Of the 123-employee workforce at West Hackberry, workers lived in 17 different towns, located from 5 miles (8 kilometers) to over 50 miles (80 kilometers) from the West Hackberry site.

Residency areas for all three SPR sites include towns of less than 1,000 persons and larger urban areas such as Baton Rouge, LA (for Bayou Choctaw), Beaumont/Port Arthur, TX (for Big Hill), and Lake Charles, LA (for West Hackberry). Based on these data from the existing sites, there is no reason to assume that most in-migrating workers at each new or expanded SPR site would choose to live in the town closest to the site, especially if that town had limited housing opportunities. Furthermore, the data show that many workers are willing to commute more than 50 miles (80 kilometers) to work at existing SPR sites.

The assumptions regarding employee in-migration and average family size provide a reasonable estimate of potential effects from employment and population. Some of the unknown factors affecting the actual number of employees in-migrating and where they will be located include the source and size of the construction contractor chosen for a given project; how local labor market conditions match needed skill categories; and the extent of employee recruiting from the local area. Results and conclusions of this analysis would not substantially change if actual in-migration rates were higher or lower than the assumptions used herein.

A large portion of the region where the new or expanded SPR sites would be located was adversely affected by Hurricanes Katrina and Rita in August and September 2005. The data included in this section reflect conditions before the hurricanes; however, the socioeconomic influence of the hurricanes on each region of influence is briefly described.

While the Gulf Coast region regularly deals with hurricanes, the effects from Hurricanes Katrina and Rita were not typical of the region; they caused devastating adverse socioeconomic effects. For example, economic activity, including employment and wages, was dramatically reduced, at least temporarily, in affected areas. A considerable portion of the existing housing stock was damaged or destroyed by wind and water, most notably in the coastal portions of Mississippi and Louisiana. The ability of local and state governments to provide public services also was reduced, and tax revenues to support these services declined. Many people were temporarily relocated, and the relocation areas such as Baton Rouge, LA incurred substantial socioeconomic effects. It will take many months or years for portions of the region of influences to recover from these effects. While this socioeconomic analysis acknowledges that the

[1] Construction workers may in-migrate into a project area with or without their families. An assumption of two people per household (including the employee) constitutes an average of some employees in-migrating without family members, some in-migrating with their spouse only, and some in-migrating with spouse and children.

[2] This analysis does not distinguish between pre- and post-hurricane residents within each region of influence.

recent hurricanes have altered socioeconomic conditions in the Gulf Coast region, it will take a substantial amount of time to systematically re-characterize baseline conditions. Many questions about the hurricanes' effects on the social and economic environments remain unanswered as the SPR program expansion mandated by EPACT progresses. In addition, further investigation of the effects of the hurricanes would not alter the basic results and conclusions of this analysis because SPR development would constitute a small fraction of economic activity and would cause a small change in population in any affected area.

3.8.2 Affected Environments at Storage and Expansion Sites and Associated Infrastructure

This section summarizes baseline socioeconomic conditions in the region of influence for each proposed new site or expansion site. The baseline conditions include the size of local population centers, the distance from the sites and terminals to these areas, and the nature of the local economies. The location of new infrastructure other than storage sites (e.g., terminals and pipelines) is not considered in this analysis because the crews needed to build, operate, and maintain such infrastructure would be relatively small.

Table 3.8.2-1 presents population data for each proposed or expansion site and its MSAs, counties or parishes, and some of the cities. The first column identifies the site, and the second column of the table shows the nearest MSA. The third column of the table shows neighboring parishes or counties, and the fourth column shows cities or towns in the vicinity of each site. The fifth column shows the driving distance of these jurisdictions to the nearest potential SPR site. The last two columns of the table present population estimates for the areas listed in previous columns. The table shows that all eight potential new or expansion storage sites are located near major population centers that could serve as substantial sources of labor under typical worker commuting expectations.

> An MSA is an area containing a recognized population nucleus (such as a city) and adjacent communities (sometimes considered suburbs) that have a high degree of integration with that nucleus. One of the major purposes in defining MSAs is to provide a nationally consistent definition for collecting, tabulating, and publishing Federal statistics for a set of geographic areas.

The Bruinsburg site would be located in Claiborne County, MS, which includes the city of Port Gibson, MS. Also nearby are the City of Vicksburg, MS (40 miles or 64 kilometers) and the Jackson MSA (45 miles or 72 kilometers) (see figure 3.8.2-1). Three major economic sectors dominate the labor market in Claiborne County: agriculture (including timber), education, and power generation. Area farmers grow hay, corn, soybeans, cotton, and wheat, but timber is the largest crop. Alcorn State University is a major economic influence with about 700 employees. The Grand Gulf Nuclear Power Plant employs about 750 workers. As one of six Mississippi River system ports in the State of Mississippi, the Claiborne County Port gives area agriculture and industry efficient access to this viable transportation option. Claiborne County has a civilian labor force of approximately 4,000, while the Jackson MSA has more than 250,000 people in the civilian labor force (Mississippi Department of Employment Security 2006). The county had an average annual unemployment rate of almost 10 percent in 2004 (Mississippi Department of Employment Security 2006). The Bruinsburg site was not substantively affected by Hurricanes Katrina or Rita, but Jackson, MS experienced a substantial indirect effect from the in-migration of hurricane victims.

The Chacahoula storage site would be located in northwest Lafourche Parish, LA and close to Terrebonne Parish, LA (see figure 3.8.2-2). It is about 20 miles (32 kilometers) from the city of Houma, LA. These parishes are part of the Houma MSA. The new pipelines for this site also would be located in this socioeconomic region of influence. Lafourche and Terrebonne Parishes have substantial traditional

Table 3.8.2-1: Population in Jurisdictions near Proposed Storage Sites (persons)

Proposed Site	Metropolitan Statistical Area	Parish or County	City or Town	Driving Distance to Jurisdiction (miles)	2000 Population	More Recent Population (year)
Bruinsburg	Jackson, MS MSA			45 miles	440,801	436,503 (2003)
		Claiborne County, MS[a]		N/A	11,831	11,546 (2004)
			Port Gibson, MS	10 miles	1,840	1,748 (2003)
			Vicksburg, MS	40 miles	26,407	26,005 (2003)
Chacahoula	Houma, LA MSA[a]			N/A	194,477	198,680 (2004)
		Lafourche Parish, LA[a]		N/A	89,974	92,157 (2004)
		Terrebonne Parish, LA		19 miles	104,503	106,523 (2004)
			Houma, LA	20 miles	32,393	32,025 (2003)
		Lafourche Parish, LA[a]		N/A	89,974	92,157 (2004)
			Galliano, LA	5 miles	7,356	NA
Richton	Hattiesburg, MS MSA[a]		Hattiesburg, MS	N/A	113,054	128,631 (2003)
				18 miles	44,789	46,664 (2003)
		Perry County, MS[a]		N/A	12,138	12,236 (2004)
			Richton, MS	3 miles	1,038	1,037 (2003)
Stratton Ridge	Houston, TX MSA[a]			N/A	1,953,631	2,009,690 (2003)
		Brazoria County, TX[a]		N/A	241,767	271,130 (2004)
			Lake Jackson, TX	3 miles	26,386	26,950 (2003)
			Clute, TX	3 miles	10,424	10,704 (2003)
Bayou Choctaw	Baton Rouge, LA MSA			N/A	602,894	722,646 (2003)
		Iberville Parish, LA[a]		N/A	33,320	32,497 (2004)
			Plaquemine, LA	8 miles	7,064	6,894 (2003)
Big Hill	Beaumont-Port Arthur, TX MSA[a]			N/A	384,737	382,629 (2003)
		Jefferson County, TX[a]		N/A	252,051	284.223 (2004)
			Port Arthur, TX	20 miles	57,755	57,042 (2003)
			Beaumont, TX	27 miles	113,866	112,434 (2003)
			Winnie, TX	10 miles	2,914	N/A
West Hackberry	Lake Charles, LA MSA[a]			20 miles	183,577	194,642 (2004)
		Calcasieu Parish, LA[a]		36 miles	183,577	184,961 (2004)
		Cameron Parish, LA[a]		N/A	9,991	9,681 (2004)
			Hackberry, LA	4 miles	1,699	N/A

Note: A parish, county, city, or town in the same row as an MSA is within the MSA boundaries. A city or town in the same row as a county or parish is located within that county or parish.

[a] Denotes MSA and parish or county where sites are located

1 mile = 1.609 kilomters; N/A = not available

Source: U.S. Census Bureau 2006, State & County QuickFacts

Figure 3.8.2-1: MSAs for Mississippi Sites

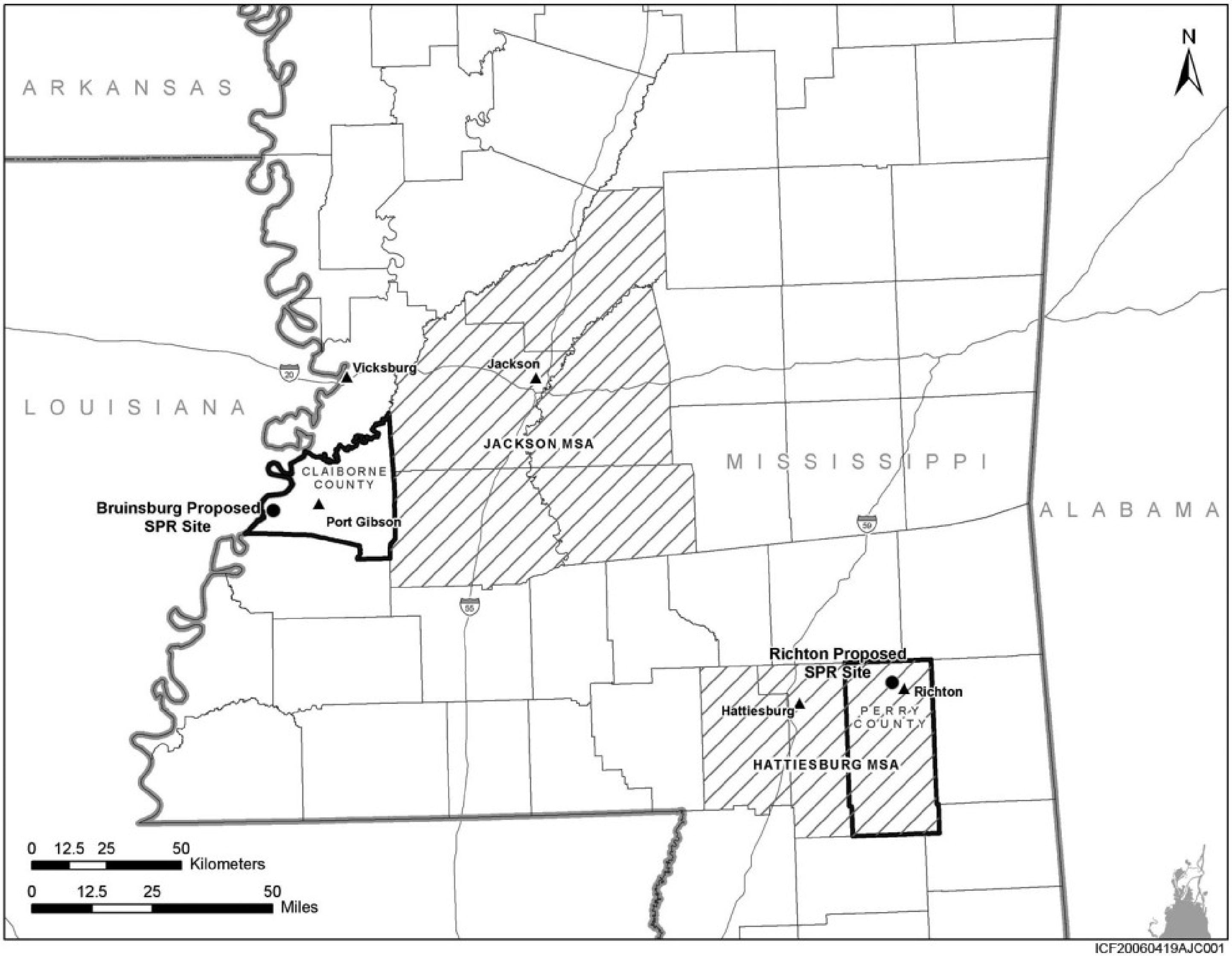
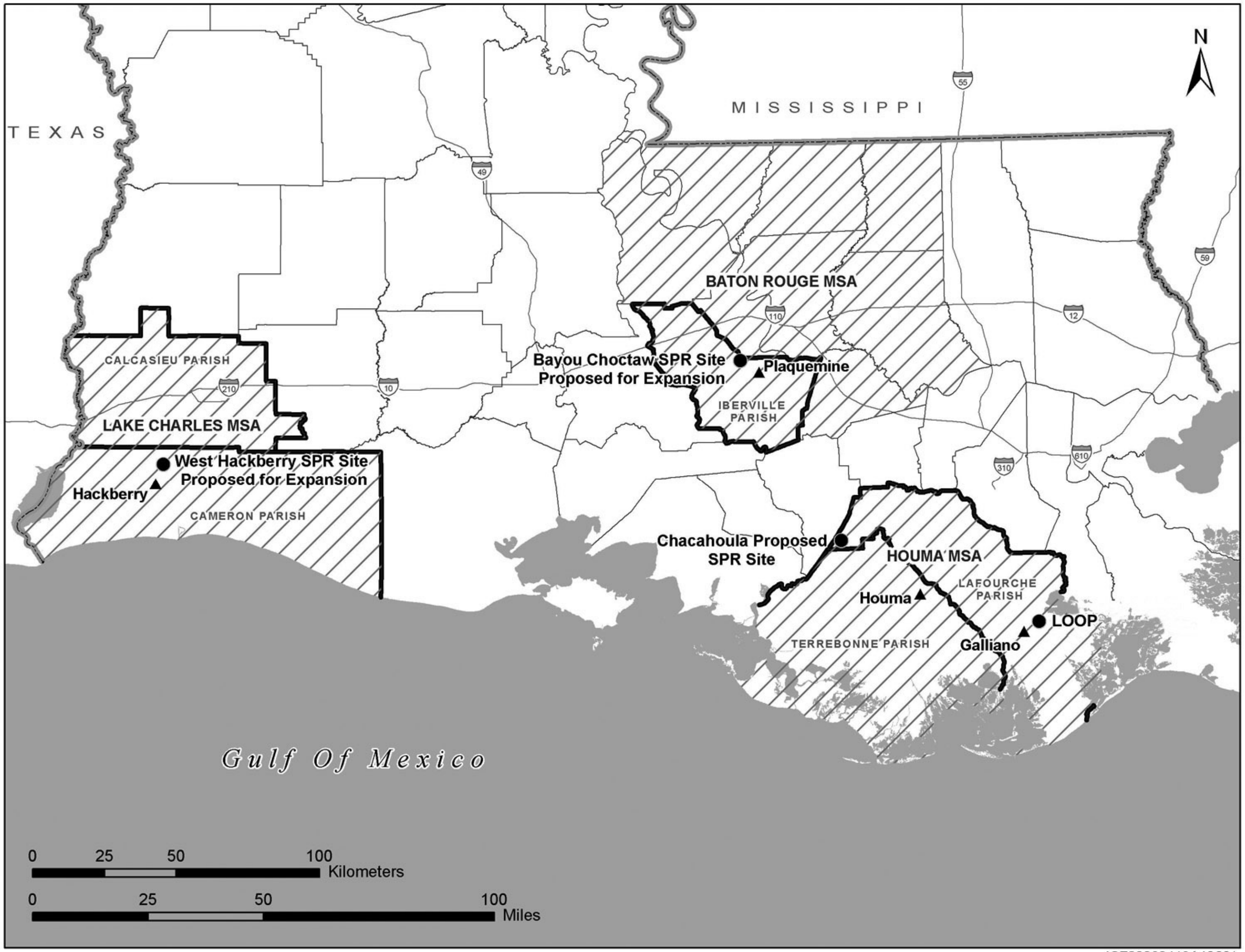


Figure 3.8.2-2: MSAs for Louisiana Sites



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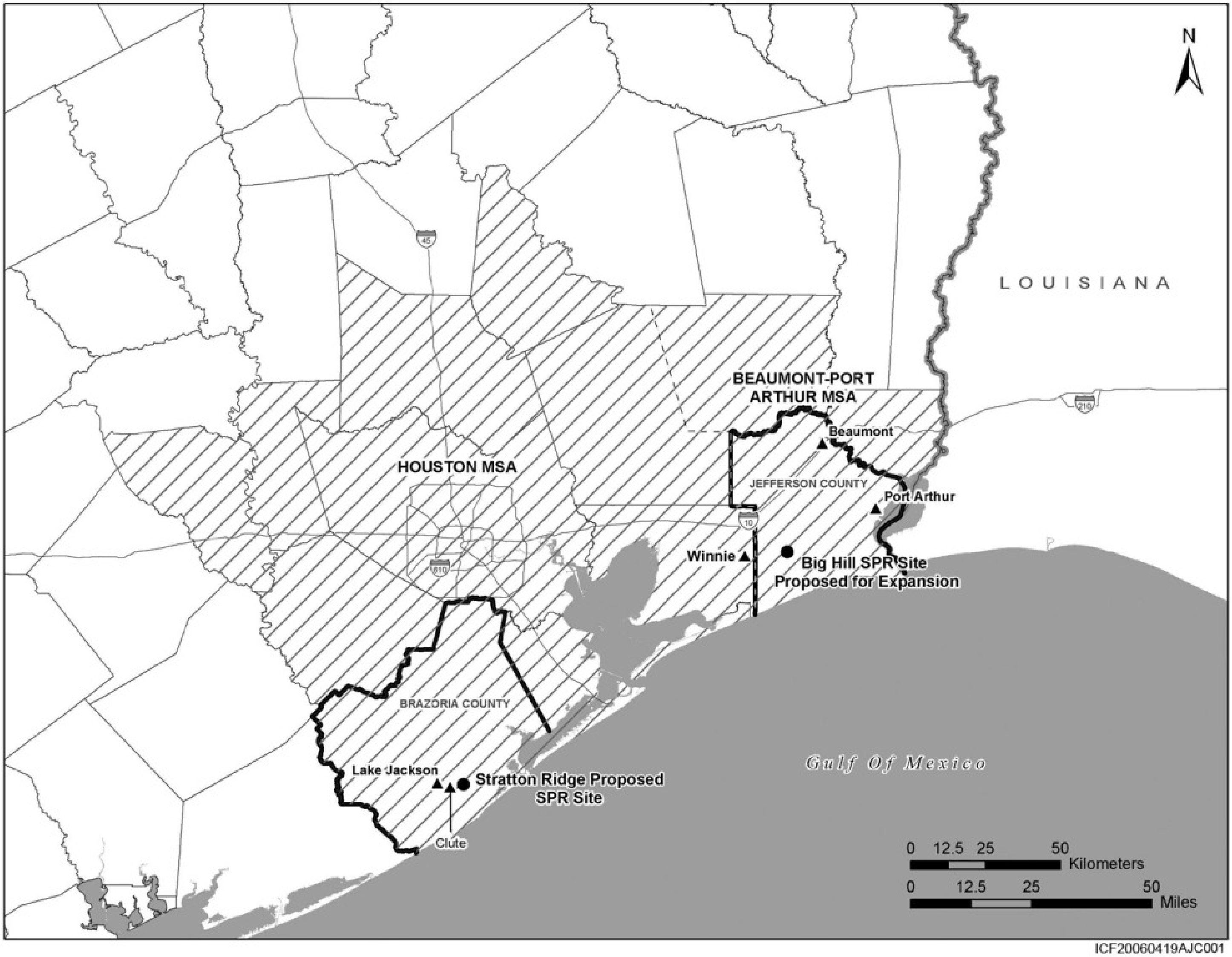
economic ties to the Gulf of Mexico and the oil and gas industry. They have a combined 100,000-person civilian labor force with an average annual unemployment rate of 3.9 percent in 2003 (Louisiana Department of Labor 2006). The Chacahoula area was in the path of Hurricane Katrina, and there was substantial damage to housing and other buildings and infrastructure in Lafourche Parish. Unemployment in the Houma MSA more than doubled from August to September 2005, but by December 2005 it had returned to pre-hurricane conditions. Hurricane recovery efforts are still underway in Lafourche Parish and its surrounding areas.

The Richton site would be located in Perry County, MS, about 3 miles (4.8 kilometers) from the city of Richton, MS and about 18 miles (29 kilometers) from the City of Hattiesburg, MS (see figure 3.8.2-1). Perry County is in the Hattiesburg MSA. The local economy is driven by wholesale and retail trade, services, manufacturing, and government (including public education). Hattiesburg is the location of the University of Southern Mississippi, with about 12,000 students. The Hattiesburg MSA has a labor force of about 63,000 people and a 5.8 percent unemployment rate as of July 2005 (Mississippi Department of Employment Security 2006). The Richton site and Hattiesburg MSA were in the path of Hurricane Katrina after it made landfall. There was some flooding and wind damage in the area. While the area was disrupted (e.g., there was an approximate 2 percent jump in unemployment from August to September 2005), the effects of the hurricane were largely short-term.

The proposed Stratton Ridge site would be located in Brazoria County, TX, which is part of the Houston MSA (see figure 3.8.2-3). Nearby cities include Lake Jackson, TX (3 miles or 4.8 kilometers), and Clute, TX (3 miles or 4.8 kilometers). The new pipeline corridor would be within the socioeconomic region of influence. Major employment and economic activities in Brazoria County center in the petrochemical, manufacturing, trade, services, construction, and agriculture sectors. The Dow Chemical Company uses salt from Stratton Ridge in its Freeport plant. This salt is the critical raw material for Dow's Chlor-Alkali production, which in turn is critical for other downstream user plants. From Stratton Ridge salt, Dow states that it makes thousands of different products worth over $5 billion annually. Dow also uses the Stratton Ridge area to store raw materials and products. Dow estimates that approximately half of the $120 million a year it pays in State and local taxes for its Texas Operations depends on these assets and operations. Oil- and gas-related activity is established in the area, including the Bryan Mound SPR storage facility near Freeport, TX. The area has access to the Gulf of Mexico and the ICW, providing extensive commerce opportunities. Brazoria County has more than 130,000 people in its labor force and a 7 percent unemployment rate as of 2004 (Texas Workforce Commission 2006). The Stratton Ridge area was not substantially affected by Hurricanes Katrina and Rita.

The Bayou Choctaw site is located in Iberville Parish, LA, about 8 miles (13 kilometers) from the town of Plaquemine, LA and about 12 miles (19 kilometers) from the Baton Rouge, LA metropolitan area (see figure 3.8.2-2). Iberville Parish and the Baton Rouge MSA have strong economic and cultural ties to the Mississippi River and the opportunities it presents. The local economy is led by the trade, services, and government sectors, with emphasis on oil- and gas-related activities, such as pipelines and refining. Iberville Parish has more than 12,000 people in its labor force and a 10.4 percent unemployment rate in 2004. The Baton Rouge MSA has more diverse, broader economic activity with its labor force of more than 309,000 people and an unemployment rate of 6.2 percent as of 2004 (Louisiana Department of Labor 2006). While the Baton Rouge area and the Bayou Choctaw expansion SPR site were in the path of Hurricane Katrina after it hit land, the major socioeconomic effect to this region of influence was that the area served as a major center for evacuee relocation from other hurricane-affected areas. Economic and social characteristics were substantially altered following Hurricane Katrina. Unemployment in the Baton Rouge MSA approximately doubled from August to September 2005, but by December 2005, it had returned to pre-hurricane levels. Hurricane recovery efforts are still underway, and the portion of hurricane evacuees who chose to stay in the Baton Route area or other hurricane relocation sites is unknown.

Figure 3.8.2-3: MSAs for Texas Sites



The Big Hill site is located in Jefferson County, TX, about 17 miles (27 kilometers) from Port Arthur, TX in the Beaumont-Port Arthur MSA (see figure 3.8.2-3). The town of Winnie, TX is about 10 miles (16 kilometers) away in Chambers County, TX and Houston is 70 miles (113 kilometers) away. Jefferson County has both rural and urban characteristics, including two relatively large urban areas (Beaumont and Port Arthur) with deepwater port infrastructure and extensive rural land used for agriculture. The County's major economic drivers include water-related transportation and trade along the ICW and from the Gulf of Mexico, shipbuilding, the petrochemical industry, and government. The Beaumont-Port Arthur MSA has about 180,000 people in its labor force and an 8.4 percent unemployment rate as of 2004 (Texas Workforce Commission 2006). The Big Hill area, including the Beaumont-Port Arthur MSA, was substantially affected by Hurricane Rita physically and socioeconomically. The unemployment rate in Jefferson County increased by 50 percent from September to October 2005, but it had returned to pre-hurricane conditions by December 2005. Hurricane recovery efforts are still underway.

The West Hackberry expansion site is located in Cameron Parish, LA, about 4 miles (6.4 kilometers) from the town of Hackberry, LA, and about 20 miles (32 kilometers) from the Lake Charles, LA, area in Calcasieu Parish, LA (see figure 3.8.2-2). For this analysis, the region of influence is the Lake Charles MSA, which consists of Calcasieu and Cameron Parishes. The major sectors in the Cameron Parish economy include agriculture, oil and gas transmission, retail trade, and government. Recreation and tourism are also important because of the beaches and water bodies in the area. Lake Charles is connected to the Gulf of Mexico by means of a deep-water ship channel, which provides a substantial source of economic activity. The ICW also runs through the Parish. Cameron Parish has about 3,100 people in its labor force and a 6.4 percent unemployment rate as of 2003 (Louisiana Department of Labor). The labor force in Cameron Parish has shown substantial declines in recent years. The Lake Charles MSA and areas in Cameron Parish were substantially affected physically and socioeconomically by Hurricane Rita. Unemployment in the Lake Charles MSA essentially doubled from September to October 2005, but by December 2005 it had returned to pre-hurricane levels. Hurricane recovery efforts are still underway.

3.8.3 Impacts

The major project characteristics affecting socioeconomic conditions would be project-related employment, wages, and expenditures. These characteristics would subsequently affect other socioeconomic variables such as population, housing, public services, taxes, and traffic congestion. As discussed below, the number of employees who would in-migrate into each region of influence is projected to be relatively small; therefore, overall adverse socioeconomic impacts are projected to be small. The effects exerted by previous SPR development at specific sites, which are relatively small-scale, long-term projects, have generally had small socioeconomic impacts in comparison to the larger trends of oil and gas activity within the region (DOE 2004g).

While Hurricanes Katrina and Rita have affected and will continue to affect the socioeconomic environment in coastal areas for some time, the regional supply of labor in the larger urban areas near the potential SPR sites would still produce a substantial level of available labor for the projects by the time construction could begin at any of the proposed new or expansion SPR sites. In addition, the positive direct economic effects such as employment and wages associated with SPR sites, as well as secondary effects such as local spending, would be beneficial for the individuals within the SPR workforce, affected communities, and local governments that are attempting to recover from the devastating damage inflicted by the two hurricanes.

3.8.3.1 Construction Impacts

Table 3.8.3-1 summarizes the peak project-related employment needs associated with each new or expansion SPR site. Peak employment would occur during the construction phase, and activities during the peak construction years would include site construction and pipeline construction. In addition to these activities, construction of off-site facilities associated with the new sites would occur prior to and after the peak construction years. Off-site facility construction activity would include RWI systems (an estimated average of 50 construction employees for each alternative) prior to peak construction, and terminal construction (an estimated average of 50 construction employees for each terminal facility associated with the Bruinsburg, Richton, and Stratton Ridge alternatives) after peak construction years have been reached.

Table 3.8.3-1: Peak Construction Employment by Site

Site	Project Component	Peak Construction Employment
Bruinsburg	Site construction	368
	Pipeline construction	86
	Peak construction employment	474
Chacahoula	Site construction	363
	Pipeline construction	82
	Peak construction employment	445
Richton	Site construction	363
	Pipeline construction	136
	Peak construction employment	499
Stratton Ridge	Site construction	363
	Pipeline construction	68
	Peak construction employment	431
Bayou Choctaw	Site construction	100
	Pipeline construction	0
	Peak construction employment	100
Big Hill	Site construction	100
	Pipeline construction	50
	Peak construction employment	150
West Hackberry	Site construction	100
	Pipeline construction	0
	Peak construction employment	100

New construction wages and project spending introduced into the affected counties and MSA economies would serve as a positive economic stimulus. Average wages associated with the SPR project likely would be higher than existing average wages in the area.

Employment opportunities associated with the construction of SPR facilities at any of the sites would be highly desirable and result in beneficial effects for the residents in the vicinity of the proposed new and expansion sites. For SPR employment, construction workers generally would be willing to commute distances requiring travel time longer than the mean travel time of 20 to 27 minutes (U.S. Census Bureau 2006) typical of the jurisdictions associated with the SPR sites. Some highly skilled positions may lead to employee in-migration; however, the region of influence could provide a substantial portion of the construction workers, and these workers would commute to the SPR site from their existing residences.

Table 3.8.3-2 shows the projected peak population increase resulting from construction activities would be no more than about 400 people for any one site (including work related to pipelines and other infrastructure). This would constitute an increase of a maximum of about 0.3 percent more than existing regional populations including the nearby MSAs. Therefore, for all potential sites, the level of population change resulting from any construction workforce in-migration is expected to be small in the regional context. This small increase in population would not create noticeable charges in traffic congestion, except possibly on rural roads close to sites when work shifts start and end. Depending on a number of factors, individuals within the construction workforce may choose to leave the region of influence after SPR construction ends, thereby potentially reducing the population and the associated demand for housing and public services.

Table 3.8.3-2: Peak In-Migration Population[a] by Site (Number of People)

Site	Peak Construction Employment	Peak Construction In-Migration
Bruinsburg	474	379
Chacahoula	445	356
Richton	499	399
Stratton Ridge	431	345
Bayou Choctaw	100	80
Big Hill	150	120
West Hackberry	100	80

Notes:

[a] In-migration population estimates assume 40 percent employee in-migration plus one additional family member per in-migrating employee. In-migration population would occur in unknown locations throughout study area including rural areas and MSAs, based on factors such as willingness to commute, housing cost and availability, and family lifestyle preferences.

Some regions of influence, especially in Louisiana, are still in an intensive hurricane recovery process. The construction of new or replacement housing, other buildings, and community infrastructure is underway and will continue for several years. The market for skilled construction workers may be competitive in those areas due to hurricane-related recovery efforts. There may be localized labor market abnormalities for some time as construction projects evolve. The locations and magnitude of such abnormalities cannot be predicted at this time. While SPR facility and pipeline construction would add to the construction labor demand in these areas, labor markets will adjust to this demand over a period of time.[3] Furthermore, the effect of SPR construction activities would be very small relative to the overall hurricane recovery effort.

Overall, construction and development of any proposed new SPR site or expansion site and the associated pipelines and other facilities would provide positive economic benefits to an affected region with little change in population. With little population change and support from existing population centers in the area, construction of SPR facilities would have small direct effects on the demand for housing and public

[3] A basic premise of economic analysis is that the supply of and demand for labor will tend to adjust toward equilibrium. Workers will tend to re-locate to areas where jobs are available, with construction workers especially showing a willingness to be mobile in their employment pursuits. The timeframe for labor market adjustment is variable depending on many case-specific conditions.

infrastructure and services. Overall, the magnitude of adverse socioeconomic impacts from construction activities would be small, and each area that was selected as an SPR site would gain the positive economic benefits of additional employment, income, and local and regional spending.

As appropriate, DOE and its contractors would establish and adhere to local hiring policies and would solicit employees accordingly. A local hiring policy encourages and supports the hiring of the local (existing residents) workforce to reduce the need for employee in-migration and maximizes opportunities for existing residents of the region of influence. Where necessary, DOE and its contractors would support employee in-migration to areas that have adequate public services and housing. These practices would further reduce any negative socioeconomic effects of developing new SPR sites or expanding existing sites.

3.8.3.2 Operations and Maintenance Impacts

Socioeconomic impacts from operations and maintenance would mirror impacts from construction at each site, with the effects smaller in magnitude but longer in duration. Employment opportunities associated with the operations and maintenance of SPR facilities at any of the sites would be highly desirable and provide a substantial economic opportunity for the residents in the regions of influence. Economic benefits from SPR employment, income, and spending would accrue to the workforce, businesses, communities, and local governments.

The SPR program would provide its operations and maintenance workforce with relatively high-paying jobs in all of the regions of influence. With an operating workforce of 75 to 100 employees at each new site and an incremental increase of 25 employees at an expanded site, the operations workforce and associated in-migration into the SPR regions of influence would have negligible subsequent effects on housing demand, public infrastructure and services, and traffic congestion. The ability of affected jurisdictions to provide infrastructure and services would not be affected dramatically by the SPR program, although the economic stimulus from employment and wages would lead to increased tax revenues. Overall, the adverse socioeconomic impacts from operations and maintenance at any proposed SPR site would be small, and any area selected as an SPR site would gain the positive economic benefits of long-term employment, income, and local and regional spending.

SPR operations at Stratton Ridge would reduce the positive economic effects from Dow's operations in the area. If the salt at the Stratton Ridge dome were to be precluded from future use by Dow operations because of the proposed SPR storage facility, the salt resource would be irretrievably lost (see also section 5.3 in Chapter 5 Irreplaceable and Irretrievable Resources), employment and income could be reduced in the region of influence, and tax revenues accruing to local and State government from Dow's operations could be reduced.

3.8.4 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would remain unchanged. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the Chacahoula storage site and the proposed site could be developed by a commercial entity for oil and gas purposes. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity. For the sites of terminals that are in developed petroleum storage areas it is possible that a commercial entity could develop them for storage.

As a result of the no-action alternative the positive short term and more modest long term economic benefits with an estimated increase of about 75 to 100 workers would not occur.

3.9 CULTURAL RESOURCES

This section evaluates potential impacts to historic properties and other cultural resources. It starts with an overview of the analytical methodology used in this EIS (section 3.9.1) and then summarizes the common kinds of impacts and mitigation measures that could be associated with construction and operations and maintenance at any of the candidate sites (section 3.9.2). The site-specific affected environment, potential impacts, and mitigation measures are described for each candidate site separately in sections 3.9.3 through 3.9.9. Finally, the impacts of the no-action alternative are reviewed in section 3.9.10. The chapter is supported by appendix K, which includes all of the consultation letters referenced later.

3.9.1 Methodology

DOE's approach for this EIS included an initial identification of known historic properties within proposed facility footprints based on record searches and consultations. DOE also has committed to conduct additional research and other actions needed to assess and resolve adverse effects after the SPR expansion or new development sites are selected.

3.9.1.1 Identification of Historic Properties and Other Cultural Resources

> As defined in 36 CFR Section 800.16 of the National Historic Preservation Act, "**historic property** means any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meets the National Register criteria."

DOE informed the State Historic Preservation Officer (SHPO) in each state with proposed SPR sites of DOE's intent to use this NEPA EIS to document the activities required under section 106 of the National Historic Preservation Act and its implementing regulations at 36 CFR Part 800. DOE also proposed to the SHPOs that DOE would confine its initial identification effort to known historic properties in proposed facility footprints by using record searches and consultations with American Indian tribes and other interested parties. Under this proposal, DOE and the SHPO of each state would enter into a programmatic agreement to cover additional actions that would be required if a site or sites in the state were selected for development as part of the SPR expansion. The SHPOs agreed with this conceptual approach, and they expressed willingness to work with DOE to develop acceptable programmatic agreements (Holmes 2005, Oaks 2005, Watson 2005).

Under the terms of programmatic agreements with the SHPO in each state, DOE would commit to identify and resolve adverse effects to historic properties in locations selected for expansion or new development. At those locations, DOE would conduct field reconnaissance and additional documentary research and consultations as appropriate to identify cultural resources including historic properties; that is, archaeological or historical sites, structures, districts, or landscapes that are eligible for listing in the National Register of Historic Places. For identified historic properties, DOE would assess project effects and resolve adverse effects in consultation with the SHPOs.

Consistent with this approach, DOE conducted record searches and consulted with interested parties to identify known archaeological sites, historic buildings and structures, state and national historic landmarks, and sites listed on the National Register of Historic Places. DOE conducted a record search at the Mississippi Department of Archives and History for the proposed new facility location at Richton and did a cursory review of mapped sites and districts along associated pipelines and ancillary facilities. For the Bruinsburg facility location, in lieu of a record search, DOE obtained information from National Park

Service personnel and the Civil War Sites Historian at the Mississippi Department of Archives and History (the office of the State Historic Preservation Officer). DOE also conducted a record search in the Texas Archeological Sites Atlas for the Stratton Ridge facility and associated pipelines and facilities. DOE did not conduct a record search for the proposed new facility location in Louisiana (Chacahoula) or proposed expansion facility locations (Bayou Choctaw and West Hackberry). The record searches were not necessary because the Louisiana SHPO, responding to a letter from DOE initiating consultation, stated that no known archaeological sites or historic properties would be affected by the undertaking, based on the information provided by DOE (LeBreaux 2005).

3.9.1.2 Contacts with American Indian Tribes

DOE requested that the SHPOs provide lists of American Indian tribes to consult, as well as other parties who might have concerns or information on historic properties in the proposed project areas. In response to the DOE request, Texas did not identify any tribes; Mississippi and Louisiana SHPOs both identified tribes likely to have information or concerns. DOE included these tribes in its consultation effort, in addition to other parties DOE had previously identified in Louisiana, Mississippi, and Texas as potentially concerned. DOE sent letters to initiate consultation with the following federally recognized tribes that might have information or cultural concerns about places in the area of proposed expansion activities:

- Alabama Coushatta Tribes of Texas,
- Chickasaw Nation of Oklahoma,
- Chitimacha Tribe of Louisiana,
- Choctaw Nation of Oklahoma,
- Coushatta Indian Tribe,
- Jena Band of Choctaw Indians,
- Mississippi Band of Choctaw Indians,
- Quapaw Tribe, and
- Tunica-Biloxi Tribe.

The Tribal Historic Preservation Officer for the Choctaw Nation of Oklahoma requested that the tribe be informed after sites are selected for development and expansion. If the tribe determines that any of the selected alternatives are within areas of concern to the tribe, the tribe will request and review all archaeological survey reports and participate in the assessment of project impacts and the identification of measures to resolve adverse effects (Cole 2005). The Director of the Cultural Department of the Chitimacha Tribe said that records and oral tradition do not indicate specific sites of concern in the project vicinity, although the area is part of the aboriginal Chitimacha homeland. She requested immediate contact with the tribe if archaeological remains representing a village site or burial site are encountered during construction (Walden 2005).

DOE also sent letters to the following tribes recognized by the State of Louisiana to request information about sites of cultural concern:

- Biloxi-Chitimacha Confederation of Muskogees,
- Point au Chien Tribe, and
- United Houma Nation.

3.9.1.3 Assessing Project Effects

As indicated earlier, DOE will not complete the identification of cultural resources, including properties eligible for the National Register of Historic Places ("historic properties") until after specific sites are selected for development or expansion. Only then would DOE proceed with field survey and additional information gathering for all facility locations and pipeline routes associated with each site, according to the terms of the relevant programmatic agreements. Consequently, DOE will not complete the assessment of potential effects and the identification of ways to resolve adverse effects until after site selection.

To assess effects on historic properties, DOE would follow the regulations at 36 CFR Part 800. As these regulations require, DOE would work in consultation with the appropriate SHPO and any Indian tribe that attaches cultural significance to identified properties. Together they would determine if the project "may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association" (36 CFR Section 800.5). If an adverse effect were found, DOE would continue consultation to develop modifications to the project or take other measures that could avoid, minimize, or mitigate the adverse effect. For resources that have cultural significance but that are not eligible for the National Register, DOE would use an analogous approach; that is, consultation with those parties that attach cultural significance to the resource to determine if the project may alter the characteristics of the property that contribute to its cultural significance. If so, DOE would identify measures to avoid or minimize the impact.

3.9.2 Common Impacts

This section discusses the possible impacts that could be associated with new construction or operations and maintenance activities. Where available, more detailed information about the nature and scope of project effects on cultural resources is provided in the subsequent sections on each site.

3.9.2.1 Construction Impacts

Following is a list of direct effects on historic properties and other cultural resources that might result from construction at proposed sites or pipelines:

- Damage or destruction of archaeological sites, Native American cultural sites, or historic buildings or structures within the construction zone; and

- A change in the characteristics of a property in or near the construction zone that would diminish qualities that contribute to its historic significance or its cultural importance. This might include visual contrast caused by an access road, noise from construction equipment, rerouting or resurfacing historic roadways, or other construction effects on the location, design, setting, materials, workmanship, feeling, or association of historic properties.

Potential indirect impacts could include vandalism of archaeological sites or historic structures in or near the construction zone because the sites would be more accessible.

3.9.2.2 Operations and Maintenance Impacts

For historic properties and other cultural resources that may be present at a facility site or along a pipeline, direct impacts could include continuing or additional (post construction) damage to archaeological sites or Native American cultural sites. This damage could occur in the facility or along the pipeline or utility corridors by ground-disturbing activities such as road maintenance, vegetation management, or pipeline repair or replacement. Generally such impacts would be less severe than construction affects because they would fall within areas previously disturbed and because the ROWs during operations would be smaller than construction ROWs. The presence of new facilities such as buildings, well pads, or access roads could change the setting or feeling of a location such as an historic plantation, a Civil War campaign site, an historic district in a town or city, or a Native American cultural site in a way that would interfere with its use or diminish qualities that contribute to its cultural or historic significance. Traffic along new access roads likewise could have visual or noise effects on qualities that contribute to the cultural or historic significance of sites in the vicinity. Bridges, houses, or other structures that are significant solely for architectural reasons are unlikely to be affected by operations and maintenance. Potential indirect operations and maintenance impacts could include vandalism of archaeological sites or historic structures near some facilities because the sites would be more accessible.

3.9.2.3 Mitigation

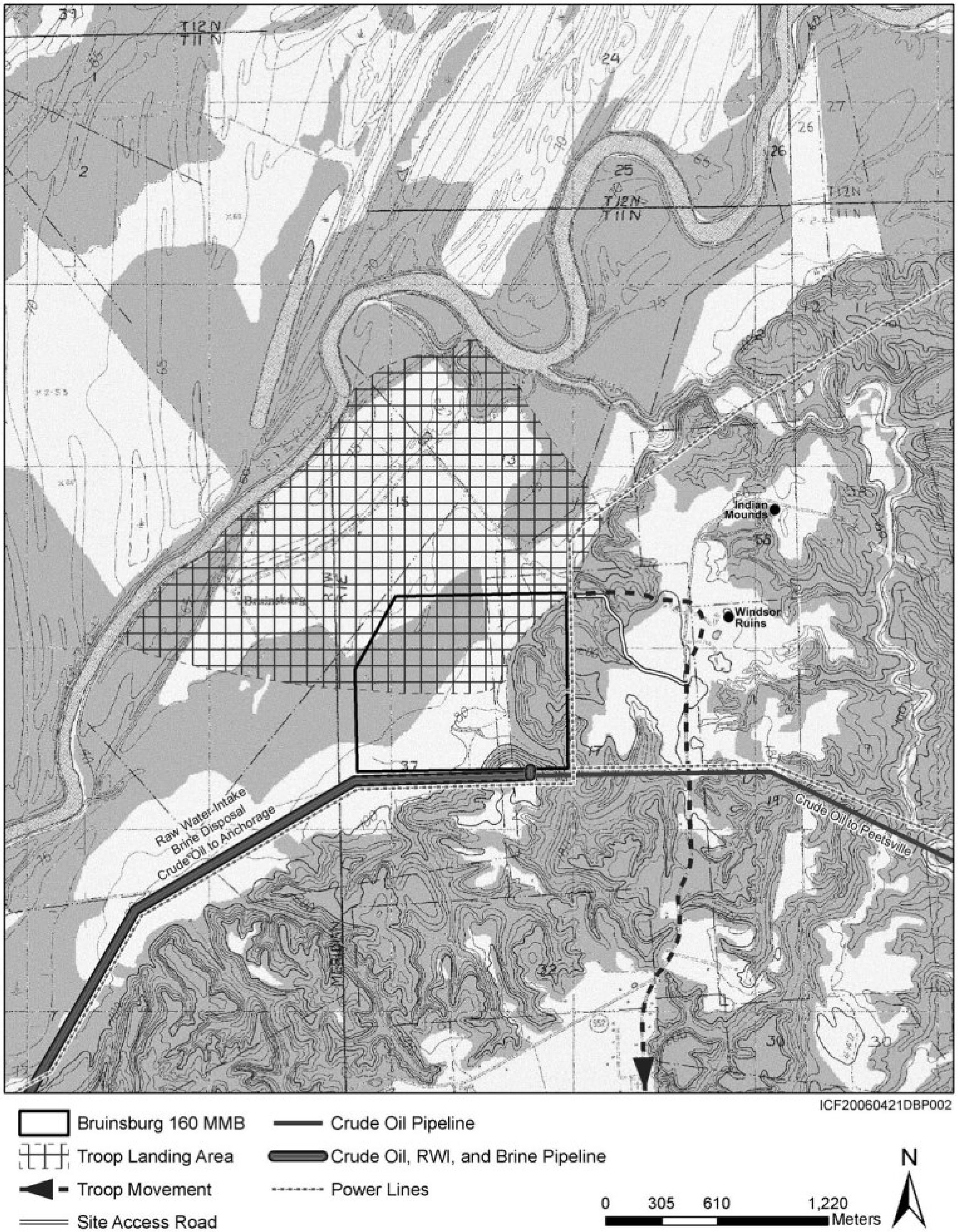
As indicated earlier, DOE will consult with the SHPO and other interested parties to identify measures to resolve adverse effects identified for specific historic properties or other cultural resources, after the SPR expansion sites are selected. Resolution of adverse effects may include measures such as rerouting a pipeline segment or shifting a surface facility footprint to avoid a historic property, thus no longer affecting it. Where avoidance is not possible, measures to mitigate disturbance or destruction of historic properties may include data recovery from an archaeological site or detailed documentation of a building or structure sufficient for the Historic American Buildings Survey or Historic Architectural and Engineering Records. These efforts might be followed with preparation of educational materials written to inform the public about the information gained from archaeological excavations or drawings and photographs of historic structures or other resources. Measures to address visual impacts or other alterations to the setting and feeling of an historic property might include use of vegetation or other methods to screen project facilities from visitors to the historic property. If screening is not possible, the preconstruction setting might be documented with photographs or video, with the resulting materials used to provide public access through interpretive displays or deposition in historical archives.

3.9.3 Bruinsburg Storage Site

3.9.3.1 Affected Environment

The floodplain where the Bruinsburg facility would be developed is the site where the Union Army, under General Grant, disembarked after crossing the Mississippi River on April 30, 1863, to begin the invasion of Mississippi that culminated in the surrender of Vicksburg on July 4, 1863 (Winschel 2005). In 1863, the Mississippi River's course followed what is now Bayou Pierre. The Union Army's landing place was at or very close to the historic town of Bruinsburg, which was a riverfront town at that time. The crosshatched area shown on figure 3.9.3-1 approximates the area that was traversed by troops after landing as they prepared for the subsequent march. The cross-hatched area is likely to contain archaeological remains of troop presence. Remains of at least one of the ships that sank during the invasion are likely to lie northwest of the facility boundary. The historic Bruinsburg Road (shown on figure 3.9.3-1 as a double interrupted line) is reportedly still visible on the floodplain and along the route of the climb up the escarpment. After scaling the escarpment, Grant's troops turned south on what is now State Route 552, passed Windsor (now in ruins), and continued south for about 2.5 miles (4 kilometers) before turning east toward Port Gibson, where a major battle was fought (Winschel 1999). The Civil War Sites Historian of the Mississippi Department of Archives and History, who works on the staff of Mississippi's SHPO, considers the site to be "much more than a campsite or march route." He expects that the Bruinsburg landing location and associated march route would be determined to be National Register eligible as a core/study area, that is, a site closely associated with a major engagement. He also noted that the landing site and the approach route along the bluff are closely associated with the inland campaign portion of the Vicksburg Campaign and the Battle of Port Gibson, which is a designated as a National Historic Landmark (Woodrick 2005).

Figure 3.9.3-1: Cultural Resources in Vicinity of Bruinsburg Facility



On the escarpment where buildings would be constructed and traversed by the power line and crude oil pipeline to Peetsville are prehistoric earthworks (labeled “Indian Mound” on figure 3.9.3-1). These may be significant to the Choctaw; the Windsor Ruins, a fire-damaged plantation house that is a well-known historical symbol of Mississippi; and a segment of the march route of Grant’s troops, as described earlier.

3.9.3.2 Impacts

On the floodplain, clearing for the security zone, fence installation, placement of fill for the storage caverns in the northern part of the facility, and construction of initial segments of the power line extending north from the facility might affect remains associated with the troop landing or prehistoric sites. Prehistoric sites might be also be affected by construction of the power lines and pipelines (RWI, brine disposal, and crude oil) extending along the floodplain from the southwest. On the escarpment, clearing for the security zone, fence installation, and other construction within the northeastern portion of the facility site, along the access road, and at the power line and crude oil pipeline crossing of State Route 552 could affect remains associated with the historic line of march of the Vicksburg campaign or prehistoric sites. Prehistoric sites might also be affected by construction elsewhere within the facility site on the escarpment, as well as along the power lines and crude oil pipeline corridor. With regard to indirect effects, construction activities on the floodplain would affect the setting and feeling of the troop-landing site. Construction traffic on State Route 552 and upgrading the access road extending from it to the facility might draw the attention of the visitors to the Windsor Ruins, but the ruins are reasonably screened from the road. Construction activities likely would not affect the mapped Indian mound shown on figure 3.9.3-1 because of distance from it. Other construction impacts of the kind described in section 3.9.2.1 would be expected in connection with cultural resources elsewhere along the pipeline routes and power line routes and around the tank farms at Anchorage and Peetsville.

Following construction, the presence of operations and maintenance of the security zone, fence, berms, and access roads on the floodplain would affect the setting and feeling of the portion of the troop-landing site near the escarpment as seen from some viewpoints. Depending upon the viewer’s location, these facilities might or might not be visible. State Route 552 and the graveled road from it descending to the floodplain have been upgraded since the 1860s; therefore, upgrade of the graveled road to provide access to the facility and the crossings of State Route 552 by the pipeline access road and power line would only add to the lack of integrity of the setting of the march route along the escarpment. Because of the distance separating them from project facilities, the setting and feeling of the Indian mound and Windsor Ruins would likely not be affected by the facility buildings, fence, security buffer zone, power line, pipelines, or access road across the escarpment.

3.9.3.3 Mitigation

Several measures could mitigate the effects of altering the setting at the troop-landing site, which is already changed from the original site because the river channel moved west and the town of Bruinsburg was abandoned. The mitigation measures might include improved access for history students to the area by the access road to the new facility, possibly including construction of a viewpoint on the descent of the escarpment. In addition, DOE might offer some financial support to the National Park Service interpretive program. Currently, access is possible only by special permission from the private landowner; interpretive signs are posted only along public roads, not at the actual site. Mitigation of damage or destruction of archaeological remains associated with the landing and troop movements would be avoidance if possible, or data recovery if not. Based on the initial consultation and review of the Bruinsburg area, staff from the Mississippi SHPO recommended avoiding the area altogether (Woodrick 2005). The current conceptual design with most buildings and other surface structures on the escarpment, however, would minimize the effect on the landing area proper.

Other potential effects of construction on cultural resources that might be identified during an investigation following selection of the Bruinsburg site might be mitigated using other measures described in section 3.9.2.3.

3.9.4 Chacahoula Storage Site

3.9.4.1 Affected Environment

As noted in section 3.9.1, the Louisiana SHPO indicated that no known archaeological sites or historic properties would be affected by SPR development at any of the proposed Louisiana locations for new storage facilities or expansion (LeBreaux 2005). For proposed pipeline corridors associated with the Chacahoula facility, SHPO staff indicated that any of the areas near major streams and tributaries are high sensitivity areas for both Native American archaeological sites and historic sites such as plantations. Lands near the Gulf of Mexico and the shallow water that would be traversed by the proposed brine pipeline are high-sensitivity areas for Native American archaeological sites because the land has subsided and sites that were near the shoreline are now under water (Watson 2005). It is unlikely that any historic buildings or structures are present in the construction zone at the Chacahoula facility site because so much of the site is submerged and historically has been submerged, although submerged Native American archaeological sites might be present.

3.9.4.2 Impacts

Based on the response from the Louisiana SHPO, no construction or operations and maintenance impacts have been identified at the potential Chacahoula SPR storage facility location or along pipeline routes. Because the proposed pipeline routes cross many areas that are archaeologically and historically sensitive, impacts like those described in section 3.9.2 would likely be identified following survey if the alternative is selected; except that vandalism of any submerged sites would be unlikely because the presence of new facilities or the brine pipeline would not improve access to submerged sites.

3.9.4.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate effects identified in an investigation following the selection of Chacahoula for development, if it is selected.

3.9.5 Richton Storage Site

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3.9.5.1 Affected Environment

DOE searched archaeological and historic site records at the Historic Preservation Division of the Mississippi Department of Archives and History in October 2005 for a 2-mile (3.2-kilometer) radius around the center of the proposed Richton facility footprint. The search found no sites listed on the National Register of Historic Places nor any national or state historic landmarks in or near the facility footprint. No archaeological surveys were shown within the footprint, and only one survey—a linear survey for utility lines along a road to the east of the site—falls in the 2-mile (3.2-kilometer) radius. Nevertheless, a number of sites had been recorded in the vicinity based on reports by a local landowner. None has been formally evaluated for National Register eligibility.

> A **lithic scatter** is a distribution of cultural items that consists primarily of lithic (i.e., stone) material. The scatter may include formed tools such as points or knives, or it may contain only chipping debris from tool making activities.

There is one recorded archaeological site in the proposed facility footprint. The site record, based on a report from a property owner (who had not visited the site) does not give exact boundaries. The site is a **lithic scatter** with some ceramics in an area that previously was disturbed by logging and replanting activities.

> **Midden soil** is soil that has been changed by long-term human occupation, and it typically contains bits of charcoal and other organic materials derived from human use. Midden soil is often darker in color and has a looser texture than surrounding soils. Archaeologists consider midden soil as evidence that a site was used for long-term residence or revisited regularly over many years, rather than reflecting short-term activities.

Within a 2-mile (3.2-kilometer) radius from the center of the proposed facility footprint, an additional 15 archaeological sites have been recorded, most discovered by the landowner inspecting the area after logging and replanting activities. Most of those recorded sites are northeast of the proposed facility footprint above Beaver Dam Creek or its tributaries. Most of these sites are reported as lithic scatters with a few ceramic potsherds. In a few cases, possible **midden soil** was noted, in one case up to 2-feet (0.61 meters) deep, at a site that was excavated by a field school from University of Southern Mississippi, according to the site record. In several cases the recorder suggests that a site may be a part of an adjacent site.

No historic structures are recorded within the facility footprint or the 2-mile (3.2-kilometer) radius.

The results of the record search for the proposed Richton facility location indicate some archaeological sensitivity of the area as well as substantial ground disturbance from forestry activities. These results suggest that a field survey in the footprint would identify a number of archaeological sites, of which some might be so badly damaged that they would be ineligible for the National Register.

DOE conducted a cursory review of site records for the proposed Richton alternative pipeline routes and marine terminal. Two historic houses listed on the National Register of Historic Places are near the pipeline from the Richton facility to Liberty. These are Tall Pines on Memorial Drive in Hattiesburg and the Lea, Wilford Zachariah House on Mississippi Highway 569 North, 2 miles (3.2 kilometers) north of Liberty. There are many National Register-eligible historic districts in larger communities, such as in Hattiesburg, which is near the proposed storage site; in Pascagoula, the location of the proposed terminal; and along the pipeline routes. In these areas, there also are many individually recorded archaeological sites and historic buildings, bridges, and other structures that have not been evaluated for National Register eligibility. These results indicate that the pipeline routes traverse or pass near historically and archaeologically sensitive areas.

3.9.5.2 Impacts

Based on the record search, no specific construction or operations and maintenance impacts can be identified for the proposed Richton site, pipelines, terminal tank farm, and pump station. Nevertheless, the results of the record search suggest that impacts such as those described in section 3.9.2 likely would be identified following a field survey if one of the Richton alternatives is selected. Impacts to prehistoric archaeological sites would be expected at the facility location, while impacts to historic structures and historic districts as well as prehistoric archaeological sites could be expected along pipeline routes, the marine terminal in Pascagoula, tank farm in Liberty, and pump station along the pipeline to Liberty.

3.9.5.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate identified effects.

3.9.6 Stratton Ridge Storage Site

3.9.6.1 Affected Environment

The Texas SHPO indicated that the Stratton Ridge location has not been surveyed for cultural resources except for a pipeline ROW that parallels the road about 328 feet (100 meters) north of Oyster Creek. The Texas SHPO also noted that one **shell midden** site has been recorded on the south side of Oyster Creek immediately across from the project area, suggesting that other sites might be present on the north side of the creek within the project area (Oaks 2005). The SHPO indicated that the entire area should be surveyed.

DOE conducted a record search of the Texas Archeological Sites Atlas for the proposed facility footprint and a 2-mile (3.2-kilometer) radius. The search identified no sites listed on the National Register of Historic Places nor any national or state historic landmarks. About 10 archaeological sites are recorded within a 2-mile (3.2-kilometer) radius of the center of the facility footprint; none has been formally evaluated for eligibility on the National Register. Most are shell middens or **shell scatters**, some with ceramics. Two sites consist of historic Anglo structure foundations of brick with associated glass, iron, and ceramic fragments. The distribution of the sites suggests that the lower lands within the 2-mile (3.2-kilometers) radius are prehistoric. Lands near Oyster Creek and its tributaries or other surface water, such as Chubb Lake, are more sensitive than the uplands. It also could mean this distribution simply may reflect greater development associated with levees, bridges, and roads in the lower lands. According to the site records, some of the sites have been disturbed by development, while others are in excellent condition. Based on these findings, DOE expects that the pipeline routes also would be archaeologically sensitive in similar low-lying areas near bayous, streams, and coastal wetlands.

> **Shell midden** is a subtype of midden-soil that has been altered by human occupation. Shell midden includes large amounts of fragmented shell mixed with charcoal and other organic materials derived from human use. Archaeologists interpret shell midden sites as the result of long-term residence or regular reuse, where the debris from a shellfish-rich diet has become part of the site. **Shell scatters** are distributions of cultural material that consist primarily of shell fragments. Shell scatters do not contain the visibly and texturally different soil of shell middens, and they are interpreted as the result of short-term use or use for only a single activity (such as shellfish harvesting) rather than residence.

3.9.6.2 Impacts

Based on the record search, DOE is unable to identify specific construction or operations and maintenance impacts for the proposed Stratton Ridge site, tank farm, and pipelines. Nevertheless, the results of the record search suggest that impacts such as those described in section 3.9.2 likely would be identified following a field survey if one of the Stratton Ridge alternatives is selected.

3.9.6.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate identified effects.

3.9.7 Bayou Choctaw Expansion Site

3.9.7.1 Affected Environment

As noted in section 3.9.1, the Louisiana SHPO indicated that no known archaeological sites or historic properties would be affected by the undertaking at any of the Louisiana locations proposed for new storage facilities or expansion (LeBreaux 2005). DOE reviewed sites listed on the Louisiana State Plan in 1976 in its evaluation of impacts prior to construction of the original Bayou Choctaw facility and identified one Indian village site within 1 mile (1.6 kilometers) of the facility location, a historic plantation within 3 miles (4.8 kilometers), and other plantation and Indian village sites in the surrounding area (DOE 1976). The distribution of the listed sites is consistent with the observation of SHPO staff regarding Chacahoula: Areas around major streams and tributaries are sensitive for Native American archaeological sites and historic plantation sites (see section 3.9.4). The review found one site listed on the National Register, a historic Mississippi River lock more than 4 miles (6.4 kilometers) from the facility location. In the description of preconstruction site conditions, the closest residences identified were 1.6 miles (3.2-kilometers) from the facility, and the review made no mention of existing structures on the facility site, which suggests the absence of any historic plantation remains. The review did note the land use during the past 100 years has been agriculture (DOE 1976).

Because the facility is situated in a geographic setting that is considered archaeologically sensitive, it is expected that Native American archaeological sites might be identified during a survey of areas where ground would be disturbed during expansion. As indicated earlier, there is no suggestion that plantation structures would be found.

3.9.7.2 Impacts

Based on the response from the Louisiana SHPO, no construction or operations and maintenance impacts have been identified at the Bayou Choctaw facility location. Impacts to prehistoric archaeological sites as described in section 3.9.2 might be identified following a field survey if one of the alternatives that includes Bayou Choctaw as an expansion site is selected. Impacts to historic structures are unlikely.

3.9.7.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate identified effects.

3.9.8 Big Hill Expansion Site

3.9.8.1 Affected Environment

The Texas SHPO indicated that the Big Hill facility and expansion area have never been surveyed for cultural resources and that no archaeological sites have been recorded in the vicinity (Oaks 2005). Because the Big Hill landform is unique, the SHPO believes that it may have attracted Native American populations, and that any previously undisturbed areas should be surveyed for archaeological sites. The SHPO also noted that because the SPR facility was not constructed until 1987, none of the buildings associated with it would be old enough to be considered historic properties.

A record search performed by the Texas Archaeological Research Laboratory for the 1992 draft EIS identified no recorded archaeological or historical sites located within the Big Hill salt dome project area that would be affected by the construction of expanded storage capacity at Big Hill (DOE 1992a). The Archaeology Division of the Texas Historical Commission has no record of field reconnaissance within the footprint or the expansion acreage to the north before or since the existing facility was constructed;

thus, the negative findings of the record search are not surprising. Archeology Division staff believes that the presence of archaeological sites on the hill above the floodplain within the Big Hill expansion footprint is likely (Martin 2005).

3.9.8.2 Impacts

Based on the response from the Texas SHPO and an earlier record search, no construction or operations and maintenance impacts can be identified at the Big Hill expansion facility location. Impacts to prehistoric archaeological sites as described in section 3.9.2 might be identified following field survey of the previously undisturbed areas within the facility and along the pipeline ROW as well as of the expansion area to be added to the facility. Impacts to historic structures are unlikely.

3.9.8.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate identified effects.

3.9.9 West Hackberry Expansion Site

3.9.9.1 Affected Environment

As noted in section 3.9.1, the Louisiana SHPO indicated that no known archaeological sites or historic properties would be affected by the undertaking at any of the Louisiana locations proposed for new storage facilities or expansion (LeBreaux 2005). For the 1976 EIS for West Hackberry, DOE reviewed National Register listings and requested that the Louisiana SHPO review state registers. No National Register sites were listed for Cameron or Calcasieu Parish and none of three historic markers in Calcasieu Parish was located in the facility area (DOE 1976). It is possible that unrecorded historic structures or prehistoric archaeological sites exist in the security area to be cleared or along the new site access road to be constructed. Around new access roads and well-pad sites within the existing facility, historic structures are unlikely, but prehistoric archaeological sites might be present.

3.9.9.2 Impacts

Based on the response from the Louisiana SHPO, no construction or operations and maintenance impacts have been identified at the West Hackberry facility location. Impacts to prehistoric archaeological sites as described in section 3.9.2 might be identified following field survey. Impacts to historic structures are unlikely, except in the perimeter zone.

3.9.9.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate identified effects.

3.9.10 No Action Alternative

The No-Action alternative would limit the impacts from SPR construction and operations to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the Chacahoula storage site and the proposed site could be developed by a commercial entity for oil and gas purposes. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity. For the sites of terminals that are in developed petroleum storage areas, it is possible that a commercial entity could develop them for further storage. If DOE selected the No-Action alternative, there would be no additional potential impact of disturbing cultural resources that include archaeological sites, historic sites, or historic visual settings.

3.10 NOISE

This section analyzes potential noise impacts. It is organized in two sections: Section 3.10.1 describes the methodology and section 3.10.2 discusses the affected environment and potential impacts. Unlike most other resource sections in chapter 3, this analysis does not include a common impacts section or separate sections for each site's affected environment and impacts. The streamlined organization is appropriate because most information is on the affected environment, namely ambient sound levels, and potential impacts is effectively presented in one table.

3.10.1 Methodology

Noise impacts from construction and operations and maintenance of the potential new and expansion SPR facilities are evaluated on the basis of two different but important approaches: (1) comparison of estimated noise level with an absolute noise level standard, and (2) comparison of estimated noise level with the estimated existing ambient noise level.

3.10.1.1 Methodology to Estimate Existing Ambient Noise Levels

No sound monitoring data are currently available for any of the proposed new or expansion SPR sites. In the absence of such data, DOE estimated ambient sound levels based on a U.S. EPA study (EPA 1974) that correlated **Day Night Average Noise Level** as a function of population density. The Day Night Average Noise Level is essentially a 24-hour average noise level with a 10-**decibel**, nighttime-noise penalty to account for peoples' increased sensitivity to noise at night. Day Night Average Noise Levels are measured in A-weighted decibels (dBA), as defined in the adjacent text box. Population density data used in this study are based on U.S. Census data.

> **A-weighted decibels** (dBA) is a measure of noise level used to compare noise from various sources. A-weighting approximates the frequency response of the human ear.

Using this approach, DOE estimates ambient noise levels within approximately 1 mile (1.6 kilometers) of the proposed new or expansion SPR sites. The extent to which project construction and operations and maintenance noise levels are greater than ambient noise levels determines how audible project noise levels would be at sensitive receptor locations. The audibility of project-related sound itself does not necessarily constitute an impact, but provides context for potential changes in the acoustic environment. Ambient noise levels were estimated at both existing and proposed SPR sites using population data, thus conservatively ignoring potentially higher existing noise levels from operations at existing sites which would reduce the impact of additional noise from SPR expansion. Ambient noise levels along pipelines and access roads were not estimated since construction noise in those areas would be temporary. Thus, DOE evaluated the noise along pipelines and access roads only by comparing their estimated construction noise to an absolute noise level standard. Power lines will also be installed along pipeline routes, but construction noise associated with this activity is minor compared with pipeline and road construction, so construction noise due to power line installation was not analyzed.

3.10.1.2 Methodology to Estimate Construction Noise

The following construction activities would result in noise:

- Drilling of new cavern entrances;
- Support facility construction;
- Pipeline construction (including any associated intermediate pumping station);

- RWI structure construction
- Road construction; and
- Tank farm construction

DOE has measured noise levels for these activities in past SPR studies (DOE 1992), and extrapolated these data to 500 feet (150 meters) as shown in table 3.10-1. These noise levels incorporate the noise levels from trucks used in construction activities. Drilling of shafts and construction of support facilities would occur within the site boundary. Construction of pipelines, terminals, and access roadways would occur largely offsite.

Table 3.10-1: Estimated Construction Activity Noise Level Contributions at 500 feet (150 meters)

Activity	Sound Level, Leq (dBA)
Drilling of shafts	67
Support facility construction	68
Pipeline construction	69
Access roadway construction	68

Leq = **Level equivalent**

Source: DOE 1992

Level equivalent (Leq) is the level of noise (in decibels) averaged over a specified period of time.

DOE estimates noise levels at any distance from these activities by assuming that noise sources are point sources and that noise levels attenuate by 6 decibels as the distance from the noise source doubles. Construction noise levels were estimated at sensitive receptors closest to the construction activities. The construction noise analysis accounts for noise generated onsite, as well as pipeline and road construction noise along the entire length of the corridor.

DOE identified sensitive receptors by reviewing USGS maps. The USGS maps typically use dark rectangles to represent homes. Because of the limited resolution and date of the available maps, DOE assumed that the rectangles could represent other types of structures. Thus, DOE conservatively assumed that every structure identified on the USGS maps could be noise-sensitive, meaning residential, schools, libraries, retirement communities, and nursing homes.

The threshold values for construction noise impacts are generally higher than threshold values for operations and maintenance because construction noise is temporary. While standardized criteria have not been developed for assessing construction noise impacts, the Federal Transit Administration (FTA) has construction noise guidelines that have been applied to a wide variety of construction projects (FTA 1995). These guidelines are shown in table 3.10-2.

Table 3.10-2: FTA Construction Noise Guidelines

Land Use	8-hour Leq (dBA)		30-day Average DNL or Leq (dBA)
	Day	Night	
Residential	80	70	DNL = 75[a]
Commercial	85	85	Leq = 80[b]
Industrial	90	90	Leq = 85[b]

Notes:

[a] In urban areas with very high ambient noise levels (DNL > 65 dBA), DNL from construction projects should not exceed existing ambient + 10 decibels

[b] 24-hour Leq is used, not DNL, since people do not sleep at commercial and industrial locations

DNL = day night average noise level; dBA = A-weighted decibels; Leq = level equivalent

Source: FTA 1995

3.10.1.3 Methodology to Estimate Operations and Maintenance Noise

During operations and maintenance, noise sources would consist of the brine disposal pump pad, well pad, RWI pad, and the intermediate pumping station associated with the Richton alternative. Based on noise measurements from previous SPR studies (DOE 1992), noise levels from the brine disposal pad and well pad would be about 60 dBA at 500 feet (150 meters) from the source and 57 dBA at 500 feet (150 meters) from the RWI. These data can be used to estimate noise levels at any distance, assuming point source propagation. Appropriate engineering solutions, such as noise barriers or enclosures would be used at the intermediate pumping station to assure the noise level would not exceed 65 DNL at 300 feet (91 meters). Noise levels were estimated at sensitive receptors closest to the operations and maintenance activities. Sensitive receptors were identified by reviewing USGS maps.

Estimated operations and maintenance noise levels were compared with the criteria of the Department of Housing and Urban Development (HUD), as shown in table 3.10-3 (HUD 2002). As shown in this table, 65 dBA Day Night Average Noise Level is the dividing line between acceptable and unacceptable noise levels for residential locations. This standard is widely accepted by state and Federal agencies and has been adopted in several other standards.

Table 3.10-3: HUD Land Use Compatibility Guidelines for Noise

Land Use Category	Sound Pressure Level (DNL, dBA)			
	Clearly Acceptable	Normally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential	<60	60–65	65–75	>75
Livestock farming	<60	60–75	75–80	>80
Office buildings	<65	65–75	75–80	>80
Wholesale, industrial, manufacturing and utilities	<70	70–80	80–85	>85

Notes:

DNL = day night average noise level; dBA = A-weighted decibels

3.10.2 Impact Analysis

Table 3-10-4 also presents data for all seven proposed new and expansion sites on the following:

- The estimated noise resulting from onsite storage facility construction, offsite pipeline and road construction.
- The estimated noise resulting from operations and maintenance noise from the storage facility. Data on estimated operations at maintenance noise at the RWI structure is presented in the text.
- Whether the estimated noise levels would be audible, would exceed the applicable guidelines of the FTA or the HUD guidelines, and would create potential impacts.

3.10.2.1 Construction Impacts

The construction noise analysis for each storage site is divided into two categories of noise-generating activities: (1) shaft drilling and support facility construction and (2) pipeline and access roadway construction. For each of these categories, the table presents the approximate distance of these activities to the closest sensitive receptor.

Noise levels are presented in terms of both Level equivalent and Day Night Average Noise Level, with the latter metric based upon the assumption that construction activities would take place only during the day. Comparing the projected level to the existing ambient level indicates whether the construction noise would be audible at certain locations. For example, at Chacahoula, the Day Night Average Noise Level for shaft drilling and support facility construction is estimated at 49, which is substantially greater than the estimated existing ambient noise level of 39. Therefore, construction noise would likely be audible in certain locations near this site.

The Bruinsburg, Bayou Choctaw, Big Hill, Richton, and West Hackberry storage sites also have estimated construction noise levels substantially above the existing ambient levels, indicating that construction noise would likely be audible at certain locations. At the Stratton Ridge site, construction noise levels are only somewhat higher than the estimated ambient noise level, so construction noise may be barely audible at certain locations. All of the sites have noise levels lower than the FTA guidelines, as presented in table 3.10-2.

For the pipeline and roads, the estimated noise levels at the nearest sensitive receptors would be below FTA guidelines; and therefore, no significant noise impacts would occur and mitigation would not be necessary.

Tank farms with significant new construction would be located in Peetsville, MS; Anchorage, LA; Liberty Station, MS; Pascagoula, MS; and Texas City, TX. Construction activities at these locations are sufficiently far from sensitive receptors such that construction noise levels would be less than the values shown in table 3.10-2, and therefore no significant construction noise impacts would be expected.

Table 3-10.4: Site-Specific Noise Analysis

		Bruinsburg	Chacahoula	Richton	Stratton Ridge	Bayou Choctaw	Big Hill	West Hackberry
Existing ambient noise	Population density (persons/mile^2)	57	47	31	33	30	3	8
	Estimated ambient noise level (DNL)	40	39	37	37	37	27	31
Construction noise	**From storage site**							
	Distance to closest receptors (feet)	6,230	3,570	4,490	10,720	3,990	2,130	2,650
	Noise level (dBA, Leq)	46	51	49	41	50	55	54
	Noise level (dBA, DNL)	44	49	47	39	48	53	52
	Audible construction noise?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Higher than FTA guidelines?	No	No	No	No	No	No	No
	Construction noise impacts?	No	No	No	No	No	No	No
	From pipeline, power line, and road construction[a]							
	Distance to closest receptors (feet)	390	2,710	240	9,810	NA	210	N/A
	Noise level (dBA, Leq)	71	54	75	43	NA	76	N/A
	Noise level (dBA, DNL)	69	52	73	41	NA	74	N/A
	Higher than FTA guidelines?	No	No	No	No	NA	No	N/A
	Construction noise impacts?	No	No	No	No	NA	No	N/A
Operations and maintenance noise for storage site	Distance to closest receptors (feet)	6,230	3,570	4,490	10,720	3,990	2,130	2,650
	Noise level (dBA, Leq)	38	43	41	N/A	N/A	N/A	N/A
	Noise level (dBA, DNL)	36	41	39	31	40	45	44
	Audible O&M noise?	No	Yes	Yes	No	Yes	Yes	Yes
	Higher than HUD guidelines?	No	No	No	No	No	No	No
	O&M noise impacts?	No	No	No	No	No	No	No

Notes:

[a] Audibility of noise from pipeline, power line, and road construction was not estimated.

dBA = A-weighted decibels; DNL = day night average noise level; Leq = Level equivalent; N/A = not applicable; O&M = operations and maintenance; mile^2 = 2.59 kilometers^2; feet = 0.3048 meters

3.10.2.2 Operations and Maintenance Impacts

The estimated operations and maintenance noise analysis includes data for the distance of the closest sensitive receptors from the following sources of noise: brine disposal pump pad, well pad, and RWI pad. The resulting noise levels are presented in terms of A-weighted and Day Night Average Noise Level, with the latter measurement based upon the assumption that operations and maintenance activities will take place only during the daytime hours. As with estimated construction noise, the operations noise levels are compared with the existing ambient levels to determine whether noise will be audible at the receptor distance. If one were to precisely calculate operational noise levels, estimated noise levels would be logarithmically added to ambient noise levels. This extra calculation is unnecessary in determining whether or not operations would be audible. Audibility can be determined by comparing estimated noise level to the ambient noise level.

At the Bruinsburg and Stratton Ridge storage sites, the operations and maintenance noise level would be lower than the existing ambient levels, so noise sources would not likely be audible at nearby receptors. At the Chacahoula, Richton, and Bayou Choctaw sites, the operations and maintenance levels would be slightly greater than the estimated ambient noise level, so noise sources might be barely audible at certain nearby receptors. At the Big Hill and West Hackberry sites, the operations and maintenance levels would be substantially higher than the estimated ambient noise levels, so noise sources would be audible at nearby receptors. Estimated operations and maintenance noise levels at all sites, however, would be lower than the HUD Land Use Compatibility Guidelines (as presented in table 3.10-3), so no significant noise impacts associated with operations and maintenance would occur, and mitigation would be unnecessary.

At the intermediate pumping station on the Richton-to-Liberty Station crude oil pipeline for the Richton storage site, the noise level from operating the pumping station would not constitute a significant impact according to the HUD guidelines. While the pumping station would be located about 300 feet (91 meters) from the closest receptor, the pump and generator would be located in a pump house with an enclosure or noise barrier and would operate only when oil is being transferred through the pipeline.

Sensitive receptors do not appear to be near the RWI at the proposed sites except for Stratton Ridge and Pascagoula where, based on aerial photographs, receptors are as close as 1,640 feet (500 meters) and 1,500 feet (457 meters) respectively. For Stratton Ridge, RWI noise would be approximately 45 Day Night Average Noise Level, which is greater than the estimated ambient level (36 Day Night Average Noise Level) at this location. Consequently, RWI noise would be audible at these receptors, but would not constitute a significant impact since the noise level would be substantially lower than the HUD guidelines. A wildlife sanctuary is also in the vicinity of the RWI, and some wildlife noise impacts might occur depending on the exact proximity to the RWI. The RWI would be located just across the ICW from the sanctuary. See section 3.7.8 for a discussion of the potential impact of the noise on the wildlife in the sanctuary.

For Pasacagoula, RWI noise would be approximately 45 DNL which is less than the estimated ambient noise level (47 DNL) at this location. Consequently, RWI noise would not likely be audible at these receptors, and would not constitute a significant impact since the noise level would be substantially lower than the HUD guidelines.

Both construction and operation and maintenance would cause only minor noise impacts based on the location of the nearest of residences and other sensitive receptors around the proposed new and expansion sites, past experience with the construction and operations and maintenance of existing SPR sites, and the results of this noise analysis.

3.11 ENVIRONMENTAL JUSTICE

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (EPA 1999). Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, tasks "each Federal agency [to] make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high adverse human health and environmental effects of its programs, policies, and activities on minority populations and low-income populations." Federal agencies must provide minority and low-income communities with access to information on matters relating to human health or the environment and opportunities for input in the NEPA process, including input on potential effects and mitigation measures. The environmental justice analysis is described in this section. Demographic information supporting the analysis is presented in appendix J.

3.11.1 Methodology

CEQ oversees the Federal government's compliance with Executive Order 12898 and the NEPA process. CEQ has prepared guidance to assist Federal agencies with their NEPA procedures to ensure that agencies identify and consider environmental justice concerns (CEQ 1997). Based on CEQ and DOE guidance (DOE 2004f), this EIS uses a three-step methodology to evaluate potential environmental justice impacts:

- Step 1: Identify the potential environmental justice populations that are located in the project area or could otherwise be affected by the proposed action. Environmental justice populations are minority groups and low-income populations.

  - CEQ defines the following groups as minorities: Black/African American, Asian, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native, and Hispanic populations (regardless of race). According to CEQ, a minority population exists where either: (a) the minority population of the affected area exceeds 50 percent; or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. In addition to the 50 percent threshold, DOE used both the United States and the state in which a city, town, or country/parish is located as the "general population." In other words, a population is minority if its percentage is either greater than 50 percent or greater than the percentage in the United States or its state.

  - CEQ defines low-income by using the annual statistical poverty thresholds from the U.S. Census Bureau. A low-income community exists when the low-income population percentage in the area of interest is "meaningfully greater" than the low-income population in the general population. For purposes of the analysis of low-income communities, DOE used both the United States and the state in which a city, town, or county/parish is located as the "general population." In other words, a population is low-income if its percentage of low-income residents is greater than the percentage in the United States, its state, or both. In addition, DOE used the population below the poverty level to define low-income population.

- Step 2: Identify the potential human health and environmental effects of the proposed alternatives.

- Step 3: Assess whether there are any potential significant adverse effects to minority and low-income populations that would be disproportionately high and adverse, that is, would appreciably exceed impacts to the general population or other appropriate comparison group. This assessment also considers whether minority and low-income populations would be affected by an alternative in different ways than the general population, such as through unique exposure pathways or rates of exposure, special sensitivities, or different uses of natural resources.

For step 1, DOE identified potential environmental justice populations for each proposed new and expansion site (see appendix J for more details). For each proposed site, DOE collected demographic data for the areas where the proposed storage site support facilities, RWI, pipelines, and oil distribution facilities would be located. DOE identified all counties or parishes in which the proposed project was located, and cities and towns of a population greater than 1,000 close to the proposed project. Towns with a population of less than 1,000 people were not included because of the large number of very small towns in rural areas near the project sites. The county or parish data cover these small towns. For the storage sites, DOE identified cities and towns within 5 miles (8 kilometers) of the site. For pipelines and other infrastructure, DOE identified cities and towns within 2 miles (3.2 kilometers) of the proposed infrastructure. DOE used a shorter distance for the pipelines and other infrastructure than for the storage sites because the potential impacts of the infrastructure generally would be smaller and more localized than for the storage sites. DOE supplemented these data with U.S. Census block information in a few instances where there are no nearby cities and towns of a population greater than 1,000. Finally, DOE compared demographic data on minority and low-income populations in these areas to similar state and national data to identify potential environmental justice communities.

The demographic data used in this analysis predate Hurricanes Katrina and Rita, which may have had systematic demographic effects on many of the potentially affected areas. DOE could not avoid this limitation because detailed post-hurricane data were not yet available. This limitation does not affect the conclusions of the environmental justice analysis because DOE finds no potential high and adverse impacts (see section 3.11.3).

3.11.2 Affected Environment

Table 3.11-1 identifies the minority and low-income populations associated with each proposed site and its associated infrastructure. A check mark in the table indicates that one or more jurisdictions or Census tracts in the potentially affected area for the proposed site may have an environmental justice community. Detailed information on the populations in each relevant jurisdiction for each proposed site is presented in appendix J.

As shown in table 3.11-1, each proposed site has at least two potential environmental justice communities. For example, low-income communities and Black or African American communities, as defined by CEQ, are located in the potentially affected areas for each site.

3.11.3 Impacts

Sections 3.2 through 3.10 describe the potential health and environmental impacts to resource areas. Based on that analysis and further consideration of whether minority and low-income populations would have different ways than the general population of being affected by an alternative (e.g., unique exposure pathways or rates of exposure, special sensitivities, or different uses of natural resources), the discussion below indicates that no environmental justice population would incur disproportionately high and adverse impacts in any resource category.

Table 3.11-1: Potential Environmental Justice Populations

Proposed Site	Potentially Affected States	Overall Minority	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian or Other Pacific Islander	Hispanic or Latino Origin	Low Income
Bruinsburg	Louisiana & Mississippi	✓	✓		✓			✓
Chacahoula	Louisiana	✓	✓	✓				✓
Richton	Mississippi	✓	✓	✓	✓	✓	✓	✓
Stratton Ridge	Texas	✓	✓	✓			✓	✓
Bayou Choctaw	Louisiana	✓	✓					✓
Big Hill	Texas	✓	✓	✓	✓		✓	✓
West Hackberry	Louisiana		✓					✓

Environmental Risks and Occupational Health and Safety: Based on SPR projections presented in section 3.2, the probability of a spill of brine, crude oil, or hazardous materials would be low. While some spills are likely to occur, they generally would be small, contained, and quickly cleaned up without causing significant or long-term impacts. Based on historical data, any fires would result in minor injuries and no environmental impacts or long-term impacts to SPR site operations. the risks to occupational safety would be small, generally lower than for comparable types of facilities. Overall the impacts would be small and minority and low-income populations would likely be affected in the same way as the general population.

- <u>Land use conflicts</u>: The proposed sites and their infrastructure generally would not conflict with existing land uses, largely because the storage facilities and associated infrastructure would be located primarily in undeveloped, rural areas away from existing land uses. While pipelines would cross land used for agricultural and recreational purposes, the impacts would be temporary because the pipelines would be buried and, following construction, prior uses of the land could continue. Where project infrastructure would be in developed areas, conflicts would not occur because the pipelines would be underground and other new infrastructure would not conflict with existing land uses. Potential land use conflicts, however, would arise where proposed pipelines:

  - For the Bruinsburg alternative would cross the Natchez Trace National Scenic Trail, the Natchez Trace Parkway, and the proclamation area for the Homochitto National Forest;
  - For the Richton alternative would cross the Percy Quinn State Park; and
  - For the Stratton Ridge alternative would cross the Brazoria Wildlife Refuge.

  In these instances, the impacts to minority and low-income communities would not appreciably exceed the impacts to the general population and would not be affected in different ways than the general population.

- <u>Visual resource impacts</u>: Throughout the region of influence for the proposed SPR development, storage facilities, pipelines, power lines, and industrial facilities are common. Many viewers of the proposed project would be familiar with the purpose and use of SPR facilities, pipelines, and power lines and tolerant of the visual changes. Viewers would be more sensitive to visual contrasts on lands with special designations that pipelines would cross, as noted above, which may be visited more often and serve a greater aesthetic or uniquely scenic purpose. In those situations, the visual impacts would not be significant, because, the amount of land area involved is small, pipelines would be underground, and the ROWs would be managed to minimize visual contrast with adjacent vegetation.

In addition, minority and low-income communities would not be affected in different ways than the general population by visual resource impacts.

- Farmlands: The construction of some proposed SPR facilities would make prime farmland unavailable for agricultural purposes. Based on DOE's consultation with the United States Department of Agriculture's (USDA's) NRCS, the conversion of farmlands to non-agricultural uses would not be significant, based on the amount, condition, and location of the land to be converted. Also, minority and low-income communities would not be affected in different ways than the general population by the conversion of farmland to other uses.

- Coastal zone: DOE will coordinate its required Coastal Determination processes with both the applicable state agencies and with the USACE, which will have a CWA Section 404 permitting responsibilities. The applicable state agencies in Texas, Louisiana, and Mississippi often use joint review processes with the U.S. Corps of Engineers on permit applications affected lands within the designated coastal zone. DOE has determined that any potential impacts to human health and the environment in coastal zone areas would not be significant to environmental justice communities. The only significant potential impacts may be to wetlands in coastal zones, which are discussed below under biological resources. Also, minority and low-income communities would not be affected in different ways than the general population by coastal zone impacts.

Geology and Soils: The potential subsidence at new SPR caverns would be only a few feet on the salt domes and any resulting environmental impacts would be small. The development of SPR caverns also would not affect other uses of the salt dome. Overall, geological and soil impacts would be small and minority and low-income communities would not be affected in different ways than the general population.

Air Quality: As discussed in section 3.5, the proposed action would not cause any significant air quality impacts. At all of the candidate sites, modeling indicates that airborne emissions from construction activities, even under a set of conservative assumptions, would not result in a local exceedance of the NAAQS for PM, NO_x, CO, and ozone. Modeling and historical operating data from existing SPR sites also show that emissions from the proposed operation and maintenance activities would not result in a level of air pollution that exceeds the NAAQS. EPA has established the NAAQS taking into account evidence of potential risks to sensitive populations, such as children, the elderly, and individuals with respiratory and cardiovascular disease. EPA also periodically reviews and revises the NAAQS based on the best available evidence related to potential health effects, including health effects in sensitive, minority, and disadvantaged groups. Therefore, compliance with the NAAQS provides a high degree of assurance that public health–including among minority and low-income populations–would be protected. Thus, minority and low-income communities would not be affected in different ways than the general population.

Water Resources: The proposed project would increase salinity from brine disposal in the Gulf Coast, temporarily increase turbidity and suspended nutrients and organic matter during construction, and would decrease water flows during the operation of the RWI facility. None of these and other potential water resource impacts, however, would be significant. Neither surface water nor groundwater would be contaminated with pollutants that would create special pathways of concern or harm human health. The availability of groundwater and surface water resources also would not be significantly affected. Also, minority and low-income communities would not be affected in different ways than the general population by water resource impacts.

Biological Resources: The proposed action would have significant impacts on wetlands, endangered species, and, for the Richton site, fish populations due to the withdrawal of water from the Leaf River.

Minority and low-income communities would not incur appreciably higher impacts than the general public and they would not be affected in different ways than the general population.

- No biological resources would be contaminated with pollutants that would create risks to human health (excluding spills, which are discussed above). Thus, unique exposure pathways or rates of exposure to pollutants would not be a concern.

- Little if any subsistence fishing, hunting, or gathering of plants occurs at the proposed storage sites or nearby. In addition, the proposed sites either have limited access or are surrounded by similar habitat that might be available for subsistence activities.

- While subsistence activities may occur along the associated infrastructure, such as pipeline or power line ROWs, the impacts of the infrastructure would be small. The ROWs are narrow; similar activities could be pursued nearby; and most construction impacts are short term.

- While the withdrawal of water from the Leaf River might reduce the fish populations, no substantial subsistence fishing occurs in that river (Beiser 2006).

Socioeconomics: The project would have positive effects on local employment, wages, expenditures, and tax revenue. Any effects from in-migration, the associated increased demand on housing and public services, and increased traffic would be minor. Also, minority and low-income communities would not be affected in different ways than the general population.

Cultural Resources: DOE will not complete the identification of cultural resources until after DOE selects a proposed alternative. Only then would DOE proceed with field survey and additional information gathering for all facility locations and pipeline routes associated with each site, according to the terms of the relevant programmatic agreements. Consequently, DOE will not complete the assessment of potential effects and the identification of ways to resolve any adverse effects until after site selection. Thus, DOE lacks information on the potential cultural impacts to minority and low-income populations. But if any impacts would occur, DOE would consider mitigation measures.

Noise: Construction activities would cause, at most, only minor, short-term noise impacts because the proposed facilities are generally located in rural areas with few nearby residences and other sensitive receptors. SPR operations and maintenance noise impacts also would be low. In addition, minority and low-income communities would not be affected in different ways than the general population.

3.11.4 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing conditions at the proposed new SPR storage site alternatives would remain unchanged. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. Since oil and gas activities occur near the Chacahoula storage site, the proposed site could be developed by a commercial entity for oil and gas production. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity. At proposed SPR oil distribution facility locations that are near existing oil distribution facilities, a commercial entity could develop them for oil storage.

The no-action alternative would leave regional socioeconomics unchanged and afford no opportunity for disproportionate impacts on populations subject to environmental justice considerations.

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Chapter 4. Cumulative Impacts

4.1 INTRODUCTION

This section of the EIS evaluates the potential cumulative impacts associated with the potential development of new or expanded SPR sites in combination with the potential impacts associated with other relevant activities that have occurred, are occurring, or may occur in the vicinity of the proposed new or expanded storage sites and their infrastructure. The primary goal of the cumulative impact analysis is to determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative effects of other past, present, and future actions. Cumulative impact analysis is required by the CEQ regulations. The definition of cumulative impacts is:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Impacts subject to the cumulative impacts analysis were identified by determining the potential environmental impacts associated with the proposed expansion of SPR facilities, establishing the geographic scope of the potential impacts, establishing the time frame of the analysis, and identifying other past, present, or future actions that have affected, or could affect, the resources of concern.

The cumulative impact assessment identifies activities in the region that have the potential interaction in time or space with the effects from the proposed SPR program expansion. The geographic scope and time frame of the cumulative impacts analysis varies depending on the environmental resource category under consideration. DOE analyzed the cumulative impacts for those situations where planned or reasonably foreseeable projects overlapped with the proposed SPR expansion in terms of geographic area and time frame. Cumulative impacts can stem from both construction and operations impacts. This analysis differentiates, where appropriate, between cumulative impacts associated with short-term, but overlapping, construction impacts and longer-term overlapping impacts associated with operations. The analysis considers all potential activities including Federal, other government, and private actions.

Because the potential sites extend over a wide geographic area within three states, the cumulative analysis considers both site-specific activities that could have cumulative impacts with the SPR and general categories of activities relevant to the Gulf Coast region as a whole. Impacts of activities within the Gulf Coast region are discussed on the ecoregion province scale because these ecologic units describe the interaction of various natural resources and environmental conditions and characteristics. Ecoregion provinces are characterized by climatic subzones and similar soil orders, factors that lead to similar natural vegetation and the establishment of similar natural resources and environmental conditions and characteristics within each zone.

4.2 METHODOLOGY

To evaluate the potential for cumulative impacts, public and private activities in the Gulf Coast were identified and reviewed to determine if the impacts associated with these actions could coincide in time and space with the impacts from the new or expanded SPR sites. The search for potential projects entailed researching projects from four sources, as shown in table 4.2-1.

Table 4.2-1: Sources for Projects for Potential Inclusion in Cumulative Impacts Analysis

Source	Expected Type of Project
USACE: New Orleans, Vicksburg, Galveston, and Mobile District Web sites (USACE 2005b, 2006a, 2006b, 2006c)	Projects affecting waterways or wetlands, including water-related projects managed by USACE
Louisiana Coastal Wetlands Conservation and Restoration Task Force Web site (www.lacoast.gov) (CWPPRA 2006)	Projects funded by the Coastal Wetlands Planning, Protection and Restoration Act aimed at wetlands restoration along the coast of Louisiana; such projects might be carried out by USACE, EPA, NOAA Fisheries, NRCS, or USFWS
State Transportation Improvement Programs for Texas, Louisiana, and Mississippi (LADOTO 2006; MDOT 2004; TxDOT 2005)	Large transportation projects
City and county governments	Private land development projects; local government projects
Federal Energy Regulatory Commission (FERC)	Liquefied natural gas (LNG) developments, pipelines, facility alterations

For each source, projects were sought for inclusion in initial lists for each proposed SPR site and associated facilities. The lists were then narrowed down through multiple passes to eliminate projects based on a variety of factors, including proximity to SPR facilities, size of project, type of project, and date of expected completion. The methods used for developing the final lists from each of these sources are discussed below.

4.2.1 U.S. Army Corps of Engineers

In addition to planning, designing, building, and operating aspects of civil works projects, the USACE is responsible for regulating the use of water resources by private organizations and government agencies. USACE District Web sites were searched for USACE-sponsored operations and both USACE and non-USACE permit applications to generate a list of projects that could potentially contribute to the cumulative impacts of SPR construction and operations. After initial county- and parish-level lists were compiled from the Web sites, multiple screening stages narrowed the lists. The screening stages included discussions with district staff regarding specific projects.

As shown in table 4.2.1-1 below, SPR proposed project sites and associated facilities are located in four USACE districts: Galveston, New Orleans, Vicksburg, and Mobile.

Table 4.2.1-1: USACE Districts and SPR Sites

District	SPR Sites
Galveston	Stratton Ridge, Big Hill
New Orleans	West Hackberry, Bayou Choctaw, Chacahoula
Vicksburg	Bruinsburg
Mobile	Richton

For each of these districts, lists were compiled for all ongoing and foreseeable projects, including projects in the construction and operation phases, as well as projects pending approval of regulatory permits. DOE then singled out projects occurring within the counties or parishes of interest for each potential SPR site. A county or parish was included in the assessment if it contained any planned SPR infrastructure or pipeline ROWs. Although differences in district Web sites forced a variety of search techniques, the process generally relied on public notice documents, pending permit application lists, and specific project

Web sites in order to populate the lists. In some cases, Web sites had not been updated recently and may have been missing projects started within the last year and recently filed permit applications.

Candidate projects for the four districts were collected from public notices of pending permit applications and other information contained in the district Web sites, sorted by county. The Galveston District's pending applications list was current as of March 2004, and its current public notice list was current as of February 2006. The New Orleans and Vicksburg Districts also provided a monthly backlog of completed projects, but gave little information regarding scale or location. A search of these lists was made dating back to January of 2004. The majority of these operations were maintenance dredging, filling, and surveying. The completed projects were listed, but not enough information was available to map the projects or conduct cumulative impact assessments. This combination of searches produced a county- and parish-wide list of projects.

DOE used several criteria to narrow the lists further. Projects that were significantly out of range of SPR operations were not considered for cumulative impact analysis, unless they influenced an entire watershed or affected large areas. Due to the scope of their effects, several of the hurricane and flood protection projects, as well as the Louisiana Coastal Area Ecosystem Restoration Project, were included for cumulative impact assessment with multiple proposed SPR sites. Many of the permits issued to individuals, as opposed to government agencies or corporations, were intended for small projects and not included on the final lists. For the same reason, permit applications for projects influencing less than 2 acres (0.8 hectares) were not considered. In addition, the process focused on permits for specific construction projects. General permits and regulatory permits did not provide precise locations and were omitted from the final lists. Finally, projects whose description area was very general or whose location could not be determined (e.g., Gulf of Mexico, ICW) were not retained. These criteria were used to create the final project lists.

Table 4.2.1-2: USACE Project Results by Screening Stage

SPR Site and Associated Facilities	Number of Projects Resulting from County/Parish Level Screen	Number of Projects Resulting from Intermediate Stage Screen	Number of USACE Projects on Shortlist
Bruinsburg	8	10	13
Chacahoula	37	7	7
Richton	6	4	2
Stratton Ridge	251	200+	122
Bayou Choctaw	5	5	5
Big Hill	29	26	13
West Hackberry	9	5	5
Totals	326	254+	167

4.2.2 Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Projects in Louisiana

Congress passed the CWPPRA in 1990, designating approximately $50 million per year for wetlands restoration work in Louisiana. Projects are planned by a cooperative commission and carried out by a number of different agencies, including USACE, EPA, NOAA Fisheries, NRCS, and USFWS. The Web site for Louisiana Coastal Wetlands Planning, Protection and Restoration Act work (www.lacoast.gov) lists past, ongoing, and future projects taking place within Louisiana coastal wetlands (CWPPRA 2006). SPR sites with associated facilities in these areas include West Hackberry, and Chacahoula.

Using the Coastal Wetlands Planning, Protection and Restoration Act Louisiana Web site, a list of projects occurring in the same basin as SPR facilities was developed. This list was then narrowed by excluding projects already completed and by locating projects on maps to determine proximity to proposed SPR facilities. Projects more than 10 miles (16 kilometers) from proposed SPR facilities were excluded from the final lists. Results from the screening process are shown in table 4.2.2-1 below.

Table 4.2.2-1: Coastal Wetlands Planning, Protection and Restoration Act Screening

SPR Site and Associated Facilities	Number of Projects Resulting from Basin Level Screen	Number of Projects Resulting from Intermediate Stage Screen	Number of Projects on Shortlist
Chacahoula	50	27	9
West Hackberry	18	4	2
Totals	68	31	11

4.2.3 State Transportation Improvement Programs

State departments of transportation are responsible for developing lists of projects that will be funded by local, state, and federal sources on a three-year basis. These documents are called State Transportation Improvement Programs and include lists of all projects in the state that are expected to receive funding for the given improvement program's period. Table 4.1.3-1 below shows the improvement program documents reviewed for projects and the relevant SPR site.

Table 4.2.3-1: State Transportation Improvement Programs and SPR Sites

State Transportation Improvement Programs	SPR Sites and Associated Infrastructure
Louisiana, 2005–2007	Bruinsburg; Chacahoula; Bayou Choctaw; West Hackberry
Mississippi, 2005–2007	Bruinsburg; Richton
Texas, 2006–2008	Stratton Ridge; Big Hill

The program documentation provide limited information about projects, including a project's description, location (generally a road name or route number and the project termini), cost, and, sometimes other information such as expected completion date, sponsor, and phase (ROW, engineering, or construction).

The above STIPs were reviewed and initial lists of projects that were occurring in the counties and parishes where SPR facilities are being proposed were compiled. Small projects were omitted (generally those under $3 million), as well as projects that consisted of re-constructing existing facilities. The process instead focused on new construction, such as new alignments, re-alignments, or widenings. Each project was then located on maps and compared with proposed SPR facility locations. Based on this more specific locating, several projects were eliminated from consideration, producing the shortlist. Results from the screening process are shown in table 4.2.3-2 below.

Table 4.2.3-2: Transportation Project Results by Screening Stage

SPR Site and Associated Facilities	Number of Projects Resulting from County/Parish Level Screen	Number of Projects Resulting from Intermediate Stage Screen	Number of Projects on Shortlist
Bruinsburg	30	8	8
Chacahoula	6	2	0
Richton	10	3	3
Stratton Ridge	35	5	3
Bayou Choctaw	0	0	0
Big Hill	6	4	3
West Hackberry	1	1	0
Totals	88	23	17

4.2.4 City and County Governments

Staff at city and county governments where SPR sites are proposed were contacted to inquire about large potential land development or local government projects known to be proposed in the vicinity of SPR facilities (Falgout 2006; Floyd Batiste 2006; Johnston 2006). The process focused on the vicinity of the sites themselves, rather than the associated pipeline facilities.

4.2.5 Federal Energy Regulatory Commission

ID Dockets at FERC were researched to identify new LNG project developments in the region and in particular those proposed within a 50-mile (62-kilomenter) spatial region of influence of the proposed new SPR storage sites in Bruinsburg, MS; Chacahoula, LA; Richton, MS; and Stratton Ridge, TX; and the expansion sites at Bayou Choctaw, LA; Big Hill, TX; and West Hackberry, LA. The Gulf Coast region is well suited for LNG development because of underlying attributes that include: a Gulf-based point of entry for inbound LNG shipments, a large market for natural gas users, and considerable existing infrastructure that supports LNG regasification, storage, and pipeline distribution. Overall estimates have been made of up to $1 billion in positive economic impact from future regional development of low-cost LNG and the creation of approximately 12,000 jobs.

LNG-related projects that lay within the region of influence of proposed and existing sites and supporting ancillary facilities that were considered for cumulative impact analysis were identified as:

- *West Hackberry, LA:* A new LNG terminal, LNG terminal expansion, and new pipelines to be located at Hackberry, Cameron, and Calcasieu Parishes, LA; underground storage at Starks salt dome in Calcasieu Parish, LA; Sabine Pass Pipeline in Cameron Parish, LA; and two natural gas storage caverns with associated distribution pipelines in Calcasieu Parish, LA.

- *Ancillary Pascagoula Tank Farm (Richton, MS):* Proposed LNG import marine terminal and related facilities in Pascagoula, MS.

Other existing and proposed LNG terminals and pipeline construction in the Gulf Coast region include: approved expansion at Lake Charles, LA; LNG terminals in the Gulf of Mexico; proposed terminals at Freeport, TX, Sabine, LA, and Sabine, TX; and planned terminal and expansions at Lake Charles, LA. LNG-related activities that were located outside the region of influence were not considered in the cumulative impact analyses.

4.2.6 Hurricane Recovery

Hurricane Katrina was one of the most destructive storms to ever hit the United States, causing extensive damage to the coastal regions of Louisiana, Mississippi, and Alabama. Katrina was a Category 4 hurricane when it made landfall on August 29, 2005 with maximum sustained winds of 143 miles per hour (230 kilometers per hour) and gusts to 165 miles per hour (266 kilometers per hour). Hurricane Rita made landfall as a Category 3 hurricane on the Louisiana-Texas border, about a month later on September 24, 2005, with maximum sustained winds of 120 miles per hour (193 kilometers per hour). A combination of high winds and water surges made these two storms the most costly natural disasters in the modern history of the United States. By far the most devastated area impacted by these two storms was the New Orleans MSA. Estimates of recovery and rebuilding range upwards of $200 billion over the next decade. Rebuilding and recovery is well underway in 2006 in all of the major elements of the regional economy, including housing, industry, education, tourism, oil and gas production, construction, and the undertaking of these efforts will ripple throughout all major job sectors. Recovery on this scale also will affect regional economic stimulus and can bring about positive benefits.

These hurricanes impacted Lafourche Parish, host to the proposed Chacahoula site; and the existing Bayou Choctaw, Big Hill, and West Hackberry expansion sites. Recovery efforts have been undertaken in these areas. The Bruinsburg, Richton, and Stratton Ridge proposed sites were not substantially impacted. DOE has found that the cumulative effects of the proposed action at proposed new sites or existing expansion sites were not discernable against the scale of regional recovery efforts and infrastructure rebuilding (much of which is focused on the levee systems and housing in the New Orleans MSA). Hence analysis is not detailed below for individual sites.

4.2.7 Gulf of Mexico Coastal Wetlands and Floodplains

The coastal areas along the Gulf of Mexico have lost more than 1.3 million acres of coastal wetlands associated with agricultural activities, land development, natural land subsidence, and erosive forces. Louisiana is experiencing the nation's highest rate of coastal wetland loss and represents about 80 percent of the wetland loss in the entire continental United States. Louisiana coastal areas have lost over 900,000 acres (364,217 hectares) of wetlands and associated floodplains since the 1930s. As recently as the 1970s, the loss rate for Louisiana coastal wetlands was as high as 25,600 acres (10,360 hectares) per year. The current rate of wetland loss is about 16,000 acres (6,475 hectares) per year. Studies estimate that Louisiana will experience a 320,000 acre (129,500 hectares) net loss of wetlands by the year 2050 (Louisiana Coast 2006).

Mississippi wetlands and floodplains have been under significant development pressure in recent decades. By the 1980s Mississippi had lost about 60 percent of its wetlands and floodplains due to agricultural activities and more recently, residential and commercial coastal development (MDEQ 2002).

The coastal wetlands of Texas also have come under similar pressures as Louisiana and Mississippi. The majority of the estuarine wetland loss in Texas has occurred in the Galveston Bay system according to the Galveston Bay Estuary Program report. The report attributes the accelerated loss of wetlands around Galveston Bay relative to the rest of Texas coast to subsidence induced by withdrawal of groundwater, oil, and gas. About 52 percent of the coastal freshwater wetlands have been lost due to agricultural activities and residential and commercial development (GBEP 1994).

The loss of Gulf Coast wetlands and floodplains and their associated functions/values increased the damage caused in the region by the 2005 hurricane season. Because of the importance of the wetlands and floodplains in the region and the potential direct effects of the proposed SPR expansion on those resources, the cumulative impact section concentrates on the biology and water issues of the region. DOE evaluated the potential direct and cumulative impacts to land use, environmental risks and health, air quality, socioeconomics, noise, and environmental justice for the various alternatives and concluded that there were no overlapping impacts of any consequence. The following sections describe the potential cumulative impacts associated with the proposed development of new and expanded SPR sites in combination with the potential impacts associated with other relevant activities that have occurred, are occurring, or may occur in the vicinity of the proposed new and expanded storage sites and their infrastructure. The potential cumulative impacts for each SPR new site and expansion site are discussed below. DOE evaluated and described the impact of each new SPR site and each expansion site separately because they are located within different ecoregions and watersheds. The selected alternative would actually include one new SPR site plus two or three expansion sites.

As presented above, table 4.2.7-1 presents a summary of the cumulative impacts by alternative for biological and water resources. The following sections discuss the cumulative impacts associated with each proposed new and expansion site.

Table 4.2.7-1: Summary of Cumulative Impacts by Alternative

Alternative*	Bruinsburg Alternative	Chacahoula Alternative	Richton Alternative	Stratton Ridge Alternative
Biological Resources	Cumulatively, up to 708 acres (286 hectares) of wetlands would be affected No cumulative impact on EFH Potential cumulative impact on the pallid sturgeon and fat pocketbook mussel**	Cumulatively, up to 2,502 acres (1013 hectares) of wetlands would be affected No cumulative impact on EFH Potential cumulative impact on the bald eagle and brown pelican**	Cumulatively, up to 1,157 acres (626 hectares) of wetlands would be affected No cumulative impact on EFH Potential cumulative adverse impacts on the gulf sturgeon, yellow blotched map turtle, and pearl darter**	Cumulatively, up to 841 acres (340 hectares) of wetlands would be affected No cumulative impact on EFH No cumulative impacts on threatened and endangered species**
Water Resources	No cumulative adverse impacts on water resources and floodplains	No cumulative adverse impact on water resources	Potential cumulative adverse impact on water resources during cavern drawdown	No cumulative adverse impacts on water resources

Notes:

*Each alternative includes the expansion of the three potential expansion sites.

**DOE would initiate formal Section 7 Consultation with the U.S. Fish and Wildlife Service and NOAA Fisheries if an alternative may adversely affect a listed species or designated critical habitat. DOE would prepare a Biological Assessment and implement conditions of the Biological Opinion, which would ensure that the cumulative impact of an alternative would not interfere with the continued viability of the species or adversely affect designated critical habitat.

4.3 BRUINSBURG STORAGE SITE AND ASSOCIATED INFRASTRUCTURE

4.3.1 Reasonably Foreseeable Activities On or Near the Bruinsburg Storage Site

In the area around the Bruinsburg site, agriculture and timber production have traditionally been and are still important economic and land use drivers. In addition, the hardwood forests in the area also provide hunting and fishing opportunities. The Grand Gulf nuclear power plant is located about 15 miles (24 kilometers) north of the SPR site. The region has extensive historic resources associated with the Civil War and the Natchez Trace Parkway.

There are no known proposed future uses of the proposed SPR site for other purposes, and the existing site-specific and adjacent land uses would likely continue into the future if the SPR site at Bruinsburg were not developed. The Grand Gulf nuclear power plant is planning for a second nuclear unit at the site, but the expansion would be built within the confines of the existing site.

No overlapping impacts exist between the storage site and the expansion of the nuclear power plant that the EIS could assess at this time. The cumulative potential impacts of the RWI and the nuclear power plant's water withdrawal are discussed below.

4.3.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Bruinsburg

The following activities are expected to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the Bruinsburg site (Johnston 2006; LADOT 2006; MDOT 2004; USACE 2006c).

Known Activity	Description
Grand Gulf Nuclear Power Plant expansion, 6 miles from raw water pipeline	The Grand Gulf nuclear station lies on a 2,100-acre site near Vicksburg. The site is wooded and contains two lakes. The plant has a 520-foot cooling tower. Plans have been submitted for a simplified boiling water reactor.
Lakes Casino Complex, northern end of the northwest branch of the crude oil pipeline near the Mississippi River	Construction of Lakes Vicksburg Casino Resort, including clearing and filling wetlands and other waters, concrete pile foundations, asphalt roadways, and parking areas for a casino, hotel, access road, parking garage and overflow parking area on 160 acres of land.
Groom Road widening, East Baton Rouge Parish, LA, 2 miles from crude pipeline	Removal of two-lane asphalt road and replacement with two-lane concrete road with turn lanes and sidewalks. No details available regarding potential wetlands effects. Does not appear to cross any perennial water bodies.
US 61 paving, Jefferson County, MS, beginning 2 miles from crude oil pipeline	Paving of US 61. Improvements are slated for the interchange at US 61 and Natchez Trace Parkway. No details available regarding potential wetlands effects.
LA 19, E. Baton Rouge Parish, 1 mile from crude oil pipeline	Widening of LA 19 from Lavey Lane to Twin Oak. No details available regarding potential wetlands effects. Does not appear to cross any perennial water bodies.

Notes:

1 foot = 0.30 meter; 1 mile = 1.609 kilometers; 1 acre = 0.404 hectare

4.3.3 Cumulative Impacts Discussion

4.3.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, wildlife and fish communities, including EFH and threatened and endangered species from the above-listed projects. The Lakes Casino Complex project was the only other project for which information on biological impacts was available.

The Bruinsburg alternative would require over 150 miles (245 kilometers) of ROW for pipeline and powerlines. The Lakes Vicksburg Casino Resort would be constructed on a 160-acre (65-hectare) parcel adjacent to the proposed raw water line near the Mississippi River. The casino parcel consists of about 48 acres (19 hectares) of wetlands and 112 acres (45 hectares) of active pastureland. Based on available information it appears that the construction and operation Bruinsburg alternative and the casino would have no cumulative adverse effects to EFH.

The projects listed in the table have the potential to affect wetland resources, including wetlands and floodplains, located in the Bruinsburg's ecoregion. The Bruinsburg storage site, associated facilities, and

ROW would affect 480 acres (194 hectares) of wetlands. Information about impacts for other projects in the same watershed was lacking, except for the proposed Lakes Casino Complex project, which would potentially impact 20 acres (8 hectares) of wetlands associated with the casino building and parking facilities.

The Bruinsburg alternative would include either two or three of the SPR expansion sites thereby increasing the cumulative impacts to wetlands and floodplains within the region. The cumulative impacts to wetlands associated with the Bruinsburg alternative and the expansion sites would increase from 703 acres (285 hectares) with two expansion sites and to 708 acres (287 hectares) with three expansion sites. The Bruinsburg alternative and the other projects in the area would have to secure regulatory permits and meet regulatory requirements for any impacts to wetlands and waters of the United States.

The regulatory permits for filling and affecting wetlands would require mitigation or compensation to ensure there is no net loss of wetlands within the project watershed. A combination of wetland and stream restoration, creation, or preservation in the watershed and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to mitigate for the impacts. The proposed Bruinsburg storage site would cause the clearing and filling of an ecologically important bald cypress forest. Therefore, DOE has determined that the Bruinsburg alternative and other planned or foreseeable projects would have a potentially adverse impact to wetlands. The adverse impact would be mitigated by compensation for impacts through wetland creation, restoration, preservation or use of a mitigation bank in accordance with the 404/401 permit.

The proposed Bruinsburg project may affect the pallid sturgeon (Federally endangered) and fat pocketbook mussell (Federally endangered). It is possible that the proposed water withdrawal from the Grand Gulf Power Plant may affect these species, but no information is available. If this site is selected for development, DOE would initiate formal Section 7 Consultation with the USFWS and NOAA Fisheries if the proposed Bruinsburg site may adversely affect these species. DOE would prepare a Biological Assessment and implement the conditions of the Biological Opinion. These actions would ensure that any cumulative impact did not adversely affect the species viability or designated critical habitat.

4.3.3.2 Water

DOE evaluated the potential cumulative impacts to water resources that include floodplains, surface water and groundwater in the Bruinsburg watershed. DOE concluded the Grand Gulf nuclear power plant expansion is the only other project that would have measurable effects to surface water and groundwater within the same watershed. Public information about impacts to floodplains and surface waters for the power plant expansion project is currently not available. It appears that the power plant expansion would require additional surface or groundwater for the cooling towers. The power plant withdraws groundwater under the influence of surface water from collector wells under the Mississippi River for a period of 4-5 years. The Bruinsburg alternative would withdraw about 50 mgd raw water directly from the Mississippi River. This represents less than 0.003 percent of the average flow in the river. A significant portion of the raw water used in the power plant cooling process is ultimately discharged back into the Mississippi River. Water would be lost during the cooling process but the percentage of water loss is not available for this EIS. Permits would be required for the Bruinsburg RWI and the power plant withdrawals, which would establish a minimum instream flow that could not be depleted. This would ensure that withdrawal rates would not pose adverse effects to surface water and groundwater resources. The Bruinsburg storage site, associated facilities, and ROW would affect about 273 acres (110 hectares) of 100-year floodplain and about 22 acres (9 hectares) of 500-year floodplain. The proposed Bruinsburg storage site is located in a predominantly undeveloped area that has numerous floodplains associated with the Mississippi River and Bayou Pierre, and their tributaries. No information was available to determine if the power plant would affect floodplains. DOE would comply with floodplain protection requirements of the local and state government. Therefore, DOE has determined that the Bruinsburg alternative and other planned or foreseeable projects in the region would not have a cumulative adverse impact to water resources or floodplains.

4.4 CHACAHOULA STORAGE SITE AND ASSOCIATED INFRASTRUCTURE

4.4.1 Chacahoula Storage Site

The salt dome at Chacahoula has historically been the site of extractive operations for production of hydrocarbons, brine, and sulfur. There is also evidence of historical oil and gas exploration and development on the south and northeast sides of the dome. Sulfur production occurred from 1955 to 1962 and 1967 to 1970 along the northeastern part of the dome. The Texas Brine Company operates three brine caverns in the south-central dome area. Infrastructure to support these operations includes roads, power lines, pipeline ROWs, well pads, and flood control levees. Areas have been filled or dredged to support these operations, resulting in alterations to the natural swamp habitat and hydrology. With the exception of the brining operations, there are presently no other activities on the dome. Other local activities include hunting, fishing, and tourism. There are no known proposed future uses of the proposed SPR site for other purposes, and the existing site-specific and adjacent land uses would likely continue into the future if the SPR site at Chacahoula were not developed.

4.4.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Chacahoula

The following activities are expected to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the Chacahoula site (Falgout 2006; CWPPRA 2006; USACE 2006b).

Known Activity	Description
Ring levee for Samson Contour, Lafourche Parish, LA, less than 1 mile from crude pipeline	Installation of board road and fill for a ring levee and culvert crossing for a drilling well, with 2 acres of bottomland hardwoods affected
Airport runway expansion, Clovelly, 2 miles from end of crude pipeline	Expansion of runway to 6,500 feet, including minor re-routing of levee. Project involves grading, but no dredging, and no wetlands will be affected
Penchant Basin Natural Resources Plan, Terrebonne Parish, LA, near the brine pipeline	Project may include rock and steel sheet-pile weirs, rock bank stabilization, dredging and marsh creation, and shell plugs, 140,000 acres
Grand Bayou hydrologic restoration, Lafourche Parish, LA, 5 miles from the crude pipeline	Installation of a major water control structure in Bayou Pointe au Chien and water control structures through the existing levee along the west side of the Grand Bayou, 16,000 acres
Little Lake shoreline protection and dedicated dredging near Round Lake, Lafourche Parish, LA, 5 miles from crude pipeline	Project includes 21,000 feet of shoreline protection constructed parallel to existing shoreline, and marsh creation along the Little Lake shoreline, 1,400 acres
Mississippi River reintroduction to Bayou Lafourche, Lafourche Parish, LA, 5 miles from the crude pipeline	Project features include a receiving intake structure at the point of diversion in the Mississippi River, a pump-siphon system, a discharge pond at Donaldsonville, modification of weir structures, bank stabilization, monitoring stations, and dredging of Bayou Lafourche, 85,000 acres
Mississippi River reintroduction to Barataria Basin, St. James Parish, LA, 5 miles from crude pipeline	Restoration strategy includes installing two siphons, gapping spoil banks, culverts, and plantings, 5,000 acres

Known Activity	Description
Delta building diversion at Myrtle Grove, Jefferson and Lafourche Parishes, 5 miles from crude pipeline	Installation of gated box culverts on Mississippi River, 416,000 acres
South Lake De Cade freshwater introduction, Terrebonne Parish, LA, 5 miles from the brine pipeline	Control structures, enlargement of Lapeyrouse Canal for controlled diversion of Atchafalaya River, outfall management structures, and installation of a rock dike along the shoreline, 1,700 acres
ICW bank restoration of critical areas, Terrebonne Parish, 1 mile from the brine pipeline	Restoration and stabilization of deteriorated channel banks with hard shoreline materials
North Lake Mechant landbridge restoration, Terrebonne Parish, LA, 1 mile from the brine pipeline	Creation of marsh using dredged material from Lake Mechant, planting of smooth cordgrass along shoreline, and repair of breeches formed by erosion and oilfield access canals, 7,600 acres

Notes:

1 foot = 0.30 meter; 1 mile = 1.609 kilometers; 1 acre = 0.404 hectare

4.4.3 Cumulative Impacts Discussion

4.4.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, wildlife and fish communities, including EFH, and threatened and endangered species from the above listed projects. The majority of the projects listed above consist of wetlands and waters of the United States restoration and protection activities initiated by the CWPPRA. The CWPPRA designs and constructs projects to preserve and restore Louisiana's coastal landscape. The USACE administers accounting and tracks project status of all CWPPRA projects. The projects listed above have restored, created, and preserved over 600,000 acres (240,000 hectares) of wetland and waters and associated wildlife habitat.

According to publicly available information, there are two known development projects in the vicinity of the Chacahoula alternative including the Ring Levee project (about 1 mile [1.6 kilometers] from the crude pipeline) and the Clovelly Airport runway extension (about 2 miles [3.2 kilometers] from the crude pipeline). The Ring Levee project would impact about 2 acres (1 hectare) of bottomland hardwood forest, and the Clovelly Airport project would not affect wetlands or waters of the United States but could affect the surrounding natural habitat where the expansion is planned.

The Chacahoula alternative and the Ring Levee project would potentially affect 2,504 acres (1,102 hectares) of wetlands, including clearing and filling of a bald cypress forest for the site storage area. The initial review of both the projects indicates that cumulative adverse effects to EFH would not result from construction and operation of the Chacahoula alternative. The Chacahoula alternative would affect about 1,067 acres (432 hectares) of EFH, most of which would be a temporary impact due to pipeline construction. The Chacahoula storage site area and proposed ROWs may affect the bald eagle, which is a Federally-threatened species that has been proposed for de-listing. The brown pelican, a Federally endangered species may be affected by the ROW for the crude oil pipeline to Clovelly. It is not known if the Ring Levee project may affect these species. DOE would initiate formal Section 7 Consultation if the project may adversely affect those species. DOE would prepare a Biological Assessment and implement any conditions of a Biological Opinion. These actions would ensure that the cumulative impact of the projects did not interfere with the continued viability of the species or adversely affect designated critical habitat.

Public information providing detailed wetland and waters of the U.S. impacts for the projects in the same watershed was not available, except for the proposed Ring Levee project, which would potentially affect

2 acres (1 hectare) of wetlands. Both the Chacahoula alternative and Ring Levee project would have to secure regulatory permits and meet regulatory requirements for impacts to wetlands and waters of the United States. Compensation for the wetland impacts would be required by the Section 404/401 permit before the actions were authorized.

The Chacahoula alternative would include either two or three of the SPR expansion sites, increasing the cumulative impacts to wetlands and floodplains within the region. The cumulative impacts to wetlands associated with the Chacahoula alternative and the expansion sites would increase from 2,497 acres (1,011 hectares) with two expansion sites and to 2,502 acres (1,013 hectares) with three expansion sites.

The regulatory permits for filling wetlands would require compensation or mitigation to ensure there is no net loss of wetlands in the project area watershed. A combination of wetland and stream creation, restoration, or preservation in the watershed and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to mitigate for wetland impacts. In addition, the number of wetland restoration and creation projects within the region far outnumbers the anticipated impacts from the proposed projects. DOE has determined that the Chacahoula alternative and other planned or foreseeable projects would have a cumulative adverse impact to wetland resources.

4.4.3.2 Water

DOE evaluated the potential cumulative impacts to water resources, which includes surface water, floodplains, and groundwater in the Chacahoula ecoregion. DOE concluded that the water-related projects within the project area include multiple stream and floodplain restoration projects, which would improve the water quality, and water resources in the ecoregion. Public information about other proposed projects that affect water resources and floodplains for the area are not available. The Chacahoula storage site and associated facilities would affect about 150 acres (61 hectares) of 100-year floodplain and the site is outside the 500-year floodplain. The floodplain in which the Chacahoula site is located extends over thousands of acres, and is part of the Louisiana Western Gulf Coastal Plain Province. DOE has determined that the Chacahoula alternative and the other planned or reasonably foreseeable projects would not have a cumulative adverse impact. The impacts from the Chacahoula site development would be mitigated by securing permits for the proposed filling or discharges to surface water and compensating for the permanent impacts to surface water bodies through the Section 404/401 permit process.

4.5 RICHTON STORAGE SITE AND ASSOCIATED INFRASTRUCTURE

4.5.1 Richton Storage Site

The Richton site currently consists of a slash pine plantation, overgrown fields (former timber stands and crops), forested, emergent, and open water wetlands, and an active chicken farm. The slash pine plantation consists of stands with ages varying between 10 to 20 years. The overgrown fields include portions of former slash pine timber stands and old cropland. Forested and emergent wetlands and open water are associated with a constructed pond located along the central portion of the western boundary. The town of Richton is about 1 mile (1.6 kilometers) from the site, and residential development is scattered near the site. While the area is not a historical oil and gas development area, there is an extensive network of oil and gas pipelines nearby. The Richton storage site and the locations of all its proposed ancillary facilities including Pascagoula were affected significantly by Hurricane Katrina.

While disturbed, the Richton site has no known proposed future uses other than SPR development or continued agricultural use. There has been discussion of use of the site for natural gas storage in past years, but there is no formal proposal for this project at the current time. The town of Richton is in close proximity to the site, and future residential development near the proposed SPR site is possible. The existing site-specific and adjacent land uses would likely continue into the future if the SPR site at Richton were not developed.

4.5.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Richton

The following activities are expected to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the Richton site (MDOT 2004).

Project	Description
SR 48 paving, Amite County, MS, following the crude pipeline for approximately 20 miles east of McComb	Paving of SR 48
US 98 widening, Pike County, MS, parallel and within 2 miles of the crude pipeline	Widening of highway for two additional lanes. No wetlands impact information is known at this time.
Shell marine Terminal	Shell has proposed constructing a LNG import marine terminal outside of the main port of Pascagoula, within 5 miles (8 kilometers) of Singing River Island.
DuPont Pascagoula Plant	The DuPont Pascagoula plant, located adjacent to the Chevron refinery, has proposed a major plant expansion project.

1 mile = 1.609 kilometers

An LNG import marine terminal and related facilities in Pascagoula, MS, has been proposed for construction and operation, and would be located within 5 miles (8 kilometers) of the tank farm that would be located on the former Naval Station on Singing River Island just outside of the main port of Pascagoula. A terminal and RWI on the Gulf of Mexico is proposed on the island. The Naval operations at Pascagoula have ceased and the property has been transferred to the state of Mississippi for future redevelopment. DOE could not identify specific details of the redevelopment at this time, but some cumulative impacts may arise because of DOE's and the State's future use of the property.

4.5.3 Cumulative Impacts Discussion

4.5.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, wildlife and fish communities, including EFH and threatened and endangered species from the above-listed projects. Two roadway projects parallel the crude oil pipeline for various distances. The SR 48 project follows the crude pipeline for approximately 20 miles (32 kilometers) and consists of repaving the road surface. No direct impacts to wetlands or other biological resources would likely result from the project construction. The US 98 project parallels the crude pipeline and is located about 2 miles (3.2 kilometers) from the Richton ROW. The US 98 roadway project consists of widening the existing road from two lanes to four lanes. No information concerning project impacts to biological resources was available at this date.

The Richton storage site, associated facilities, and ROWs would affect about 1,320 acres (534 hectares) of wetlands. The impacts associated with the above-referenced road improvement projects are unknown, but considering the project descriptions, it appears that impacts to biological resources would likely be minimal because the projects are following existing road ROW. The construction and operation of the Richton alternative would not adversely affect EFH. DOE determined that the Richton project may have a potential adverse effect on the gulf sturgeon (Federally threatened), the yellow blotched map turtle (Federally threatened), and the pearl darter (Federal candidate species) due to the possible impingement and entrainment of these fish by the Leaf River RWI and modification of the flow, water quality, and habitat in the Leaf River. The brine discharge pipeline would also cross designated critical habitat in the Mississippi Sound for the Gulf sturgeon. The proposed Pascagoula RWI would be located in designated critical habitat for the Gulf sturgeon. The proposed ROW may affect the gopher tortoise (Federally threatened) and the black pine snake (Federal candidate species). The Richton alternative may have a cumulative adverse effect on the Gulf sturgeon, pearl darter, and yellow blotched map turtle. No cumulative adverse effect would occur to other state or federally listed rare, threatened or endangered species or designated critical habitat. The US 98 widening project parallels the crude oil pipeline but does not cross the Leaf River. Therefore, it appears that the roadway project would not affect these special status species located in the project area. The DOE would prepare a Biological Assessment required by the ESA and implement recommendations of the Biological Opinion from the NOAA Fisheries and USFWS if the Richton alternative is selected. DOE would consult with these agencies who would establish the Minimum Instream Flow in the Leaf River, water withdrawal limitations, supplemental water sources, and appropriate intake velocities and mesh size for the RWI on the Leaf River. DOE has already modified the original conceptual plan for the Leaf River RWI to reduce the potential for impingement and entrainment and identified a supplemental water source in the Gulf of Mexico as part of the Richton alternatives to reduce potential adverse effects to the Gulf sturgeon, pearl darter, and yellow blotched map turtle.

The Richton alternative would include either two or three of the SPR expansion sites, increasing the cumulative impacts to wetlands and floodplains in the region. The cumulative impacts to wetlands associated with the Richton alternative and the expansion sites would increase from 1,551 acres (628 hectares) with two expansion sites and to 1,556 acres (630 hectares) with three expansion sites. Both the Richton alternative and US 98 roadway project would have to secure regulatory permits and meet regulatory requirements, including compensation for impacts to wetlands.

The regulatory permits for filling and affecting wetlands would require compensation to ensure there is no net loss of wetlands in the ecoregion. A combination of wetland and stream restoration in the watershed and use of authorized mitigation banks or in-lieu fees would be utilized by these projects to mitigate for impacts. DOE has determined that the Richton alternative and other planned or reasonably foreseeable projects may have a cumulative adverse impact on wetland resources. However, the impacts would be mitigated through the compensation process required by the Section 404/401 permit.

4.5.3.2 Water

DOE evaluated the potential cumulative impacts to water resources, which include surface water and groundwater in the Richton ecoregion. DOE concluded that the US 98 roadway widening project is the only other project in the area that would affect surface waters, mainly as a result of stream crossings. No public information concerning water resources within the US 98 project was available, but it appears that the roadway would cross six streams or drainage ways. The Richton alternative ROWs would cross about 67 water bodies most of which are in different watersheds. Most of these crossings would be considered a temporary impact because either directional drilling would be utilized or stream banks would be restored to preexisting conditions. DOE determined that the impact of the Leaf River RWI would have a potential adverse effect on the aquatic resources in the Leaf River during drawdown activities. The impact could be mitigated by conditions in the Stream Diversion and Use of Public Waters Permit from the Mississippi DEQ and CWA Section 404 permit, which would ensure the protection of the Minimum Instream Flow. DOE has also identified a supplemental water source (Gulf of Mexico) which could provide water during low flow conditions in the Leaf River. “These permit processes would consider utilization of Leaf River water by the upstream paper mill and power plant and downstream facilities (including the Chevron refinery) would also consider unpermitted removal of water for uses such as irrigation and livestock watering, and thereby consider cumulative effects of both upstream and downstream water usage.” The Richton storage site and associated facilities would affect about 49 acres (20 hectares) of 100-year floodplain and would be outside the 500-year floodplain. The area surrounding the proposed storage site and associated infrastructure consists of several floodplains associated with various streams mostly in the Pascagoula or Pearl River drainage basins. DOE has determined that the Richton alternative and the other planned or reasonably foreseeable projects may have a cumulative adverse impact on water resources.

4.6 STRATTON RIDGE STORAGE SITE AND ASSOCIATED INFRASTRUCTURE

4.6.1 Stratton Ridge Storage Site

Although mostly forested, the Stratton Ridge site has been disturbed by human activities. Most of the site is classified as evergreen forested wetlands with pockets of emergent wetlands and deciduous forest. Open fields associated with ROWs are evident in the area. Three areas of permanent and semi-permanent standing water with emergent vegetation are located on the proposed SPR site. Cattle and feral pigs roam throughout the site. The Stratton Ridge site includes pipeline ROWs for several oil, gas, and chemical/petrochemical plants and large power lines that run across the site's northeast corner. Agriculture is also a prominent local land use.

The proposed Stratton Ridge storage site is the last remaining major undeveloped area on the Stratton Ridge dome and there is some competition for this land for oil/gas development. There has been some discussion of use of the site as a future natural gas storage area. The Freeport LNG project is currently under construction on the Stratton Ridge salt dome, in close proximity to the proposed site of the DOE caverns. The natural gas storage cavern will be a major development in the area and will create cumulative site development changes with the potential SPR use.

4.6.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Stratton Ridge

The following projects are expected to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the Stratton Ridge site (TxDOT 2005; USACE 2006a).

Project	Description
SH 146 Expansion, Texas City, TX, crosses the crude pipeline	Construction of two-lane, southbound frontage road, and bridge across Dickinson Bayou along and parallel to existing two-lane portion of SH 146. Project would affect 1.3 acres of wetlands, and includes 10 acres of salt marsh habitat restoration as mitigation
I-45 expansion, Galveston County, TX, 1 mile from crude pipeline	Major upgrades to I-45, including widening to eight lanes and improved access ramps
SH 3 widening, Galveston County, TX, 1 mile from crude pipeline	Widening and re-surfacing of SH 3
Freeport LNG terminal, pipeline, and transfer facility	Construction of new marine terminal on Quintanna Island, a 9.6 mile (15.4 kilometers) pipeline, a transfer facility, and up to two LNG storage caverns.

Notes:

1 mile = 1.609 kilometers; 1 acre = 0.404 hectare

4.6.3 Cumulative Impacts Discussion

4.6.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, wildlife and fish communities, including EFH, and threatened and endangered species from the above listed projects. The projects located within the Stratton Ridge ecoregion include various roadway improvement projects and multiple USACE permit applications located near Texas City and Freeport. No detailed information of the USACE permits was available for this analysis.

The SH 146 Expansion project, which crosses the crude pipeline, is in Texas City and would affect 1.3 acres (0.5 hectares) of wetlands. Both the I-45 Expansion project and the SH 4 widening project would require upgrades and would potentially impact wetlands and other natural resources. The pipeline construction associated with the Freeport LNG facility would impact (temporary and permanent) 89.7 acres (35.6 hectares) of wetlands, would affect EFH, and would not affect any Federally-listed species. No other information concerning project impacts to natural resources is available to the public to date.

The Stratton Ridge storage site, associated facilities, and ROW would permanently impact about 613 acres (248 hectares) of wetlands and waters of the United States. The impacts associated with the other projects not previously described are unknown but considering the project descriptions it appears that impacts to natural resources would likely be minimal because the projects are following existing road ROWs. The Stratton Ridge alternative would have no adverse effect on EFH; therefore, there would be no cumulative impact. The proposed roadway projects would occur in developed areas of Texas City and follow existing ROWs and therefore it is unlikely they would affect the bald eagle and the Freeport LNG Project has no effect on the bald eagle. DOE determined that the Stratton Ridge storage site and ROWs may affect roosting and foraging habitat for the bald eagle. The bald eagle is Federally threatened, but is proposed for de-listing. DOE would initiate formal Section 7 Consultation with the USFWS if the project may adversely affect the species or designated critical habitat. DOE would prepare a Biological Assessment and implement conditions of a Biological Opinion. These actions would ensure that the cumulative impact of the projects did not interfere with the continued viability of the species or adversely affect designated critical habitat.

The SH 146 Expansion project would impact about 1 acre (0.4 hectares) of wetlands. According to the project permit, 10 acres (4 hectares) of salt marsh habitat restoration is proposed as mitigation. The Freeport LNG Project would impact 89.7 acres of wetland and would provide 111.3 acres (45 hectares) in wetland restoration or mitigation.

The Stratton Ridge alternative would include either two or three of the SPR expansion sites, increasing the cumulative impacts to wetlands and floodplains within the region. The cumulative impacts to wetlands associated with the Stratton Ridge alternative and the expansion sites would increase from 836 acres (338 hectares) with two expansion sites and to 841 acres (340 hectares) with expansion sites. The Stratton Ridge alternative and above-mentioned projects would have to secure regulatory permits and meet regulatory requirements for impacts to wetlands.

The regulatory permits for filling and affecting wetlands would require compensation to ensure there is no net loss of wetlands in the project watershed. A combination of wetland and stream restoration in the project vicinity and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to avoid cumulative adverse impacts. DOE has determined that the Stratton Ridge alternative and other planned or foreseeable projects would have a cumulative adverse impact on wetlands. However, the impacts would be mitigated through the wetland compensation plan.

4.6.3.2 Water

DOE evaluated the potential cumulative impacts to water resources that include surface water, floodplains, and groundwater in the Stratton Ridge area. The Stratton Ridge alternative would cross about 20 water bodies (mainly manmade channels through marshlands). The Stratton Ridge storage site and associated facilities would affect about 139 acres (56 hectares) of 100-year floodplain and about 186 acres (75 hectares) of 500-year floodplain. The floodplain surrounding the proposed storage site and associated infrastructure is large, extending over thousands of acres and is part of the San Jacinto-Brazos Coastal Basin. The above-referenced projects would have impacts to water resources in the project vicinity, but the cumulative impacts were not available. However, the projects would require a Section 404/401 permit and compensation for any permanent impacts to waters. Therefore, DOE has determined that the Stratton Ridge alternative and the other planned or reasonably foreseeable projects would not have a cumulative adverse impact on water resources.

4.7 BAYOU CHOCTAW EXPANSION SITE AND ASSOCIATED INFRASTRUCTURE

4.7.1 Bayou Choctaw Expansion Site

Bayou Choctaw is an existing SPR storage site. The extensive diversions and control structures added elsewhere to protect populated areas have made water levels at the site particularly uncertain. However, the existing SPR site is normally dry and protected from spring flooding by the site's flood control levees and pumps. The area surrounding the site is a fresh-water swamp, which includes substantial stands of bottomland hardwoods with interconnecting waterways. The original cypress wetlands at the SPR site was clear-cut long before SPR development began. The region has experienced widespread petroleum extraction activity. The Choctaw field was already a mature producer prior to the advent of SPR oil storage. Most of the wells in the area have been abandoned. Union Texas Petroleum operates seven hydrocarbon storage caverns and two brine caverns on the dome, closely interspersed with the SPR caverns.

As an existing SPR site, expansion of the Bayou Choctaw site would be a logical extension of activity. There are no known competing uses proposed for this site or in the adjacent area that would compete with or add to development of the site as SPR expansion. If the Bayou Choctaw site is not used for SPR expansion purposes, it is likely that the existing site would remain as is for the foreseeable future.

4.7.2 Cumulative Impacts Discussion

4.7.2.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, floodplains, wildlife and fish communities, including EFH, and threatened and endangered species from the Bayou Choctaw alternative. No expected activities were found to occur within close proximity to this alternative. However, the Bayou Choctaw expansion site would permanently affect 34 acres (14 hectares) of wetlands associated with the storage site expansion and upgrades.

The regulatory permits for filling and affecting wetlands would require compensation to ensure there is no net loss of wetlands in the project area. A combination of wetland and stream restoration, creation, and preservation within the watershed and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to avoid cumulative adverse effects. Therefore, DOE has determined that the cumulative effects to biological resources from the Bayou Choctaw expansion site and other planned or foreseeable projects would not be adverse.

4.7.2.2 Water

DOE evaluated the potential cumulative impacts to water resources, which include surface water and groundwater in the Bayou Choctaw ecoregion. No stream crossings or water body crossings would result from the alternative. Expansion of the Bayou Choctaw storage site and associated facilities would affect about 24 acres (9.7 hectares) of 100-year floodplain and would be outside the 500-year floodplain. The expansion site is located in the Louisiana portion of the Western Gulf Coastal Plain Province and is composed of the Mississippi River floodplain, which is extensive. Therefore, DOE has determined that the Bayou Choctaw expansion site would not have an adverse cumulative impact to water resources.

4.8 BIG HILL EXPANSION SITE AND ASSOCIATED INFRASTRUCTURE

4.8.1 Big Hill Expansion Site

Big Hill is an existing SPR storage site. The area surrounding the SPR expansion proposed site is primarily agricultural with rice and cattle grazing the two main land uses. The site is situated within a small area of industrial-use land with large areas of croplands and pastures to the north and west, and extensive marshlands to the south and southeast that stretch to the coast. Hunting and fishing occurs in the marsh areas. There are two historical liquid petroleum gas storage caverns just north of the proposed expansion area with access roads. Areas where brine has been either disposed of or spilled are void of vegetation. The area has water control structures including levees, and hunting, fishing, and fish and wildlife management activities occur nearby. Hurricane Rita had identifiable effects on the natural environment and infrastructure at the Big Hill site.

As an existing SPR site, expansion of the Big Hill site would be a logical extension of activity. There are no known competing uses proposed for this site or in the adjacent area that would compete with or add to development of the site as SPR expansion. If the Big Hill site is not used for SPR expansion purposes, it is likely that the existing site would remain as is for the foreseeable future.

4.8.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Big Hill

The following activities are expected to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the Big Hill site (Floyd Batiste 2006; TxDOT 2005; USACE 2006a).

Project	Description
Flood control improvements, Jefferson County, TX, near the crude pipeline	Flood control improvements to Green Pond Gully and Taylor Bayou, including regional detention and levee construction, channel improvements, and a diversion channel, affecting 700 acres of wetlands
FM 365 widening, Jefferson County, TX, 3 miles from crude pipeline	FM 365 widening, including a grade-separated intersection at W. Port Arthur Road and a grade-separated bridge at the UP railroad tracks
New land development along SR 73, Jefferson County, TX, 1 mile from crude pipeline	Construction of 81 new homes and a commercial development that includes a hotel, covering 50 acres. Impacts to wetlands are unknown

Notes:

1 mile = 1.609 kilometers; 1 acre = 0.404 hectare

4.8.3 Cumulative Impacts Discussion

4.8.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, floodplains, wildlife and fish communities, including EFH, and threatened and endangered species from the above-listed projects. Projects located within the Big Hill vicinity include a flood control project, the FM 365 Widening project, a residential/commercial development, and multiple USACE permits currently under review.

The flood control improvements to Green Pond Gully and Taylor Bayou are located in Jefferson County near the crude pipeline. The proposed project includes regional detention and levee construction, channel improvements, and a diversion channel, all of which would impact about 700 acres (283 hectares) of wetlands. The FM 365 widening, the new land development project and the multiple USACE permit applications could affect wetlands and other natural resources but details were not available to the public.

The Big Hill expansion site would potentially affect about 189 acres (77 hectares) of wetlands. The impacts associated with the above referenced projects include 700 acres (283 hectares) associated with the flood control improvements in Jefferson County. The remaining impacts are unknown but impacts to wetlands would be mitigated because the projects would be required to undergo the USACE Section 404/401 permitting process. The Big Hill expansion site would have no adverse effects on EFH or any state or federally listed rare, threatened or endangered species or designated critical habitat.

Both the Big Hill alternative and flood control improvement project would have to secure regulatory permits and meet regulatory requirements for impacts to wetlands and waters of the United States. The regulatory permits for filling and affecting wetlands would require compensation to ensure there is no net loss of wetlands in the project area watershed. A combination of wetland and stream restoration, creation, and preservation in the watershed and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to avoid cumulative adverse impacts. Therefore, DOE has determined that the Big Hill expansion site and other planned or foreseeable projects would not have a cumulative adverse impact to biological resources.

4.8.3.2 Water

DOE evaluated the potential cumulative impacts to water resources, which include surface and ground water in the Big Hill ecoregion. No information concerning the number of stream crossings that would result from the above referenced projects was available. The Big Hill expansion site ROWs would cross about 11 water bodies including open water, marsh, and the ICW. Most of these crossings would be considered a temporary impact because either directional drilling would be utilized or stream banks would be restored to preexisting conditions. Appropriate Section 404/401 permits would be secured for the impacts to waters. Expansion of the Big Hill storage site and associated facilities would affect about 11 acres (5 hectares) of 100-year floodplain and about 27 acres (11 hectares) of 500-year floodplain. The proposed Big Hill expansion site is located in a predominantly undeveloped, extensive floodplain system. Therefore, DOE has determined that the Big Hill expansion site and the other planned or reasonably foreseeable projects would not have a cumulative adverse impact to water resources.

4.9 WEST HACKBERRY EXPANSION SITE AND ASSOCIATED INFRASTRUCTURE

4.9.1 West Hackberry Expansion Site

West Hackberry is an existing SPR storage site. In addition to the SPR facilities, numerous canals and natural waterways bisect the area. The area surrounding the SPR site consists of marshland with natural ridges. The major historical land use of the area has been oil and gas exploration and development.

Exploration for oil began on the dome in 1902. Extensive exploration for sulfur also took place, but no records indicate that the dome was mined for sulfur. Olin Corporation and its predecessors have been producing brine since 1934. Hurricane Rita had identifiable effects on the natural environment and infrastructure at the West Hackberry site.

As an existing SPR site, expansion of the West Hackberry site would be a logical extension of activity. There are no known competing uses proposed for this site or in the adjacent area that would compete with or add to development of the site as SPR expansion. If the West Hackberry site is not used for SPR expansion purposes, it is likely that the existing site would remain as is for the foreseeable future.

4.9.2 West Hackberry Associated Infrastructure

No expected activities were found to occur within 5 miles (8 kilometers) of the onsite construction activities associated with the West Hackberry site. However the following LNG development activities were identified in the host Parishes of Cameron and Calcasieu: One LNG Terminal (Trunkline LNG) is operating in Calcasieu Parish and three FERC-approved LNG terminals are under development in Cameron Parish. The Trunkline LNG Terminal has been approved for expansion, and two of the LNG terminals that are under development in Cameron Parish have already applied to FERC for expansion; one of the applications has been approved by FERC. New pipelines are to be located at Hackberry, Cameron, and Calcasieu Parishes; other facilities include underground gas storage at Starks salt dome, Calcasieu Parish; and two natural gas storage caverns with associated distribution pipelines, Calcasieu Parish.

4.9.3 Cumulative Impacts Discussion

4.9.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, floodplains, wildlife and fish communities, including EFH, and threatened and endangered species from the ecoregion for the West Hackberry alternative. No expected activities were found to occur within the vicinity of this expansion site.

The West Hackberry expansion site would impact about 5 acres (2 hectares) of wetlands and waters of the United States. Expansion of the West Hackberry site would have no adverse effect on EFH or any state or federally listed rare, threatened or endangered species or critical habitat would result from construction and operation of the project.

The West Hackberry expansion site would have to secure Section 404/401 permits and meet regulatory requirements for impacts to wetlands.

The regulatory permits for filling and affecting wetlands would require compensation to ensure there is no net loss of wetlands in the project area. A combination of on-site wetland and stream restoration, creation, and preservation and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to avoid cumulative adverse impacts. Therefore, DOE has determined that the cumulative impacts to biological resources from the West Hackberry expansion site and other planned or foreseeable projects would not be adverse.

4.9.3.2 Water

DOE evaluated the potential cumulative impacts to water resources, which include surface water and groundwater in the West Hackberry ecoregion. No information concerning the number of stream crossings that would result from the above referenced projects was available. In addition, the expansion of the West Hackberry site would not affect any 100-year or 500-year floodplains. Therefore, DOE has determined that the cumulative impact to water resources, including surface water and groundwater from the West Hackberry ecoregion alternative and the other planned or reasonably foreseeable projects would not be adverse.

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Chapter 5. Irreversible and Irretrievable Commitment of Resources

This section describes the amounts and types of resources that would be irreversibly and irretrievably committed if the proposed expansion of the SPR is undertaken. The principal resource that would be would be committed to SPR expansion is the land that would be required for the construction and expansion of the proposed sites, pipeline ROWs, and marine terminals. Construction of storage caverns in the salt domes at the proposed new and expansion sites would also result in the irretrievable loss of the salt, which would be either discharged as brine to the Gulf of Mexico or disposed of by underground injection, and irretrievable use of the water needed to dissolve the salt. Additional water would be used during drawdown. Other resources that would be committed to the proposed new and expansion sites include construction materials (e.g., steel, concrete) and energy (e.g., electricity, fuel) used for construction and operation.

5.1 LAND RESOURCES

The amount of land that would be committed during construction of the proposed new and expansion sites would include land used for the SPR site construction, pipeline construction ROWs, RWI structure construction, tank farm, and other terminal construction, and, to a lesser extent, road construction. While not all the acreage required for SPR construction would actually be developed, standard security measures require that the entire site be enclosed in fencing. This would effectively preclude use of the fenced-in land for the duration of the operation.

The land required for proposed new and expansion site and pipeline construction would include both uplands and wetlands. Temporary easements would be required during pipeline construction, and permanent easements would be maintained for the pipeline ROWs. Permanent easement lands would be considered to be irretrievable resources. Temporary easement lands would not ordinarily be considered as irretrievable resources; however, impacts to temporary easement lands during construction would be degraded for the duration of the SPR operation. The total acreage that would be committed for each proposed new and expansion site, including both temporary and permanent easements, is shown in table 5.1-1, and the total acreage that would be committed for each alternative is shown in table 5.1-2. (See chapter 2 for more information on the alternatives). The land area of the temporary easements for pipeline construction would be approximately 50 percent of the total area of the crude oil, brine, and raw water pipeline ROWs.

For the Bayou Choctaw and Big Hill sites, the land required for expansion would be the same regardless of the additional storage capacity and number of additional storage caverns. The West Hackberry site would either be expanded through acquisition of three existing storage caverns or not expanded at all. The total area of the West Hackberry site shown in tables 5.1-1 and 5.1-2 includes the disturbed areas and buffer for the proposed expansion but does not include an additional 240 acres (97 hectares) of land adjacent to the existing West Hackberry site that would be purchased by DOE but not developed.

Table 5.1-1: Commitment of Land for Proposed New and Expansion SPR Sites (acres)

Site	MMB	SPR Site Construction and Buffer	Terminal, Pump Station, and Tank Farm	RWI Structure and Security Buffer	Power Line ROW	Crude Oil Pipeline ROW	Brine Pipeline ROW	Brine Injection Well Area	Raw Water Pipeline ROW	Access Road Area	Total Land Area
Bayou Choctaw	20	0	0	0	0	0	7	96	0	2	105
Big Hill	96	206	0	0	0	278	16	0	0	0	500
	80	206	0	0	0	278	16	0	0	0	500
Bruinsburg	160	365	141	16	194	1,742	214	73	7	47	2,795
Chacahoula	160	320	0	16	382	899	553	0	28	15	2,213
Richton	160	350	116	16	201	3,060	0	0	56	10	3,778
Stratton Ridge	160	371	39	16	45	911	9	0	125	4	1,505
West Hackberry	0	0	0	0	0	0	0	0	0	0	0
	15	81	0	80	0	0	0	0	0	0	81

Notes:

1 acre = 0.405 hectare

Table 5.1-2: Commitment of Land for Proposed New and Expansion SPR Alternatives (acres)

Alternative	SPR Site Construction and Buffer	Terminal, Pump Station, and Tank Farm	RWI Structure	Power Line ROW	Crude Oil Pipeline ROW	Brine Pipeline ROW	Brine Injection Well Area	Raw Water Pipeline ROW	Access Road Area	Total Land Area
Bruinsburg w/3 Expansion Sites	652	141	16	194	2,020	237	169	7	49	3,485
Bruinsburg w/2 Expansion Sites	571	141	16	194	2,020	237	169	7	49	3,405
Chacahoula w/3 Expansion Sites	607	0	16	382	1,177	576	96	28	17	2,999
Chacahoula w/2 Expansion Sites	526	0	16	382	1,177	576	96	28	17	2,818
Richton w/3 Expansion Sites	637	116	16	201	3,338	23	96	56	12	4,495
Richton w/2 Expansion Sites	556	116	16	201	3,338	23	96	56	12	4,414
Stratton Ridge w/3 Expansion Sites	658	39	16	45	1,189	32	96	125	6	2,206
Stratton Ridge w/2 Expansion Sites	577	39	16	45	1,189	32	96	125	6	2,125
No Action	0	0	0	0	0	0	0	0	0	0

Notes:

1 acre = 0.405 hectare

5.2 WATER RESOURCES

There are three primary uses of water during site construction and operation: cavern leaching, cavern fill, and drawdown. Water used for both leaching and drawdown would be discharged or disposed of as brine into a different waterbody from the source. Such water use would be considered an irretrievably committed resource for each of the proposed new and expansion sites. No significant water resources would be required for construction of the pipelines or terminals or for SPR operations other than fill and drawdown. Leaching requires a volume of water equal to approximately seven times the potential storage capacity of the leached cavern, in other words, seven barrels of water would create storage capacity for one barrel of oil. In the case of the Richton alternatives, this 7:1 ratio may be higher if salt water from the Gulf of Mexico is used for solution mining. Quantities of water that would be required for leaching storage caverns for each site and for each alternative are shown in table 5.2-1 and table 5.2-2. Storage cavern fill and drawdown cycles require a water volume approximately equal to the displaced volume of oil (i.e., one barrel of water/one barrel of oil). Water requirements for fill/withdrawal for each alternative are also shown in table 5.2-1 and table 5.2-2, assuming five drawdown/fill cycles over the operating life of each proposed new and expansion SPR site.

5.3 MATERIAL AND ENERGY RESOURCES

Material and energy resources committed for development of the SPR expansion sites would include construction materials (e.g., steel and concrete), electricity, fuel (e.g., diesel and gasoline), salt, and crude oil through evaporation losses during cavern fill, storage, and drawdown. All energy used during construction and operation would be irretrievable. Relative to the potential energy stored in the form of crude oil in the caverns, the energy consumed during construction and operation would be very small. In addition, the amount of crude oil lost to evaporation during fill, storage, and drawdown would be small.

The amount of construction materials used in constructing the proposed new and expansion SPR sites would also be small as compared to overall consumption of construction materials.

Salt, which is potentially economically valuable, would be leached from the caverns and disposed of as brine and its economic value would be irreversibly lost. Although salt is an inexhaustible resource found in sea water, its economic value is higher when the salt is in a concentrated form, such as in a salt dome. The amount of salt lost during cavern leaching would have a volume equal to the storage capacity of the oil storage caverns. The volume of salt that would be lost during leaching may be estimated from the cavern volume using an average density of 2.16 grams per cubic centimeter (135 pounds per cubic foot). For a single 10 MMB storage cavern, the volume of salt is equivalent to 3.4 million metric tons (3.7 million short tons) of salt, which is equivalent to approximately 7% of annual U.S. salt production (USGS 2006b). For any of the alternatives, the amount of salt lost would be approximately 95 million metric tons (105 million short tons).

While there is a potential economic value in any salt that would be lost through cavern development, the salt that would be lost at the Stratton Ridge would represent a real economic loss because the Dow Chemical Company uses salt from the Stratton Ridge salt dome in chemical manufacturing. The salt that would be removed from the dome through SPR development and disposed of as brine would not be available for use as a raw material in chemical manufacturing. Although the economic value of a given amount of salt is theoretically the same for any of the new and expansion sites, the other sites do not have existing infrastructure in place to use the salt, and such infrastructure would need to be constructed to realize the economic value of the salt. Therefore, the potential to realize the economic value of the salt is lower for the other sites than for the Stratton Ridge site.

Table 5.2-1: Water Required for Construction and Operation of Proposed New and Expansion SPR Sites (MMB)

Site	Capacity	Leaching	Fill/Withdrawal	Total
Bruinsburg	160	1,120	800	1,920
Chacahoula	160	1,120	800	1,920
Richton	160	1,120*	800	1,920
Stratton Ridge	160	1,120	800	1,920
Bayou Choctaw	20	140	100	240
Big Hill	96	672	480	1,152
	80	560	400	960
West Hackberry	0	0	0	0
	15	0	75	75

*Would be higher if salt water from the Gulf is used due to withdrawal limitations in the Leaf River.

Table 5.2-2: Water Required for Construction and Operation of SPR Expansion Alternatives (MMB)

Alternative	Capacity	Leaching	Fill/Withdrawal	Total
Bruinsburg w/3 Expansion Sites	275	1,820	1,375	3,195
Bruinsburg w/2 Expansion Sites	276	1,932	1,380	3,312
Chacahoula w/3 Expansion Sites	275	1,820	1,375	3,195
Chacahoula w/2 Expansion Sites	276	1,932	1,380	3,312
Richton w/3 Expansion Sites	275	1,820	1,375	3,195
Richton w/2 Expansion Sites	276	1,932	1,380	3,312
Stratton Ridge w/3 Expansion Sites	275	1,820	1,375	3,195
Stratton Ridge w/2 Expansion Sites	276	1,932	1,380	3,312
No-Action	0	0	0	0

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Chapter 6. List of Preparers

6.1 DEPARTMENT OF ENERGY OFFICE OF PETROLEUM RESERVES

Donald Silawsky	Document Manager DOE Office of Petroleum Reserve

6.2 CONTRACTORS

ICF International and its subcontractors were responsible for supporting the Department of Energy in conducting its environmental analysis and preparing the EIS.

Name, Firm, Project Function	**Qualifications/Experience**
Project Management	
Alan Summerville, ICF International Project Manager	M.A., City Planning; B.A., Economics and Political Science 15 years of experience participating in and managing the preparation of EISs and EAs
Todd Stribley, ICF International Deputy Project Manager	M.S., Environmental Science and Policy; B.S., Biology 11 years of experience supporting environmental projects
Stephen Wyngarden, ICF International Technical Guidance	M.E.M., Environmental Management; B.S., Applied Biology 15 years of experience in human health and environmental impact assessment, waste management, and environmental policy analysis
Michael Berg, ICF International Document Manager	J.D., Law; M.P.P., Public Policy; B.A., Economics/Political Science 24 years of experience managing and conducting economic, policy, scientific, and other technical analyses
Technical and Other Expertise (alphabetically)	
Lisa Bendixen, ICF International Environmental Risk and Health and Safety	S.M., Operations Research; S.B., Applied Mathematics 25 years of experience in risk assessment for safety and spills/releases from fixed facilities and transportation systems, and NEPA
Henry Camp, ICF International Engineering Interface	B.A., Biology 21 years of experience in environmental analysis, environmental impact assessment, and NEPA documentation
Ed Carr, ICF International Air Quality	M.S., Atmospheric Science 19 years experience in air quality assessments and analysis, source assessment impact analysis, and State Implementation Planning

Name, Firm, Project Function	Qualifications/Experience
Joshua Cleland, ICF International Biological Resources (special status species)	M.E.M., Resources Economics and Policy; B.S., Biology 14 years of experience in risk and environmental assessment
David E. Coate, David Coate Consulting Noise	M.S., Energy Technology; B.A., Mathematics, Chemistry and Physics 27 years experience in acoustics, noise and vibration control
Karen Fadely, ICF International Biological Resources	M.E.M., Conservation Science and Policy; B.S., Biology 5 years of experience in environmental sciences and communication
Ian G. Frost, EEE Consulting, Inc. Biological Resources, Water Resources, Wetlands	M.S., Zoology; B.S., Zoology 22 years experience in water resource and biological studies, NEPA documents, and wetlands
Erin Healy, ICF International Water Resources	M.S., Marine Science; B.A., Geology/Biology 18 years experience in environmental assessment, water resources, and hazardous materials
Michelle Rome Moser, ICF International Biological Resources, Document Production	M.S., Biological Sciences; Sc.B., Environmental Sciences 5 years of experience in biological studies and environmental regulatory analysis
Walter Palmer, ICF International Water Resources	M.S., Environmental Management; B.S. Biology/Chemistry 28 years of experience in environmental management and environmental impact assessment
Ami Parekh, ICF International Water Resources	M.P.H., Environmental Health; B.A., Geology 4 years of experience in environmental site assessments, water resources, and human health risk assessments
Polly Quick, ICF International Cultural Resources	Ph.D., Anthropology; M.A., Anthropology; B.A., Anthropology 30 years of experience in cultural resource management, anthropology environmental planning for development, social impact assessment, and indigenous community consultation
Robert Randall, Consultant Brine Discharge Modeling	Ph.D. Ocean Engineering, M.S., Ocean Engineering, B.M.E., Mechanical Engineering 30 years of experience in ocean and civil engineering
Richard M. Stanwood, ICF International Land Use, Socioeconomics	M.S., Economics; B.A., Psychology 25 years of experience in socioeconomics, land use, environmental impact analysis, and NEPA documentation

Name, Firm, Project Function	Qualifications/Experience
Carter M. Teague, EEE Consulting, Inc. Biological Resources, Water Resources, Wetlands	B.S., Natural Resources 8 years experience in water resource and biological studies and environmental permitting
Nathan Wagoner, ICF International Document Management	M.S., Human Dimensions of Ecosystem Science and Management; B.S., Natural Resources Policy and Planning 3 years of experience in environmental analysis
Hova Woods, ICF International Environmental Justice, Public Involvement	M.P.A., Environmental Management; B.S., Finance 5 years of experience in NEPA environmental analyses, environmental regulatory analysis, and environmental management
Gary Yoshioka, ICF International Accidental Releases	Ph.D., Geography and Environmental Engineering; J.D., Law; B.S., Mathematics 38 years of experience in environmental research, environmental regulatory analysis, and oil spill data analysis
Elizabeth Zelasko, ICF International Biological Resources	M.S.E.S., M.P.A. Environmental Policy and Natural Resource Management; B.S., Biology 3 years of experience in environmental analysis and documentation
Lianyang Zhang, ICF International Geology and Soils	Ph.D., Geotechnical Engineering; M.S., Civil and Environmental Engineering; B.S., Naval Architecture and Ocean Engineering 16 years of experience in geotechnical and geoenvironmental engineering, rock mechanics, and earthquake engineering

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Chapter 7. List of Agencies, Organizations, and People Receiving Copies of the Final Environmental Impact Statement

This section lists the agencies, officials, and other interested parties who are receiving the final EIS on the proposed expansion of the Strategic Petroleum Reserve.

When the final EIS was issued, DOE filed copies with EPA, who published a Notice of Availability of the final EIS in the *Federal Register*. DOE also distributed paper copies of the final EIS to federal agencies, key state agencies, elected officials, local libraries, those who commented on the draft EIS, and any other requesting parties. Additional summaries of the final EIS were sent to the remaining interested parties. All recipients of the paper copies and the summaries also received a CD-ROM of the final EIS unless they requested otherwise. The following sections list state and federal agencies, tribal entities, elected officials, and other interested parties who received the final EIS or summary. (Chapter 7 of the draft EIS was limited to those receiving the paper copy of the draft EIS). DOE will provide copies to other interested organizations or individuals on request.

7.1 FEDERAL AGENCIES

- Advisory Council on Historic Preservation
- Federal Aviation Administration, Office of Commercial Space Transportation
- Federal Emergency Management Agency, Department of Homeland Security
- Minerals Management Service
- National Ocean Service, Office of Ocean and Coastal Resource Management
- National Park Service
- NOAA Fisheries
- U.S. Army Corps of Engineers
- U.S. Coast Guard
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service
- U.S. Department of the Interior (DOI), Office of Environmental Policy and Compliance
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Forest Service

7.2 STATE AGENCIES

7.2.1 Louisiana

- Louisiana Department of Agriculture and Forestry
- Louisiana Department of Environmental Quality
- Louisiana Department of Health and Hospitals
- Louisiana Department of Natural Resources
- Louisiana Department of Transportation and Development
- Louisiana Department of Wildlife and Fisheries
- Louisiana Division of Historic Preservation
- Louisiana Oil Spill Coordinator’s Office

7.2.2 Mississippi

- Grand Gulf Military Park
- Mississippi Department of Archives and History
- Mississippi Department of Environmental Quality

- Mississippi Department of Marine Resources
- Mississippi Department of Transportation
- Mississippi Department of Wildlife, Fisheries, and Parks
- Mississippi Development Authority

7.2.3 Texas

- Railroad Commission of Texas
- Southeast Texas Regional Planning Commission
- Texas Association of Regional Councils
- Texas Commission on Environmental Quality
- Texas Department of Highways and Public Transportation
- Texas General Land Office
- Texas Health and Human Services Commission
- Texas Historical Commission
- Texas Parks and Wildlife Department
- Texas State Health Services
- Texas State Soil and Water Conservation Board
- Texas Water Commission
- Texas Water Development Board

7.3 TRIBAL GOVERNMENTS

- Alabama-Coushatta Tribes of Texas, Livingston, TX
- Biloxi-Chitimacha Confederation of Muskogees, Zachary, LA
- Chickasaw Nation of Oklahoma, Ada, OK
- Chitimacha Tribe of Louisiana, Charenton, LA
- Choctaw Nation of Oklahoma, Durant, OK
- Comanche Nation, Oklahoma, Lawton, OK
- Coushatta Tribe of Louisiana, Elton, LA
- Jena Band of Choctaw Indians, Jena, LA
- Mississippi Band of Choctaw Indians, Philadelphia, MS
- Point au Chien Tribe, Montegut, LA
- Quapaw Tribe of Indians Business Committee, Quapaw, OK
- Tonkawa Tribe of Indians of Oklahoma, Tonkawa, OK
- Tunica-Biloxi Indian Tribe of Louisiana, Marksville, LA
- United Houma Nation, Golden Meadow, LA

7.4 COUNTY AND LOCAL GOVERNMENT

7.4.1 Louisiana

- Calcasieu Parish Office of Homeland Security and Emergency Preparedness
- Calcasieu Parish Planning and Development
- Cameron Parish Health Services
- Cameron Parish Office of Emergency Preparedness
- Greater Lafourche Port Commission
- Iberville Parish Office of Emergency Preparedness
- Iberville Parish Parks and Recreation
- Iberville Parish Permit and Inspection Department
- Iberville Parish Planning Commission

- Lafourche Parish Department of Coastal, Energy, and Environment
- Lafourche Parish Department of Public Works
- Lafourche Parish Emergency Preparedness Office
- Lafourche Parish Parks, Recreation, and Public Facilities
- Terrebonne Coastal Zone Management
- Terrebonne Parish Consolidated Government
- Terrebonne Parish Economic Development Authority
- Terrebonne Parish Tree Board
- West Baton Rouge Parish Office of Planning and Zoning

7.4.2 Mississippi

- Claiborne County Administration
- Claiborne County Emergency Coordinator
- Claiborne County Planning Department
- Hattiesburg Area Development Partnership
- Hattiesburg Public Services Department
- Hattiesburg Office of Urban Development
- Jackson County Chamber of Commerce
- Jackson County Emergency Communications District
- Jackson County Planning Department
- Jackson County Port Authority, Port of Pascagoula
- Lincoln County Chamber of Commerce
- Lincoln County Emergency Coordinator
- Pascagoula Office of the City Manager
- The Area Development Partnership

7.4.3 Texas

- Brazoria County Economic Development Alliance
- Brazoria County Office of Emergency Management
- Brazoria County Parks Department
- Brazosport Area Chamber of Commerce
- Houston-Galveston Area Council
- Galveston County Office of Emergency Management
- Galveston County Public Information Office
- Jefferson County Emergency Management Office
- Jefferson County Environmental Control
- Port of Freeport

7.5 ELECTED OFFICIALS

7.5.1 Congressional Committees

7.5.1.1 Senate

- Committee on Appropriations, Chairman, Senator Thad Cochran, Mississippi
- Committee on Appropriations, Ranking Minority Member, Senator Robert C. Byrd, West Virginia
  - Subcommittee on Energy and Water Development, Chairman, Senator Pete V. Domenici, New Mexico

  - Subcommittee on Energy and Water Development, Ranking Minority Member, Senator Harry Reid, Nevada
- Committee on the Budget, Chairman, Senator Judd Gregg, New Hampshire
- Committee on the Budget, Ranking Minority Member, Senator Kent Conrad, North Dakota
- Committee on Energy and Natural Resources, Chairman, Senator Pete V. Domenici, New Mexico
- Committee on Energy and Natural Resources, Ranking Minority Member, Senator Jeff Bingaman, New Mexico

7.5.1.2 House of Representatives

- Committee on Appropriations, Chairman, Representative Jerry Lewis, 41st district, California
- Committee on Appropriations, Ranking Minority Member, Representative David R. Obey, 7th district, Wisconsin
  - Subcommittee on Energy and Water Development, Chairman, Representative David L. Hobson, 7th district, Ohio
  - Subcommittee on Energy and Water Development, Ranking Minority Member, Representative Peter J. Visclosky, 1st district, Indiana
- Committee on the Budget, Chairman, Representative Jim Nussle, 1st district, Iowa
- Committee on the Budget, Ranking Minority Member, Representative John Spratt, 5th district, South Carolina
- Committee on Energy and Commerce, Chairman, Representative Joe L. Barton, 6th district, Texas
- Committee on Energy and Commerce, Ranking Minority Member, Representative John D. Dingell, 15th district, Michigan
  - Subcommittee on Energy and Air Quality, Chairman, Representative Ralph M. Hall, 4th district, Texas
  - Ranking Minority Member, Representative Rick Boucher, 9th district, Virginia

7.5.2 Louisiana

7.5.2.1 Federal

- Representative Richard Baker, 6th District, LA
- Representative Charles W. Boustany, Jr., 7th District, LA
- Senator Mary Landrieu, LA
- Representative Charlie Melancon, 3rd District, LA
- Senator David Vitter, LA

7.5.2.2 State

- Governor Kathleen Babineaux Blanco, LA
- Representative Damon J. Baldone, Louisiana State House of Representatives
- Senator Joel Chiasson, Louisiana State Senate
- Representative Carla Blanchard Dartez, Louisiana State House of Representatives
- Representative Gordon Dove, Sr., Louisiana State House of Representatives
- Senator Reggie P. Dupre, Jr., Louisiana State Senate
- Representative Mickey Frith, Louisiana State House of Representatives
- Senator D.A. Gautreaux, Louisiana State Senate
- Representative Karen Gaudet St. Germain, Louisiana State House of Representatives
- Senator Robert Marrionneaux, Louisiana State Senate
- Representative Loulan J. Pitre, Jr., Louisiana State House of Representatives
- Representative Roy J. Quezaire, Jr., Louisiana State House of Representatives

- Senator Gerald J. Theunissen, Louisiana State Senate
- Representative Warren J. Triche, Jr., Louisiana State House of Representatives

7.5.2.3 Local

- Curtis Anderson, Council, District 5, West Baton Rouge Parish, LA
- Donnis Bell, Sr., Constable, Ward 6, Calcasieu Parish, LA
- Ralph Bergeron, City Council, District 3, Port Allen, LA
- James Bernauer, Mayor, Patterson, LA
- Riley Berthelot, Jr., President, West Baton Rouge Parish, LA
- Roland Bertrand, Constable, Ward 2, Calcasieu Parish, LA
- Sheila Bourdreaux, Council Clerk, Lafourche Parish, LA
- Carroll P. Bourgeois, Mayor, Addis, LA
- Herman Bourgeois, Mayor, Gramercy, LA
- Joey Bouziga, Mayor, Golden Meadow, LA
- Nolan J. Broussard, Constable, Ward 1, Cameron Parish, LA
- Orgy Broussard, Constable, Ward 8, Calcasieu Parish, LA
- Huey Brown, Council, District 6, West Baton Rouge Parish, LA
- Maurice A. Brown, Mayor, White Castle, LA
- Charles Caillouet, Mayor, Thibodaux, LA
- Brent Callais, Council, District 8, Lafourche Parish, LA
- Harlan Cashiola, Council, District 7, West Baton Rouge Parish, LA
- Richard Champagne, Mayor, Lockport, LA
- Michael Chauffe, Mayor, Grosse Tete, LA
- Gwen S. Constance, Constable, Ward 6, Cameron Parish, LA
- Hilda Curry, Mayor, New Iberia, LA
- Jeff Duhon, Constable, Ward 7, Calcasieu Parish, LA
- Daniel J. East, Constable, Ward 2, Cameron Parish, LA
- Tommy Eschete, City Council Administrator, Thibodaux, LA
- Rayward Fremin, Jr., Council, District 3, Iberia Parish, LA
- E.R. Giles, Mayor, Lake Arthur, LA
- George Grace, Mayor, St. Gabriel, LA
- Mark A. Gulotta, Mayor, Plaquemine, LA
- Emmet Hardaway, Mayor of Berwick, LA
- Raymond Harris, Jr., Mayor, Franklin, LA
- Melvin Holden, Mayor, Baton Rouge, LA
- Earnestine Horn, Policy Jury, Parish Administrator, Cameron Parish, LA
- Johnny Johnson, City Council, District 4, Port Allen, LA
- Larry Johnson, Council, District 8, West Baton Rouge Parish, LA
- Jeff “Petit” Kershaw, Council, District 2, West Baton Rouge Parish, LA
- Ray Helen Lawrence, City Council, District 1, Port Allen, LA
- Dantin Leblanc, Council, District 4, West Baton Rouge Parish, LA
- Derek A. Lewis, Mayor, Port Allen, LA
- Daniel Lorraine, Council, District 9, Lafourche Parish, LA
- R.J. Loupe, Jr., Mayor Pro-tem, Port Allen, LA
- Michael Matherne, Council Chairman, Lafourche Parish, LA
- Tim Matte, Mayor, Morgan City, LA
- Hal McMillin, Police Jury, President, Calcasieu Parish, LA
- S. Mark McMurry, Police Jury, Parish Administrator, Calcasieu Parish, LA
- Brandon Mellieon, City Inspector, Plaquemine, LA
- Louis Michiels, Sr., Constable, Ward 1, Calcasieu Parish, LA

- Nicholas P. Migliacio, Council, District 9, Iberville Parish, LA
- Randal Mouch, Council, District 1, West Baton Rouge Parish, LA
- Betty Nelson, Council, District 8, West Baton Rouge Parish, LA
- Joey Normand, Mayor, Brusly, LA
- J. Mitchell Ourso, Jr., President, Council, Iberville Parish, LA
- Troas Poche, Mayor, Lutcher, LA
- Charlotte Randolph, President, Lafourche Parish, LA
- Hugh Riviere, City Council, District 2, Port Allen, LA
- Randy Roach, Mayor, Lake Charles, LA
- Nolton Saltzman, Constable, Ward 3, Cameron Parish, LA
- Don Schwab, Council President, Terrebonne Parish, LA
- Randy Sexton, Council, District 11, Iberville Parish, LA
- Arnold L. Smith, Constable, Ward 5, Calcasieu Parish, LA
- John P. Stephenson, Constable, Ward 4, Cameron Parish, LA
- Leroy Sullivan, Mayor, Donaldsville, LA
- Wayne Thibodeaux, Council, District 2, Terrebonne Parish, LA
- Steve Trahan, President, Police Jury, District 2, Cameron Parish, LA
- Tim Trahan, Constable, Ward 5, Cameron Parish, LA
- Keith Washington, Council, District 3, West Baton Rouge Parish, LA

7.5.3 Mississippi

7.5.3.1 Federal

- Senator Thad Cochran, MS
- Senator Trent Lott, MS
- Representative Charles W. “Chip” Pickering, Jr., 3rd District, MS
- Representative Gene Taylor, 4th District, MS
- Representative Bennie Thompson, 2nd District, MS
- Representative Roger Wicker, 1st District, MS

7.5.3.2 State

- Governor Haley Barbour, MS
- Representative Billy Broomfield, Mississippi State House of Representatives
- Secretary Eric Clark, Mississippi Secretary of State
- Representative Daniel D. Guice, Jr., Mississippi State House of Representatives
- Representative Frank Hamilton, Mississippi State House of Representatives
- Representative Gregory L. Holloway, Sr., Mississippi State House of Representatives
- Representative Robert L. Johnson III, Mississippi State House of Representatives
- Senator Thomas E. King, Jr., Mississippi State Senate
- Senator Ezell Lee, Mississippi State Senate
- Assistant Secretary Gerald McWhorter, Mississippi Secretary of State Office
- Representative America “Chuck” Middleton, Mississippi State House of Representatives
- Senator T.O. Moffat, Mississippi State Senate
- Senator J. Edward Morgan, Mississippi State Senate
- Senator Lynn Posey, Mississippi State Senate
- Representative John O. Read, Mississippi State House of Representatives
- Senator Thomas E. Robertson, Mississippi State Senate
- Representative J. Shaun Walley, Mississippi State House of Representatives
- Representative Carmel Wells-Smith, Mississippi State House of Representatives

- Representative Henry B. Zuber III, Mississippi State House of Representatives

7.5.3.3 Local

- Seren Ainsworth, Mayor, Ocean Springs, MS
- John Anderson, Board of Supervisors, Perry County, MS
- Amelda Arnold, Mayor, Port Gibson, MS
- Matthew J. Avara, Mayor, Pascagoula, MS
- Manly Barton, President, Board of Supervisors, Jackson County, MS
- Xavier Bishop, Mayor, Moss Point, MS
- Bobby Bolton, Board of Supervisors, Perry County, MS
- William Brooks, Mayor, Leakesville, MS
- Tim Broussard, Board of Supervisors, District 3, Jackson County, MS
- Allen Burks, Board of Supervisors, Claiborne County, MS
- Linda Carroll, Assessor/Collector, Perry County, MS
- Martha Clark, Circuit Court Clerk, Perry County, MS
- William Cooley, Board of Supervisors, Perry County, MS
- Chad Cornett, Board of Supervisors, Hattiesburg, MS
- Johnny L. DuPree, Mayor, Hattiesburg, MS
- Albert Garner, Mayor, New Augusta, MS
- Prentiss Garner, Board of Supervisors, Perry County, MS
- Mott Headley, Jr., Board of Supervisors, Claiborne County, MS
- Carlos Herring, Sheriff, Perry County, MS
- James Johnston, Board of Supervisors, Claiborne County, MS
- L.D. Keady, Alderman, Richton, MS
- Frank Leach, Board of Supervisors, District IV, Jackson County, MS
- Martha Lott, Board of Supervisors, Claiborne County, MS
- Robert V. Massengill, Mayor, Brookhaven, MS
- James Miller, Board of Supervisors, Claiborne County, MS
- Doug Moak, Board of Supervisors, Lincoln County, MS
- Pete Pope, Mayor, Gautier, MS
- Charlotte M. Rahaim, Alderman, Richton, MS
- L.D. Ready, Alderman, Richton, MS
- Charles Shorts, Board of Supervisors, Claiborne County, MS
- Leon Small, Mayor, Beaumont, MS
- John Thompson, Board of Supervisors, Perry County, MS
- Tim Waldrup, Mayor, Ellisville, MS
- Gary Walker, Board of Supervisors, Lincoln County, MS
- Vickie Walters, Chancery Court Clerk, Perry County, MS
- Gregory Warr, Mayor, Gulfport, MS
- Bobby Watts, Board of Supervisors, Lincoln County, MS
- Michael Wells, Board of Supervisors, Claiborne County, MS
- Jimmy White, Mayor, Richton, MS
- Nolan Williamson, Board of Supervisors, Lincoln County, MS
- Jerry Wilson, Board of Supervisors, Lincoln County, MS
- Larry A. Wilson, Alderman, Richton, MS

7.5.4 Texas

7.5.4.1 Federal

- Senator Kay Bailey Hutchison, TX
- Senator John Cornyn, TX
- Representative Ron Paul, 14th District, TX
- Representative Ted Poe, 2nd District, TX

7.5.4.2 State

- Governor Rick Perry, TX
- Representative Alma A. Allen, Texas State House of Representatives
- Representative Kevin Bailey, Texas State House of Representatives
- Representative Dwayne Bohac, Texas State House of Representatives
- Representative Dennis Bonnen, Texas State House of Representatives
- Representative William Callegari, Texas State House of Representatives
- Representative Garnet F. Coleman, Texas State House of Representatives
- Representative Joel Crabb, Texas State House of Representatives
- Representative John E. Davis, Texas State House of Representatives
- Representative Glenda Dawson, Texas State House of Representatives
- Representative Joe D. Deshotel, Texas State House of Representatives
- Representative Harold V. Dutton, Texas State House of Representatives
- Representative Alma Edwards, Texas State House of Representatives
- Representative Gary Elkins, Texas State House of Representatives
- Senator Rodney G. Ellis, Texas State Senate
- Representative Jessica C. Farrar, Texas State House of Representatives
- Senator Mario Gallegos, Texas State Senate
- Representative Peggy Hamric, Texas State House of Representatives
- Representative Scott Hochberg, Texas State House of Representatives
- Senator Mike Jackson, Texas State Senate
- Senator Kyle Janek, Texas State Senate
- Senator Jon Lindsay, Texas State Senate
- Representative Joseph Nixon, Texas State House of Representatives
- Representative Rick Noriega, Texas State House of Representatives
- Representative Debbie Riddle, Texas State House of Representatives
- Representative Allan B. Ritter, Texas State House of Representatives
- Representative Wayne Smith, Texas State House of Representatives
- Representative Robert Talton, Texas State House of Representatives
- Representative Senfronia P. Thompson, Texas State House of Representatives
- Representative Sylvester Turner, Texas State House of Representatives
- Representative Corbin Van Arsdale, Texas State House of Representatives
- Representative Hubert Vo, Texas State House of Representatives
- Senator John Whitmore, Texas State Senate
- Senator Thomas Williams, Texas State Senate
- Representative Martha Wong, Texas State House of Representatives
- Representative Beverly Woolley, Texas State House of Representatives

7.5.4.3 Local

- Jerry Adkins, Mayor, Clute, TX
- Everette Alfred, Commissioner, Precinct 4, Jefferson County, TX
- Eddie Arnold, Commissioner, Precinct 1, Jefferson County, TX
- Mark Domingue, Commissioner, Precinct 2, Jefferson County, TX
- Robert Eckels, Judge, Harris County, TX

- Charles Fancy, Mayor, China, TX
- Alfred S. Gerson, Judge, Jefferson County, TX
- Guy N. Goodson, Mayor, Beaumont, TX
- Carl R. Griffith, Jr., Judge, Jefferson County, TX
- Waymon D. Hallmark, Commissioner, Precinct 3, Jefferson County, TX
- Bruce Halstead, Mayor, Liberty, TX
- Mark Huddleson, Commissioner, Precinct 1, Chambers County, TX
- Guy Jackson, Mayor, Anahuac, TX
- Tanya Lowrance, Commissioner Secretary, Precinct 1, Chambers County, TX
- Gloria Millsap, City Council, Clute, TX
- Calvin Mundinger, Mayor, Baytown, TX
- James Nevil, Mayor, Quintana, TX
- Oscar Ortiz, Mayor, Port Arthur, TX
- Dude Payne, Commissioner, Precinct 1, Brazoria County, TX
- Jim Phillips, Mayor, Freeport, TX
- Shane Pirtle, Mayor, Lake Jackson, TX
- L.M. Sebasta, Jr., Mayor, Angleton, TX
- Larry Stanley, Commissioner, Brazoria County, TX
- John Willy, Judge, Brazoria County, TX

7.6 ORGANIZATIONS AND INDUSTRY

- Akzo Nobel Salt America, Inc.
- Alliance for Affordable Energy of Louisiana
- Argonne National Laboratory, Environmental Science Division
- Arthur D. Little, Inc.
- Audubon Institute of New Orleans
- BASF
- Bat Conservation International
- Baton Rouge Audubon Society
- Battelle
- Bayou Preservation Organization
- BioMarine Technologies
- Black Bear Conservation Committee
- BM, Missouri City, Texas
- Boeing World Headquarters
- British Gas
- British Petroleum/Amoco
- Burlington Resources, Inc.
- Calpot Oil and Gas
- Cameron Community Action Agency, Inc.
- Cargill, Inc.
- Chevron Corporation
- Citizens' Environmental Coalition
- Citizens for a Healthy Environment
- Clean Water Action, Texas Office
- Clean Water Action, Washington, DC
- Coalition to Restore Coastal Louisiana
- Coastal Conservation Association of Louisiana
- Cockrell Oil Corporation
- ConocoPhillips

- Consul Global Petroleum and Supply
- Continental Shelf Associates, Inc.
- Council for Environmental Education
- Deep South Center for Environmental Justice, Xavier University of Louisiana
- Diversified Plant Services, L.C.
- Dominion Natural Gas Storage, Inc.
- Dominion Resource Services, Inc.
- Dominion Transmission, Inc.
- Dow Chemical Company
- Ducks Unlimited
- Dynamac Corporate
- Earth Share of Texas
- Earthwave Society
- Ecology and Environment, Inc.
- Environmental Defense
- Exxon Mobil Corporation
- Flynt and Associates
- Freeport League
- Freeport Liquid Natural Gas
- Gulf Environmental Associates
- Gulf Restoration Network
- Halliburton
- Houston Audubon Society
- Houston Wilderness
- Iberia Industrial Development Foundation
- Independent Terminal Operators Association
- Ineos Olefins and Polymers
- International Chemical Workers Union
- International Union of Operating Engineers
- Jefferson County Indigent Health Care Program
- Landau Associates, Inc.
- Law Companies, Houston, TX
- League of Women Voters, Austin, TX
- League of Women Voters, Baton Rouge, LA
- League of Women Voters, Jackson, MS
- Louis Dreyfus Energy Services
- Louisiana Environmental Action Network
- Louisiana Environmental Research Center, McNeese State University
- Louisiana Land and Water Foundation
- Louisiana Offshore Oil Port
- Marine Advisory Service
- Mississippi Coast Audubon Society
- Mississippi Gulf Coast Community College
- Mississippi Power Company
- Mississippi River Basin Alliance
- Mississippi State Audubon Society
- Mississippi Wildlife Federation
- Morris P. Herbert, Inc.
- Morton International
- National Audubon Society, Audubon Texas
- National Petrochemical and Refiners Association

- National Petroleum Council
- National WildBird Refuge, Inc.
- Neel-Schaffer, Inc.
- Occidental Petroleum
- Parsons Brinckerhoff
- Pine Woods Audubon Society
- Pinto Energy Partners, L.P.
- Reed, Smith, Hazel, and Thomas, LLP
- Safari Club International, Bayou Chapter, Cut Off, LA
- SAIC, San Diego
- Save our Wetlands
- Save the Pascagoula
- Shell Oil Company
- Shell Pipeline Company, LP
- Shinteaux Environmental Services
- Sierra Club, Delta Chapter, New Orleans
- Sierra Club, Lone Star Chapter, Houston
- Sierra Club, Mississippi Chapter
- Sierra Club, Southern Plains National Field Office, Austin, TX
- Southern Mississippi Electric Power Association
- South Plains Wildlife Rehabilitation Center, Inc.
- Squire, Sanders, and Dempsey
- Steptoe & Johnson, LLP
- Student Action and Notice for the Environment
- T. Baker Smith, Inc. Environmental Services
- The Nature Conservancy, Arlington, VA
- The Nature Conservancy, Baton Rouge, LA
- The Nature Conservancy, Jackson, MS
- The Nature Conservancy, San Antonio, TX
- Texas A&M University, College of Agriculture and Life Science, Department of Wildlife and Fisheries
- Texas A&M University, Oil Spill Control Technologies
- Texas Archaeological Society
- Texas Campaign for the Environment
- Texas Gulf Properties
- Texas Wildlife Rehabilitation Coalition
- Union Carbide Corporation
- Universal Weather and Aviation, Inc.
- Wetland Habitat Alliance of Texas
- Wildlife Rescue and Rehabilitation

7.7 MEDIA

7.7.1 Louisiana

- Houma Daily Carrier, Houma, LA
- KPLC-TV, NBC, Lake Charles, LA
- KUIL-TV, FOX, Beaumont, TX
- KVHP-TV, FOX, Lake Charles, LA
- Lake Charles American Press, Lake Charles, LA
- Southwest Daily News, Sulphur, LA

- The Advocate, Baton Rouge, LA
- The Courier, Houma, LA
- The Daily Comet, Thibodaux, LA
- The Lafayette Daily Advertiser, Lafayette, LA
- The Times-Picayune, New Orleans, LA
- WAFB-TV, CBS, Baton Rouge, LA
- WBRZ-TV, ABC, Baton Rouge, LA
- WDSU-TV, NBC, New Orleans, LA
- WGMB-TV, FOX, Baton Rouge, LA
- WGNO-TV, ABC, New Orleans, LA
- WLPB-TV, PBS, Baton Rouge, LA
- WVLA-TV, NBC, Baton Rouge, LA
- WVUE-TV, FOX, New Orleans, LA
- WWL-TV, CBS, New Orleans, LA
- WYES-TV, PBS, New Orleans, LA

7.7.2 Mississippi

- Clarion-Ledger, Jackson, MS
- Hattiesburg American, Hattiesburg, MS
- Jackson Free Press, Jackson MS
- Mississippi Press, Pascagoula, MS
- Port Gibson Reveille, Port Gibson, MS
- Richton Dispatch, Richton, MS
- Sun-Herald, Biloxi, MS
- The Vicksburg Post, Vicksburg, MS
- WAPT-TV, ABC, Jackson, MS
- WDAM-TV, NBC, Hattiesburg, MS
- WHLT-TV, CBS, Hattiesburg, MS
- WJTV-TV, CBS, Jackson, MS
- WLBT-TV, NBC, Jackson, MS
- WMPN-TV, PBS, Jackson, MS
- WUFX-TV, FOX, Jackson, MS

7.7.3 Texas

- Baytown Sun, Baytown, TX
- Beaumont Enterprise, Beaumont, TX
- Brazosport Facts, Clute, TX
- KBMT-TV, ABC, Beaumont, TX
- KBTV-TV, NBC, Beaumont, TX
- KETH-TV, Community Educational Television, Inc., Houston, TX
- KFDM-TV, CBS, Beaumont, TX
- KFTH-TV, TeleFutura, Houston, TX
- KHOU-TV, CBS, Houston, TX
- KHWB-TV, WB, Houston, TX
- Korea Times Houston Edition, Houston, TX
- KPRC-TV, NBC, Houston, TX
- KRIV-TV, FOX, Houston, TX
- KTMD-TV, Telemundo Network Group LLC, Houston, TX
- KTRK-TV, ABC, Houston, TX

- KTXH-TV, UPN, Houston, TX
- KUHT-TV, PBS, Houston, TX
- KXLN-TV, Noticias, Houston, TX
- Metro Networks News, Houston, TX
- Port Arthur News, Port Arthur, TX
- The Facts, Clute, TX
- The Pasadena Citizen, Pasadena, TX

7.8 LIBRARIES

- East Baton Rouge Parish Library, Baton Rouge, LA
- Eudora Welty Library, Jackson, MS
- Harriette Person Library, Port Gibson, MS
- Lake Jackson Library, Lake Jackson, TX
- Martha Sowell Utley Memorial Library, Thibodaux, LA
- Pascagoula Public Library, Pascagoula, MS
- Richton Public Library, Richton, MS
- Terrebonne Parish Public Library, Houma, LA

7.9 PRIVATE CITIZENS

- Ms. Irene Adams
- Mr. Jesse Aguilar, Jr.
- Mr. Stanley E. Alba
- Mr. John W. Anderson
- Mr. and Mrs. Melvin and Jessie Arnold
- Mr. Daniel B. Ault
- Ms. Jorene Aycock
- Mr. Wayne Bahr
- Mr. Buddy Baker
- Mr. Rick Basaldua
- Mr. Cliff Baylis
- Mr. and Mrs. Charles and Verna Bellam
- Ms. Bernice Bilich
- Mr. Roger Blackwell
- Mr. Tony Bland
- Ms. Maudine P. Boszer
- Mr. Larry Boudreaux
- Mr. J.T.S. Brock
- Mr. Billy S. Broome
- Ms. Opal Moreau Broussard
- Mr. Brint Brown
- Mr. Charles J. Brown
- Mr. Bruce Browning
- Mr. M.E. Bryant
- Mr. Tim Bucsax
- Ms. Jeannette Bumpers
- Mr. C. Glen Bush
- Mr. Charles Bush
- Ms. Mary Bush
- Mr. Albert Butler

- Mr. James Cassell, Jr.
- Ms. Bertha Cassingham
- Ms. Diana Chance
- Mr. Ray S. Chesson
- Ms. Jill Church
- Mr. Ralph B. Chustz
- Mr. Jessie Clark
- Ms. Dorthy Cole
- Mr. Scott Conway
- Ms. Tracie Copeland
- Mr. and Mrs. Roger and Teresa Cornelison
- Mr. Benny C. Crawford
- Mr. J.P. Creel
- Mr. David Culpeppur
- Mr. Fred Cummins
- Mr. Joe Damian
- Mr. Lee J. Darin
- Mr. Paul Davidson
- Mr. Claude Devall
- Mr. John J. deVink
- Mr. Dan Dickens
- Mr. Carlton Dufrechou
- Mr. Chris Dum
- Mr. Dennis Edwards
- Mr. Malcom Edwards
- Mr. and Mrs. Roy and Jan Edwards
- Ms. Sheri Edwards
- Mr. Nate Ellis
- Mr. Rome Emmons
- Ms. Terri Estay
- Mr. Carlo Filippi
- Mr. Tim Fischer
- Ms. Wanda Fischer
- Mr. Shelton R. Foles
- Mr. Robert Freeman
- Mr. Herbert Garza
- Mr. Charles Golden
- Mr. W.F. Gonzales
- Dr. Olivia Graves
- Ms. Janice Gray
- Mr. Randy Griffin
- Mr. Larry Grimmett
- Mr. Karl Grossman
- Mr. J.D. Hargrove
- Ms. Paula Harvey
- Ms. June Havens
- Ms. Bobbie Hawkins
- Mr. Jerry C. Hayslip
- Mr. Buddy Hillman
- Mr. Mike Holden
- Ms. Karen J. Holland

- Ms. Holly Hollingsworth
- Mr. Bobby A. Holmes
- Mr. Derrek Howell
- Mr. Fred Howell
- Mr. T.L. Howell
- Mr. Michael Horsley
- Mr. Thomas I. Hughes
- Mr. Robert Hycock
- Lin Jacobson
- Mr. Xavier Jimenez
- Ms. Jennifer Johnson
- Ms. Nan Johnson
- Mr. and Mrs. Frank and Ann Jones
- Mr. Henry Jones
- Mr. Roger D. Jones
- Ms. Sharon Jones
- Mr. Kevin Kennedy
- Mr. Danny Kier
- Mr. Lance Kiley
- Mr. Bruce Landrum
- Mr. Tom Landrum
- Mr. Clayton Lassiter
- Mr. Joseph Laurich
- Mr. Frank Leatherbury
- Jaime Ledesma
- Mr. Fred Lemon
- Mr. Leighton Lewis
- Mr. Lipshaw
- Mr. and Mrs. Bill and Brenda Logan
- Mr. A.K. Lovett, Sr.
- Mr. Paul Maclean
- Mr. Dennis Mahaffey
- Ms. Teri G. Masterson
- Mr. Alex Major
- Mr. Matt Manning
- Mr. Jim Martin
- Mr. Howard Matney
- Mr. Jeff May
- Mr. Terrell May
- Mr. Ken McCaskill
- Mr. Mike McCleary
- Mr. Donald McKee
- Mr. Max Meinen
- Mr. James Mihalovich
- Ms. Lorie Mitchell
- Mr. Chad Mondragon
- Mr. Jesse Mondragon
- Mr. Randall P. Montgomery
- Ms. Cheryl Moore
- Mr. Chester Morgan
- Mr. Charles G. Moss

- Mr. Karl Mueller
- Mr. Randy Murrell
- Dr. James A. Nicholson
- Mr. Fred O'Quin, Jr.
- Mr. Mike Oliphant
- Dr. Edward B. Overton
- Ms. Debra Parker
- Mr. William Ray Parker
- Mr. Matt Pavlik
- Ms. Clotee Pearson
- Mr. Mike Perry
- Mr. Tom R. Phillips
- Mr. Vernon Phillips
- Mr. Hart Pillow
- Mr. Charles Price
- Mr. Jason Price
- Mr. James F. Puckett
- Mr. George Randolph
- Mr. Douglas Rhodes
- Mr. W.J. Rhodes
- Mr. Kenneth E. Rich
- Mr. Julius Ridgway
- Ms. Mary Robinson
- Mr. B. Sachau
- Mr. Jimmy Salina
- Mr. Santos Sanchez, Jr.
- Mr. Sanford
- Mr. Van Savoie
- Dr. Roddy Scarbrough
- Mr. Norman Schroeder
- Mr. V.L. Scott
- Mr. Clyde Sellers
- Mr. and Mrs. Jim and Jane Sharp
- Mr. George Simar
- Ms. Lynn Simon
- Mr. William R. Sledge
- Mr. Dennis Smith
- Mr. Larry R. Smith
- Mr. Rod Smith
- Mr. Stephen M. Smith
- Mr. William A. Smith
- Mr. Mario Solano
- Mr. Daniel T. Strecker
- Mr. Alan Stevens
- Mr. Ben Stevens
- Mr. Murry Stewart
- Ms. Wilma Subra
- Mr. Allan Taylor
- Julian W. Taylor
- Mr. Allen Thomason
- Mr. Art Thompson

- Dr. Robert Thoms
- Mr. Mike Thornberg
- Mr. George Touart
- Mr. Joe Tucker
- Mr. R. Duke Tullis
- Mr. Scott Tyler
- E.R. Tywater
- D.L. Vaughn
- Mr. Johnny Voss
- Florin Vrazet
- Ms. Cile Waite
- Mr. Jerry West
- Mr. Marion L. Williams
- Mr. Everett Winginton
- Mr. Paul Wolf
- Mr. Neill Wood
- Ms. Peggy Wood
- Mr. William Woods
- Mr. and Ms. Joey and Gloria Wyatt
- Mr. Bill Yates
- Mr. Roland Yardoroush
- Mr. O.L. Yonce

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Chapter 8. Draft EIS Comment-Response

8.1 INTRODUCTION

The Notice of Availability for the draft EIS was published on May 26, 2006. The comment period for the draft EIS ended on July 10, 2006, 45 days later. During the comment period, DOE held five public hearings between June 20, 2006, and June 28, 2006, in Pascagoula, MS; Richton, MS; Port Gibson, MS; Lake Jackson, TX; and Houma, LA.

DOE received oral or written comments from the following:

- 9 elected officials;
- 15 government agencies;
- 8 companies or other organizations; and
- 76 individuals.

These commenters submitted 93 written comment letters and 21 of them provided oral comments at the public hearings.

This chapter contains the text of comments extracted from the comment letters and hearing transcripts, together with DOE responses to the extracted comments. The transcripts of the public hearings and comment letters are reproduced in appendix N.

Section 8.2 describes DOE's methodology for acquiring, categorizing, addressing, and documenting the comments. Section 8.3 provides guidance to help readers find comments and responses. Section 8.4 presents the comments and the corresponding responses. See section 1.4.4 for a summary of the major comments received on the draft EIS and the major changes to the EIS that resulted from the public comments.

8.2 METHODOLOGY

In preparing the EIS, DOE considered all comments, including those submitted after the close of the comment period. After identifying specific comments in the comment documents, DOE categorized the comments by the issues they addressed, prepared responses, and modified the EIS if appropriate. In some cases, more than one commenter submitted comments on the same issue. In this situation, DOE grouped the comments and prepared a single response.

Comments were extracted from comment documents as submitted by the commenters. DOE has neither edited nor rewritten the comments submitted. In some cases to ensure clarity, DOE added words, which are indicated with brackets. DOE did not modify comments excerpted from certified transcripts of public meetings. However, where transcripts contained obvious errors (for example, misspelled names or words), DOE made corrections.

8.3 HOW TO FIND COMMENTS AND RESPONSES

Comments on the draft EIS and the corresponding DOE responses can be located using the two tables in this section. As described further below, table 8.3-1 lists the commenters and the categories of issues each commenter addressed; table 8.3-2 outlines these issue categories, which generally follow the organization of the EIS, and provides the page number for responses to comments on each issue category.

In table 8.3-1, comment documents are organized by the following groups of commenters: Federal, state, or local elected official; Federal, state, or local agencies; other organizations; and individuals. Comment documents are in alphabetical order by commenter within each commenter category. In addition to identifying the person submitting the comment and any associated organization, the table lists the document number, the comment numbers, and the comment issue categories.

- DOE assigned each comment letter a number based on when it was received. For example, D0074 was the 74th comment document received. For the public meeting transcripts, DOE assigned a number for the testimony of each oral commenter. These comment document numbers go from D0083 through D0103. See the footnotes to table 8.3-1.

- Within each comment document or public hearing statement, DOE numbered the comments sequentially starting with "1." Each of these numbered comments was assigned to a comment category or, in a few instances, two or more comment categories.

Table 8.3-2 indexes the comments by issue category, generally following the structure of the EIS, and provides the page number for DOE responses, found in section 8.4.

Section 8.4 presents the comments, sorted by issue category, and DOE responses. Some issues were addressed by multiple comments, which are listed in order of commenter number. The corresponding responses are numbered sequentially. For example, the response to the fifth comment on the issue of Land Use, which is issue 3.3, is numbered 3.3-5.

Appendix N presents the comment documents organized by document number and identifies the numbered comments in each document.

As an actual example, Martin Mayer submitted a letter on behalf of the U.S. Army Corps of Engineers. To read the DOE responses to these comments, first find the name of the agency in the "Agencies-Federal Government" section of table 8.3-1. In addition to the name of the agency, the table includes the number of the comment document (D0074) and the comment categories for the five comments in the letter. For example, the second comment is directed to comment category 2.2 on capacity issues of specific alternatives. To see this comment and DOE's response, go to category 2.2 on capacity in section 8.4 and look for comment D0074-02. To read the comment in the context of the entire comment document go to table N.1-1 in appendix N and find U.S. Army Corps of Engineers under the "Agencies-Federal Government" section, then turn to the page listed.

Table 8.3-1: Index of Comment Documents and Comments

Commenter Organization/Title	Commenter	Comment Document #	Comment # (Comment Issue Category)	Comment Issue Category (Comment #)
ELECTED OFFICIALS				
Federal Government				
Representative Ron Paul	Diane Kile	D0097[a]	1 (2.2.2), 2 (3.3), 3 (2.2.2)	2.2.2 (1), 2.2.2 (3), 3.3 (2)
Senator Thad Cochran and Senator Trent Lott	Senators Thad Cochron and Trent Lott	D0016	1 (2.2.1), 2 (2.2.1)	2.2.1 (1), 2.2.1 (2)
Local Government				
Brazoria County Precinct 1, Commissioner	Donald Payne	D0021	1 (3.8), 2 (2.2.2), 3 (3.8), 3 (3.3), 3 (5), 4 (3.3), 5 (3.8), 6 (3.8), 7 (3.8)	2.2.2 (2), 3.3 (3), 3.3 (4), 3.8 (1), 3.8 (3), 3.8 (5), 3.8 (6), 3.8 (7), 5 (3)
Brazoria County Precinct 1, Commissioner	Donald Payne	D0095[a]	1 (3.8), 2 (2.2.2), 3 (3.8)	2.2.2 (2), 3.8 (1), 3.8 (3)
Claiborne County Board of Supervisors, President	Charles Shorts	D0015	1 (2.2.1)	2.2.1 (1)
Claiborne County Board of Supervisors	James Miller	D0090[b]	1 (2.2.1)	2.2.1 (1)
Jackson County Board of Supervisors	Frank Leach	D0084[c]	1 (1.2), 2 (3.3), 3 (2.2), 4 (3.6.2.2), 5 (2.2), 6 (2.2), 7 (2.2), 8 (1.1), 9 (3.7.6.1), 10 (1.2), 11 (1.2), 12 (2.2.2)	1.1 (8), 1.2 (1), 1.2 (10), 1.2 (11), 2.2 (3), 2.2 (5), 2.2 (6), 2.2 (7), 2.2.2 (12), 3.3 (2), 3.6.2.2 (4), 3.7.6.1 (9)
Jackson County Board of Supervisors, District IV Supervisor	Frank Leach	D0010	-	-
Lafourche Parish, President	Charlotte Randolph	D0103[d]	1 (2.2.1), 2 (2.2.3)	2.2.1 (1), 2.2.3 (2)
Lake Jackson, Immediate and Former Mayor	Shane Pirtle	D0099[a]	1 (2.2.2)	2.2.2 (1)
AGENCIES				
Federal Government				
NOAA Fisheries	Rickey N. Ruebsamen	D0073	1 (3.7.1), 2 (3.7.6.2), 3 (3.7.6.2), 4 (3.7.6.2), 5 (3.7.6.2), 6 (3.7.6.2), 7 (3.7.6.2), 8 (3.7.4.2), 9 (3.3), 10 (3.7.6.2), 11 (4.2), 12 (2.2.3)	2.2.3 (12), 3.3 (9), 3.7.1 (1), 3.7.4.2 (8), 3.7.6.2 (2), 3.7.6.2 (3), 3.7.6.2 (4), 3.7.6.2 (5), 3.7.6.2 (6), 3.7.6.2 (7), 3.7.6.2 (10), 4.2 (11)
U.S. Army Corps of Engineers, New Orleans District	Martin S. Mayer	D0074	1 (2.2), 1 (3.7.3.2), 2 (2.2), 3 (2.2), 4 (4.3.2), 5 (3.7.4.2), 5 (3.7.6.2)	2.2 (1), 2.2 (2), 2.2 (3), 3.7.3.2 (1), 3.7.4.2 (5), 3.7.6.2 (5), 4.3.2 (4)

[a] See Lake Jackson Public Hearing transcript, which covers Documents #D0091 to D0100.
[b] See Port Gibson Public Hearing transcript, which covers Documents #D0088 to D0090.
[c] See Pascagoula Public Hearing transcript, which covers Documents #D0083 to D0086.
[d] See Houma Public Hearing transcript, which covers Documents #D0101 to D0103.
[e] See Richton Public Hearing transcript, which covers Document #D0087.
[f] USFWS and Mississippi Natural Heritage Program submitted joint comments.

Table 8.3-1: Index of Comment Documents and Comments

Commenter Organization/Title	Commenter	Comment Document #	Comment # (Comment Issue Category)	Comment Issue Category (Comment #)
U.S. Department of Agriculture, Natural Resources Conservation Service, Texas Office	James M. Greenwade	D0006	1 (3.3)	3.3 (1)
U.S. Department of the Interior	Stephen R. Spencer	D0078	1 (3.7.2.1), 2 (3.7.4.1), 3 (3.7.3.2), 4 (3.7.2.1), 5 (3.7.5.2), 6 (3.7.2.1), 7 (3.3), 7 (3.7.5.2), 8 (2.1), 9 (3.7.3.1), 10 (3.7.4.1), 11 (3.7.2.1), 12 (3.7.5.1), 13 (3.7.3.1), 14 (3.7.2.1)	2.1 (8), 3.3 (7), 3.7.2.1 (1), 3.7.2.1 (4), 3.7.2.1 (6), 3.7.2.1 (11), 3.7.2.1 (14), 3.7.3.1 (9), 3.7.3.1 (13), 3.7.3.2 (3), 3.7.4.1 (2), 3.7.4.1 (10), 3.7.5.1 (12), 3.7.5.2 (5), 3.7.5.2 (7)
U.S. Department of the Interior, National Park Service, Gulf Islands National Seashore	Stephen R. Spencer	D0081	1 (3.3), 2 (3.7.4.2), 3 (3.3), 4 (3.7.6.2), 5 (3.6.2.2), 5 (3.7.6.2), 6 (3.7.4.2), 7 (3.7.4.2), 8 (3.6.5.1), 9 (3.7.5.2), 10 (3.7.6.2), 11 (3.7.3.1)	3.3 (1), 3.3 (3), 3.6.2.2 (5), 3.6.5.1 (8), 3.7.3.1 (11), 3.7.4.2 (2), 3.7.4.2 (6), 3.7.4.2 (7), 3.7.5.2 (9), 3.7.6.2 (4), 3.7.6.2 (5), 3.7.6.2 (10)
U.S. Department of the Interior, National Park Service, Natchez Trace Parkway	Wendell A. Simpson	D0001	1 (3.3), 1 (3.9), 2 (3.9)	3.3 (1), 3.9 (1), 3.9 (2)
U.S. Department of the Interior, National Park Service, Natchez Trace Parkway	Stennis R. Young	D0114	1 (3.3), 2 (1.3), 3 (3.9), 4 (3.3), 5 (3.9), 6 (3.9)	1.3 (2), 3.3 (1), 3.3 (4), 3.9 (3), 3.9 (5), 3.9 (6)
U.S. Environmental Protection Agency, Region 6	Rhonda M. Smith	D0077	1 (1.3), 2 (4.2), 3 (2.3.1), 4 (2.3.6), 5 (3.4), 6 (3.5.2), 7 (3.5.3), 8 (2.3.1), 9 (3.6.2.2), 10 (3.6.2.1), 11 (3.6.2.2), 12 (3.6.2.2), 13 (3.6.2.2), 14 (3.6.2.2), 15 (3.8), 16 (3.8), 17 (3.9), 18 (3.10), 19 (4.1), 20 (4.3.6), 21 (4.3.9), 22 (3.5.2), 23 (3.5.2), 24 (3.5.2), 25 (3.5.3), 26 (3.5.2), 27 (3.7.3.1), 28 (2.2.3), 28 (3.7.3.2), 29 (3.7.3.1), 30 (3.7.3.1), 31 (3.7.3.1), 32 (3.7.3.1), 33 (3.6.2.2), 33 (3.7.2.1), 34 (2.1)	1.3 (1), 2.1 (34), 2.2.3 (28), 2.3.1 (3), 2.3.1 (8), 2.3.6 (4), 3.4 (5), 3.5.2 (6), 3.5.2 (22), 3.5.2 (23), 3.5.2 (24), 3.5.2 (26), 3.5.3 (7), 3.5.3 (25), 3.6.2.1 (10), 3.6.2.2 (9), 3.6.2.2 (11), 3.6.2.2 (12), 3.6.2.2 (13), 3.6.2.2 (14), 3.6.2.2 (33), 3.7.2.1 (33), 3.7.3.1 (27), 3.7.3.1 (29), 3.7.3.1 (30), 3.7.3.1 (31), 3.7.3.1 (32), 3.7.3.2 (28), 3.8 (15), 3.8 (16), 3.9 (17), 3.10 (18), 4.1 (19), 4.2 (2), 4.3.6 (20), 4.3.9 (21)

[a] See Lake Jackson Public Hearing transcript, which covers Documents #D0091 to D0100.
[b] See Port Gibson Public Hearing transcript, which covers Documents #D0088 to D0090.
[c] See Pascagoula Public Hearing transcript, which covers Documents #D0083 to D0086.
[d] See Houma Public Hearing transcript, which covers Documents #D0101 to D0103.
[e] See Richton Public Hearing transcript, which covers Document #D0087.
[f] USFWS and Mississippi Natural Heritage Program submitted joint comments.

Table 8.3-1: Index of Comment Documents and Comments

Commenter Organization/Title	Commenter	Comment Document #	Comment # (Comment Issue Category)	Comment Issue Category (Comment #)
U.S. Fish and Wildlife Service and Mississippi Natural Heritage Program[f]	Ray Aycock	D0106	1 (3.7.3.1), 2 (2.2), 3 (3.6.2.2), 4 (3.7.4.2), 5 (3.7.4.2), 6 (4.3.5), 7 (2.2), 8 (3.7.3.1), 9 (3.7.4.1), 10 (3.6.5.1), 11 (3.7.3.2), 12 (3.7.2.1), 13 (3.2), 14 (3.7.2.1), 15 (3.2), 16 (3.7.3.1), 17 (3.6.2.2), 17 (3.7.4.2), 18 (3.7.2.1), 19 (3.7.2.1), 20 (3.7.2.1), 21 (3.7.4.2), 22 (3.7.4.2), 23 (3.7.3.1), 24 (3.7.4.2), 25 (3.7.4.2), 26 (3.7.4.2), 27 (3.6.2.2), 27 (3.7.4.2), 28 (2.2.2), 29 (3.6.5.1), 30 (3.7.2.2), 31 (3.6.2.2), 32 (3.7.3.2)	2.2 (2), 2.2 (7), 2.2.2 (28), 3.2 (13), 3.2 (15), 3.6.2.2 (3), 3.6.2.2 (17), 3.6.2.2 (27), 3.6.2.2 (31), 3.6.5.1 (10), 3.6.5.1 (29), 3.7.2.1 (18), 3.7.2.1 (19), 3.7.2.1 (20), 3.7.2.1 (12), 3.7.2.1 (14), 3.7.2.2 (30), 3.7.3.1 (1), 3.7.3.1(8), 3.7.3.1 (16), 3.7.3.1 (23), 3.7.3.2 (11), 3.7.3.2 (32), 3.7.4.1 (9), 3.7.4.2 (4), 3.7.4.2 (5), 3.7.4.2 (17), 3.7.4.2 (21), 3.7.4.2 (22), 3.7.4.2 (24), 3.7.4.2 (25), 3.7.4.2 (26), 3.7.4.2 (27), 4.3.5 (6)
State Government				
Louisiana Department of Wildlife and Fisheries	Brandt Savoie	D0080	1 (3.7.3.1), 2 (3.7.4.2), 3 (3.7.4.2)	3.7.3.1 (1), 3.7.4.2 (2), 3.7.4.2 (3)
Louisiana Department of Environmental Quality	Lisa L Miller	D0005	1 (3.6.2.1), 1 (3.7.3.1), 2 (3.7.3.1), 3 (3.6.4.1), 4 (3.5.3)	3.5.3 (4), 3.6.4.1 (3), 3.7.3.1 (1), 3.7.3.1 (2)
Mississippi Development Authority	Jack Moody	D0087[e]	1 (2.2.1)	2.2.1 (1)
Mississippi Development Authority	Jack Moody	D0088[b]	1 (2.2)	2.2 (1)

[a] See Lake Jackson Public Hearing transcript, which covers Documents #D0091 to D0100.
[b] See Port Gibson Public Hearing transcript, which covers Documents #D0088 to D0090.
[c] See Pascagoula Public Hearing transcript, which covers Documents #D0083 to D0086.
[d] See Houma Public Hearing transcript, which covers Documents #D0101 to D0103.
[e] See Richton Public Hearing transcript, which covers Document #D0087.
[f] USFWS and Mississippi Natural Heritage Program submitted joint comments.

Table 8.3-1: Index of Comment Documents and Comments

Commenter Organization/Title	Commenter	Comment Document #	Comment # (Comment Issue Category)	Comment Issue Category (Comment #)
Mississippi Natural Heritage Program[f] and U.S. Fish and Wildlife Service	Ray Aycock	D0106	1 (3.7.3.1), 2 (2.2), 3 (3.6.2.2), 4 (3.7.4.2), 5 (3.7.4.2), 6 (4.3.5), 7 (2.2), 8 (3.7.3.1), 9 (3.7.4.1), 10 (3.6.5.1), 11 (3.7.3.2), 12 (3.7.2.1), 13 (3.2), 14 (3.7.2.1), 15 (3.2), 16 (3.7.3.1), 17 (3.6.2.2), 17 (3.7.4.2), 18 (3.7.2.1), 19 (3.7.2.1), 20 (3.7.2.1), 21 (3.7.4.2), 22 (3.7.4.2), 23 (3.7.3.1), 24 (3.7.4.2), 25 (3.7.4.2), 26 (3.7.4.2), 27 (3.6.2.2), 27 (3.7.4.2), 28 (2.2.2-1), 29 (3.6.5.1), 30 (3.7.2.2), 31 (3.6.2.2), 32 (3.7.3.2)	2.2 (2), 2.2 (7), 2.2.2.1 (28), 3.2 (13), 3.2 (15), 3.6.2.2 (3), 3.6.2.2 (17), 3.6.2.2 (27), 3.6.2.2 (31), 3.6.5.1 (10), 3.6.5.1 (29), 3.7.2.1 (12), 3.7.2.1 (14), 3.7.2.1 (18), 3.7.2.1 (19), 3.7.2.1 (20), 3.7.2.2 (30), 3.7.3.1 (1), 3.7.3.1 (8), 3.7.3.1 (16), 3.7.3.1 (23), 3.7.3.2 (11), 3.7.3.2 (32), 3.7.4.1 (9), 3.7.4.2 (4), 3.7.4.2 (5), 3.7.4.2 (17), 3.7.4.2 (21), 3.7.4.2 (22), 3.7.4.2 (24), 3.7.4.2 (25), 3.7.4.2 (26), 3.7.4.2 (27), 4.3.5 (6)
Texas Department of State Health Services	Eduardo J. Sanchez	D0004	none	none
Texas Parks and Wildlife Department	Amy Hanna	D0116	1 (3.7.3.2)	3.7.3.2 (1)
County and Local Government				
Greater Lafourche Port Commission	Ted M. Falgout	D0002	1 (2.3.3), 2 (2.3.3), 3 (1.3)	1.3 (3), 2.3.3 (2), 2.3.3 (1)
OTHER ORGANIZATIONS				
Anabasis, LLC	Vernon Phillips	D0089[b]	1 (2.2.1), 2 (2.2.1), 3 (2.3.1), 4 (2.3.1), 5 (2.3.1), 5 (3.6.4.2), 6 (2.3.1), 7 (2.3.1), 8 (2.3.1), 9 (2.3.1)	2.2.1 (1), 2.2.1 (2), 2.3.1 (3), 2.3.1 (4), 2.3.1 (5), 2.3.1 (6), 2.3.1 (7), 2.3.1 (8), 2.3.1 (9), 3.6.4.2 (5)
Audubon Society, Houston	Flo Hannah	D0115	1 (3.7.2.1), 2 (3.7.3.2), 3 (3.7.2.1), 4 (3.7.5.2), 5 (3.7.3.1)	3.7.2.1 (1), 3.7.2.1 (3), 3.7.3.1 (5), 3.7.3.2 (2), 3.7.5.2 (4)
Brazosport Area Chamber of Commerce, Chairman	L.G. Murrell, Jr.	D0110	1 (3.8)	3.8 (1)
Dominion Natural Gas Storage, Inc.	David Kohler	D0101[d]	1 (2.2.1), 2 (3.7.3.2), 3 (2.2.1)	2.2.1 (1), 2.2.1 (3), 3.7.3.2 (2)

[a] See Lake Jackson Public Hearing transcript, which covers Documents #D0091 to D0100.
[b] See Port Gibson Public Hearing transcript, which covers Documents #D0088 to D0090.
[c] See Pascagoula Public Hearing transcript, which covers Documents #D0083 to D0086.
[d] See Houma Public Hearing transcript, which covers Documents #D0101 to D0103.
[e] See Richton Public Hearing transcript, which covers Document #D0087.
[f] USFWS and Mississippi Natural Heritage Program submitted joint comments.

Table 8.3-1: Index of Comment Documents and Comments

Commenter Organization/Title	Commenter	Comment Document #	Comment # (Comment Issue Category)	Comment Issue Category (Comment #)
Dominion Natural Gas Storage, Inc.	Anne E. Bomar	D0075	1 (2.2.1), 2 (2.2.1)	2.2.1 (1), 2.2.1 (2)
Dow Chemical Company	Paul Bork	D0079	1 (4.2), 2 (3.5.3), 3 (5), 4 (3.5.3), 5 (3.7.3.2), 6 (3.7.4.2), 7 (3.11), 8 (1.3), 9 (2.2.2), 10 (3.3), 11 (3.3), 12 (3.8), 13 (2.2.2), 13 (3.3), 13 (3.8), 14 (2.2.2), 15 (3.3), 16 (2.2.2), 17 (2.2.2), 17 (3.3), 18 (3.3), 19 (3.8), 20 (3.8), 21 (3.8), 21 (5), 22 (3.4), 23 (3.3), 24 (3.2), 25 (3.4), 26 (3.8), 27 (3.8), 28 (3.3), 29 (4.2), 30 (3.3), 31 (3.2), 32 (3.4), 33 (3.2), 34 (3.8), 35 (3.11), 36 (2.2.2), 36 (3.8), 37 (2.3.6),	1.3 (8), 2.2.2 (9), 2.2.2 (13), 2.2.2 (14), 2.2.2 (16), 2.2.2 (17), 2.2.2 (36), 2.3.6 (37), 3.2 (24), 3.2 (31), 3.2 (33), 3.3 (10), 3.3 (11), 3.3 (13), 3.3 (15), 3.3 (17), 3.3 (18), 3.3 (23), 3.3 (28), 3.3 (30), 3.4 (22), 3.4 (25), 3.4 (32), 3.5.3 (2), 3.5.3 (4), 3.7.3.2 (5), 3.7.4.2 (6), 3.8 (12), 3.8 (13), 3.8 (19), 3.8 (20), 3.8 (21), 3.8 (26), 3.8 (27), 3.8 (34), 3.8 (36), 3.11 (7), 3.11 (35), 4.2 (1), 4.2 (29), 5 (3), 5 (21)
Dow Chemical Company	Bob Walker	D0091[a]	-	-
Economic Development Alliance	David Stedman	D0092[a]	1 (2.2.2), 2 (3.8), 3 (2.2.2)	2.2.2 (1), 2.2.2 (3), 3.8 (2)
Freeport LNG	Bill Henry	D0093[a]	1 (4.2), 2 (4.2), 3 (4.2)	4.2 (1), 4.2 (2), 4.2 (3)
Gulf Restoration Network	Cynthia M. Sarthou	D0013	1 (2.2), 2 (3.6.5.1), 2 (3.7.2.1), 3 (2.2), 4 (2.2.3), 5 (2.2), 6 (3.7.3.2), 7 (3.7.4.2), 8 (3.7.5.2), 9 (3.7.2.2), 10 (2.2.3)	2.2 (1), 2.2 (3), 2.2 (5), 2.2.3 (4), 2.2.3 (10), 3.6.5.1 (2), 3.7.2.1 (2), 3.7.2.2 (9), 3.7.3.2 (6), 3.7.4.2 (7), 3.7.5.2 (8)
Pinto Energy Partners	Tommy Soriero	D0098[a]	1 (3.3)	3.3 (1)
Sierra Club, Houston Regional Group	Brandt Mannchen	D0113	1 (3.7.3.2), 2 (4.2), 3 (4.2), 4 (1.3)	1.3 (4), 3.7.3.2 (1), 4.2 (2), 4.2 (3)
Sierra Club, Mississippi Chapter	Becky Gillette	D0083[c]	1 (2.2), 2 (1.2), 3 (3.6.2.2), 4 (4.4.5), 5 (1.2), 6 (3.4), 7 (3.6.4.2), 8 (3.7.2.1), 9 (4.2)	1.2 (2), 1.2 (5), 2.2 (1), 3.4 (6), 3.6.2.2 (3), 3.6.4.2 (7), 3.7.2.1 (8), 4.2 (9), 4.4.5 (4)

[a] See Lake Jackson Public Hearing transcript, which covers Documents #D0091 to D0100.
[b] See Port Gibson Public Hearing transcript, which covers Documents #D0088 to D0090.
[c] See Pascagoula Public Hearing transcript, which covers Documents #D0083 to D0086.
[d] See Houma Public Hearing transcript, which covers Documents #D0101 to D0103.
[e] See Richton Public Hearing transcript, which covers Document #D0087.
[f] USFWS and Mississippi Natural Heritage Program submitted joint comments.

Table 8.3-1: Index of Comment Documents and Comments

Commenter	Comment Document #	Comment # (Comment Issue Category)	Comment Issue Category (Comment #)
INDIVIDUALS			
Aguilar, Jesse Jr.	D0031	see D0017 (form letter)	
Ault, Daniel B.	D0032	see D0017 (form letter)	
B., Tim	D0055	see D0017 (form letter)	
Basaldua, Richard Jr.	D0042	see D0017 (form letter)	
Basaldua, Rick	D0025	see D0017 (form letter)	
Bilich, Bernice	D0109	1 (3.8)	3.8 (1)
Bland, Tony	D0014	1 (2.2.2), 2 (3.6.2.2), 3 (3.7.6.2), 4 (3.6.4.2)	2.2.2 (1), 3.6.2.2 (2), 3.6.4.2 (4), 3.7.6.2 (3)
Brown, Brint	D0052	see D0017 (form letter)	
Browning, Bruce	D0012	1 (2.2.2)	2.2.2 (1)
Bumpers, Jeanette	D0054	1 (2.2.2), 1 (3.8)	2.2.2 (1), 3.8 (1)
Church, Jill	D0064	see D0017 (form letter)	
Cummins, Fred	D0047	1 (2.2.1)	2.2.1 (1)
Dickens, Dan	D0049	see D0017 (form letter)	
Edwards, Dennis	D0067	see D0017 (form letter)	
Edwards, Janice	D0100[a]	1 (2.2)	2.2 (1)
Edwards, Sheri	D0028	see D0017 (form letter)	
Filippi, Carlo	D0111	see D0017 (form letter)	
Fischer, Tim	D0070	see D0017 (form letter)	
Fischer, Wanda	D0023	see D0017 (form letter)	
Fuentes, Manuel	D0046	see D0017 (form letter)	
Garza, Herbert	D0105	see D0017 (form letter)	
Griffin, Randy	D0045	see D0017 (form letter)	
Grimmett, Larry	D0018	see D0017 (form letter)	
Grossman, Karl	D0063	see D0017 (form letter)	
Guidry, Sybil	D0102[d]	1 (3.7.3.2), 2 (2.2.2)	2.2.2 (2), 3.7.3.2 (1)
Havens, June	D0009	1 (3.6.4.2), 1 (2.2.2), 1 (3.4), 2 (3.7.4.2)	2.2.2 (1), 3.4 (1), 3.6.4.2 (1), 3.7.4.2 (2)
Holden, Mike	D0039	see D0017 (form letter)	

[a] See Lake Jackson Public Hearing transcript, which covers Documents #D0091 to D0100.
[b] See Port Gibson Public Hearing transcript, which covers Documents #D0088 to D0090.
[c] See Pascagoula Public Hearing transcript, which covers Documents #D0083 to D0086.
[d] See Houma Public Hearing transcript, which covers Documents #D0101 to D0103.
[e] See Richton Public Hearing transcript, which covers Document #D0087.
[f] USFWS and Mississippi Natural Heritage Program submitted joint comments.

Table 8.3-1: Index of Comment Documents and Comments

Commenter	Comment Document #	Comment # (Comment Issue Category)	Comment Issue Category (Comment #)
Hollingsworth, Holly	D0071	see D0017 (form letter)	
Hudgins, Anthony	D0037	see D0017 (form letter)	
Jacobson, Lin	D0086[c]	1 (1.2), 2 (3.6.5.1), 3 (1.2)	1.2 (1), 1.2 (3), 3.6.5.1 (2)
Jimenez, Xavier	D0072	see D0017 (form letter)	
Johnson, Bob Ed	D0022	see D0017 (form letter)	
Johnson, Bob Ed	D0030	see D0017 (form letter)	
Johnson, Bob I.	D0026	see D0017 (form letter)	
Johnson, Jennifer	D0048	see D0017 (form letter)	
Johnson, Nan	D0011	1 (2.2.2), 2 (3.4), 3 (3.7.4.2)	2.2.2 (1), 3.4 (2), 3.7.4.2 (3)
Jones, Sharon L.	D0065	see D0017 (form letter)	
Kennedy, Kevin	D0061	see D0017 (form letter)	
Kier, Danny	D0024	see D0017 (form letter)	
Lampard, Rick	D0107	1 (2.1)	2.1 (1)
Ledesma, Jaime	D0053	see D0017 (form letter)	
Lemon, Fred	D0085[c]	1 (2.2.2), 2 (3.3), 3 (3.6.5.1), 4 (1.2), 5 (3.6.4.2), 6 (2.2.2), 7 (3.6.4.2), 8 (3.4), 9 (2.2.2)	1.2 (4), 2.2.2 (1), 2.2.2 (6), 2.2.2 (9), 3.3 (2), 3.4 (8), 3.6.4.2 (5), 3.6.4.2 (7), 3.6.5.1 (3)
Logan, Bill and Brenda	D0076	1 (2.2.2), 1 (3.8)	2.2.2 (1), 3.8 (1)
Major, Alex	D0008	1 (3.6.2.2)	3.6.2.2 (1)
Masterson, Teri	D0096[a]	-	-
Matt (last name not provided)	D0034	see D0017 (form letter)	
McCleary, Mike	D0029	see D0017 (form letter)	
Mihalovich, James M.	D0033	see D0017 (form letter)	
Mondragon, Chad	D0036	see D0017 (form letter)	
Mondragon, Jesse	D0020	see D0017 (form letter)	
Morgan, Chester	D0035	see D0017 (form letter)	
Murrell, Randy	D0040	see D0017 (form letter)	
Pavlik, Matt	D0059	see D0017 (form letter)	

[a] See Lake Jackson Public Hearing transcript, which covers Documents #D0091 to D0100.
[b] See Port Gibson Public Hearing transcript, which covers Documents #D0088 to D0090.
[c] See Pascagoula Public Hearing transcript, which covers Documents #D0083 to D0086.
[d] See Houma Public Hearing transcript, which covers Documents #D0101 to D0103.
[e] See Richton Public Hearing transcript, which covers Document #D0087.
[f] USFWS and Mississippi Natural Heritage Program submitted joint comments.

Table 8.3-1: Index of Comment Documents and Comments

Commenter	Comment Document #	Comment # (Comment Issue Category)	Comment Issue Category (Comment #)
Price, Charles	D0041	see D0017 (form letter)	
Price, Jason	D0069	see D0017 (form letter)	
Sanchez, Santos Jr.	D0062	see D0017 (form letter)	
Schroeder, Norman	D0082	see D0017 (form letter)	
Schuelke, Timmy	D0060	see D0017 (form letter)	
Singletary, Charlie	D0017	1 (2.2.2), 1 (3.8)	2.2.2 (1), 3.8 (1)
Smith, Larry R.	D0051	see D0017 (form letter)	
Solano, Mario	D0056	see D0017 (form letter)	
Suggs, Cindy	D0104	1 (2.2.2), 2 (3.8)	2.2.2 (1), 3.8 (2)
Thomason, Allen	D0068	see D0017 (form letter)	
Thornberg, Mike	D0019	see D0017 (form letter)	
Tullis, R. Duke	D0027	see D0017 (form letter)	
Tyler, Scott	D0057	see D0017 (form letter)	
Tywater, E.R.	D0058	see D0017 (form letter)	
Vaughn, Donald	D0050	1 (2.2.2), 1 (3.8)	2.2.2 (1), 3.8 (1)
Voss, Johnny	D0038	see D0017 (form letter)	
Wade, Vick	D0094[a]	1 (2.2.2)	2.2.2 (1)
Waldorf, Elizabeth	D0007	1 (3.6.2.2), 2 (3.6.2.2), 3 (3.6.4.2), 4 (3.7.4.2)	3.6.2.2 (1), 3.6.2.2 (2), 3.6.4.2 (3), 3.7.4.2 (4)
Wessels, Kimmy	D0043	see D0017 (form letter)	
Whitworth, Mary	D0003	1 (3.7.5.2)	3.7.5.2 (1)
Williams, Hannah	D0066	see D0017 (form letter)	
Woods, William	D0044	see D0017 (form letter)	

[a] See Lake Jackson Public Hearing transcript, which covers Documents #D0091 to D0100.
[b] See Port Gibson Public Hearing transcript, which covers Documents #D0088 to D0090.
[c] See Pascagoula Public Hearing transcript, which covers Documents #D0083 to D0086.
[d] See Houma Public Hearing transcript, which covers Documents #D0101 to D0103.
[e] See Richton Public Hearing transcript, which covers Document #D0087.
[f] USFWS and Mississippi Natural Heritage Program submitted joint comments.

Table 8.3-2: Issue Categories (Outline of Comment Responses in Section 8.4)

Table 8.3-2: Issue Categories (Outline of Comment Responses in Section 8.4)

	Page Number
3.6.4.1 General Impacts	8-98
3.6.4.2 Site or Alternative Specific Impact	8-99
3.6.5 Brine Discharge	8-102
3.6.5.1 General Impacts	8-102
3.6.5.2 Site or Alternative Specific Impact	*no comments received*
3.7 Biological Resources	8-104
3.7.1 Methodology and Common Impacts	8-104
3.7.2 Plants and Wildlife	8-105
3.7.2.1 General Impacts	8-105
3.7.2.2 Site or Alternative Specific Impact	8-118
3.7.3 Wetlands	8-119
3.7.3.1 General Impacts	8-119
3.7.3.2 Site or Alternative Specific Impact	8-129
3.7.4 Threatened or Endangered Species	8-140
3.7.4.1 General Impacts	8-140
3.7.4.2 Site or Alternative Specific Impact	8-143
3.7.5 Special Status Areas	8-158
3.7.5.1 General Impacts	8-158
3.7.5.2 Site or Alternative Specific Impact	8-159
3.7.6 Essential Fish Habitat	8-162
3.7.6.1 General Impacts	8-162
3.7.6.2 Site or Alternative Specific Impact	8-164
3.8 Socioeconomics	8-172
3.9 Cultural Resources	8-183
3.10 Noise	8-187
3.11 Environmental Justice	8-187
4. Chapter 4. Cumulative Impacts	**8-188**
4.1 Methodology	8-188
4.2 General Cumulative Impacts	8-189
4.3 Cumulative Biological Impacts	8-195
4.3.1 Bruinsburg	*no comments received*
4.3.2 Chacahoula	8-195
4.3.3 Clovelly	*no comments received*
4.3.4 Clovelly and Bruinsburg	*no comments received*
4.3.5 Richton	8-196
4.3.6 Stratton Ridge	8-196
4.3.7 Bayou Choctaw	*no comments received*
4.3.8 Big Hill	*no comments received*
4.3.9 West Hackberry	8-197
4.4 Cumulative Water Impacts	8-197
4.4.1 Bruinsburg	*no comments received*
4.4.2 Chacahoula	*no comments received*
4.4.3 Clovelly	*no comments received*

Table 8.3-2: Issue Categories (Outline of Comment Responses in Section 8.4)

	Page Number
4.4.4 Clovelly and Bruinsburg	*no comments received*
4.4.5 Richton	8-197
4.4.6 Stratton Ridge	*no comments received*
4.4.7 Bayou Choctaw	*no comments received*
4.4.8 Big Hill	*no comments received*
4.4.9 West Hackberry	*no comments received*
5. Chapter 5. Irretrievable and Irreversible Resources	**8-198**

[a] Site specific comments are also included in this table under the issue categories for chapters 3, 4, and 5.

8.4 COMMENTS AND RESPONSES

This section presents all the comments received on the draft EIS and the corresponding DOE responses. This section is organized by the comment categories listed in table 8.3-2, which generally follow the organization of the EIS for chapters 1 through 5.

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COMMENT	RESPONSE
1. NEPA Procedural Issues	
1.1 Agency Consultation	
Comment D0084-8 (Frank Leach, Jackson County Board of Supervisors) *I would further ask that the Gulf of Mexico program office be consulted with regard to any and all concerns as well as national marine fisheries simply because our Gulf is a very -- is very much an impact financially and economically across the entire southern United States.*	**Response 1.1-1** DOE met and consulted with EPA Region 4, where the Gulf of Mexico Program Office is based. DOE contacted NOAA offices in Panama City and St. Petersburg, FL, Baton Rouge, LA, and Galveston, TX. DOE sent each office an initial consultation letter in September 2005, as well as subsequent project mailings, including copies of the draft EIS. Appendix K contains a complete list of the agencies consulted, as well as sample consultation letters.

COMMENT	RESPONSE
1. NEPA Procedural Issues	
1.2 Public Involvement	
Comment D0083-2 (Becky Gillette, Sierra Club) *Now, specific to the draft EIS, when I made - I made this point with the scoping comments, that when this hearing was held in Jackson we were still recovering from the nation's largest national disaster. Local residents, nobody was aware of this. Our elected officials were not aware of it. The environmental community was not aware of it. I am co-chair of the Mississippi Chapter of the Sierra Club. I only became aware of this the day after when a reporter called me for comment and said that there were no opponents or nobody at the scoping meeting in Jackson.* **Comment D0083-5 (Becky Gillette, Sierra Club)** *Also, even though you only see a few members of the public here I would like to make the point that there was a proposal simply to put a dam on the buoy in Hattiesburg for which flows into the Leaf. That was involved about a year or two ago. I guess it was two years ago now in an area where the gulf sturgeon spawns. There was -- they filled up the*	**Response 1.2-1** DOE was aware that residents in the project area were recovering from the devastating effects of Hurricane Katrina. For example, DOE had to cancel the public scoping meetings in Hattiesburg and Pascagoula, MS, because the meeting facilities were no longer available. Instead, DOE held a meeting in Jackson, MS, after extending the scoping period. The scoping period was extended twice; it ran from September 1 through December 19, 2005. DOE publicized the project in various media outlets and notified organizations and the public. In accordance with NEPA and its implementing regulations and guidance and in light of the hurricanes, DOE mailed notices for the scoping and public comment meetings, including one to the Mississippi chapter of the Sierra Club, placed multiple meeting announcements in newspapers in the Gulf region—the Clarion-Ledger, the Hattiesburg American, and the Sun Herald—and ran online announcements.

COMMENT	RESPONSE
1. NEPA Procedural Issues	
1.2 Public Involvement	
whole - a room bigger than this with people who were opposed to that project, so I think if people knew about the impact -- if people in the Hattiesburg area knew about the impact to the Leaf River water quality alone, that there would be a large number people that would have turned out for that.	**[See response 1.2-1 above]**
Comment D0084-1 (Frank Leach, Jackson County Board of Supervisors) *Dr. Osborne and Mr. Johnson, especially on behalf of Jackson County, I would like to say welcome here this evening. And to the rest of you folks that are here to support this, the effort, I am appreciative of your coming our way. I suppose that I would much rather have been able to say that I appreciated being officially invited here this evening, but as you well know I was not officially invited and as far as I am aware, there is not a member of the Jackson County Board of Supervisors that was officially invited or notified as to this meeting or this hearing. Neither was there a notification on October 5th, which was to be a local scoping meeting for this -- Environmental Impact Statement was there any notice given to our Board of Supervisors nor our port authority, nor was there any local meeting relative to input that I am aware of in either Jackson County nor was there one on October the 4th, I believe, as it was scheduled in Hattiesburg, either.* *So with regard to the fact that none of the meetings have been held on a local level and I don't believe there has been adequate notice relative to this issue being placed before the citizens of Jackson County, I would say that I think this Environmental Impact Statement needs to take a step backward and I think in taking a step backward we need to then recognize and realize that the citizens of the Gulf Coast of Mississippi should be apprised and especially those individuals that are elected to represent a constituency, especially in Jackson County, should be one of the very first people that are on mailing list.*	**Response 1.2-2** See response 1.2-1. DOE acknowledges the communications difficulties posed by Hurricane Katrina. The Jackson County, MS, Board of Supervisors has been on the EIS mailing list from the initiation of the project. To facilitate future information distribution, the Jackson County Port Authority has been added to the project distribution list. After the Pascagoula public hearing, DOE met with representatives of the Pascagoula Naval Station, Pascagoula Refinery, and the Pascagoula Port Authority on July 18, 2006, to increase communication between DOE and the local government, businesses, and citizens of Pascagoula. DOE will continue to consult with the Port Authority in the future, as necessary.

COMMENT	RESPONSE
1. NEPA Procedural Issues	
1.2 Public Involvement	
I would further request that the Board of Supervisors be advised of why we have not been on an official mailing list and I would like to also know who has been notified as to any scoping meetings or any of the publications of the record that are taking place with regard to this Environment Impact Statement. *I am aware that also within this Environmental Impact Statement it makes reference to establishing a marine terminal within the Port of Pascagoula. The Port of Pascagoula is represented by nine board members. Five of those being appointed by the Board of Supervisors. Four of those being appointed by the governor of the State of Mississippi and they, too, were not in the loop with regard to this project at all.* *I notified -- after having found out via the grapevine today that this meeting was taking place, I notified Mark McAndrews, the director of the Port of Pascagoula, as to this meeting and suggested that -- I wondered if he was aware of this and he apprised me that he was not.* *Mr. Johnson, it's my understanding that a meeting was scheduled at 3:00 p.m. this afternoon to bring Mr. McAndrews as well as George Freeland, the director of the Jackson County Economic Development Foundation, QUASI, up to speed on what may be taking place here. I think all of this is a little bit on the ridiculous side as far as our federal government not working with local government to at least apprise it of what is going on.*	**[See response 1.2-2 above]**

COMMENT	RESPONSE
1. NEPA Procedural Issues	
1.2 Public Involvement	
Comment D0084-10 (Frank Leach, Jackson County Board of Supervisors) *So with that you can gather from my comments that I am concerned. I am very much displeased with the fact that a federal agency has come to Pascagoula, Mississippi on this date without having had any prior meeting in Jackson County with regard to something that is going to ultimately end up here in our county and guess what, it is not appropriate I do not believe for this local government to be ignored and to be glossed over. So for that I would say y'all have not done justice to our local government. It is with great disdain that I stand here having to say this evening that I don't appreciate any or all of this. I don't appreciate that many federal agencies have been involved, but yet, none of have had any discussion with the people that are elected to care about our county and how we go forward.*	**[See response 1.2-2 above]**
Comment D0084-11 (Frank Leach, Jackson County Board of Supervisors) *In that I am going to close and I am going to say once again I thank you for allowing us the opportunity to come. I am saddened by the fact that this was not very well publicized. I am saddened by the fact that we do not have an abundance of people here this evening to respond to what I think could be an issue that could provide a critical situation in Jackson County as we go forward.* **Comment D0085-4 (Fred Lemon, individual)** *Now, as far as us having this meeting, I am not sure it's a legal meeting because if it wouldn't have been for Ms. Gillette I wouldn't have even known about it, so, you know, I think we need to look at that.* **Comment D0086-1 (Lin Jacobson, individual)** *I was amazed to see a small blurb in Saturday's Mississippi Press*	**Response 1.2-3** See responses 1.2-1 and 1.2-2 above.

COMMENT	RESPONSE
1. NEPA Procedural Issues	
1.2 Public Involvement	
announcing this pubic hearing. And in my asking around town the past three days, does anybody have any information on this public hearing. Nobody knew the first thing about it. **Comment D0086-3 (Lin Jacobson, individual)** *The planning on this may have been exquisite for you guys, but your public relations as to what is going on to the people of Jackson County has been a zero and that's unfortunate.*	**[See response 1.2-3 above]**

COMMENT	RESPONSE
1. NEPA Procedural Issues	
1.3 Other	
Comment D0002-3 (Greater Lafourche Port Commission) *From a brief review of the EIS, it does not appear that the huge savings and efficiency of tying in with a proven system and existing support infrastructure [for the Clovelly alternatives] has been fully evaluated.*	**Response 1.3-1** After additional studies were completed by DOE, the Clovelly and Clovelly-Bruinsburg alternatives that involve cavern development at Clovelly are no longer considered reasonable alternatives. They are discussed in Section 2.7 Alternatives Eliminated from Detailed Study in the final EIS. Further detail on why these alternatives were eliminated appears in response 2.2-1.
Comment D0077-1 (EPA Region 6) *EPA rates the DEIS as "EC-2," i.e., EPA has "Environmental Concerns and Requests Additional Information in the Final EIS (FEIS)." EPA has identified environmental impacts that should be avoided to protect the environment. These concerns may require changes to the preferred alternative or application of mitigation measures that can reduce environmental impact. EPA has identified the need for additional information to be included in the FEIS to complement and to more fully insure compliance with the requirements of NEPA and the Council on Environmental Quality (CEQ) regulations. Areas requiring additional*	**Response 1.3-2** In accordance with your specific comments, DOE has included additional factual information in the final EIS. General information was added to chapter 2; air quality information was added to section 3.5; wetlands information was added to section 3.7, appendix E, and appendix O; and water permit information was added to sections 3.6 and 3.7 and appendix L.

COMMENT	RESPONSE
1. NEPA Procedural Issues	
1.3 Other	
information or clarification include: general information, air quality, wetlands, and water permits. Detailed comments are enclosed with this letter, which more clearly identify our concerns and the informational needs requested for incorporation into the FEIS. *Our classification will be published in the Federal Register according to our responsibility under Section 309 of the Clean Air Act to inform the public of our views on proposed Federal actions. If you have any questions, please contact Mike Jansky of my staff at (214) 665-7451 for assistance.*	**[See response 1.3-2 above]**
Comment D0079-8 (Dow Chemical Company) *[DOW Chemical] urges DoE to re-review its entire examination of the potential Stratton Ridge site, because since this error was made (and the error about the actual co-located nesting Bald Eagle and the continuing installation of the Freeport LNG facility), there may well be other errors relating to the Stratton Ridge potential site that would need to be found and corrected before DoE could select the Stratton Ridge potential site as the SPR expansion site*	**Response 1.3-3** DOE has incorporated this information into the final EIS. See response 3.7.4.2-7 for a discussion of the bald eagle and responses 2.3.6-1, 4.2-4, 4.2-5, and 4.2-6 for discussions of the proposed Freeport LNG facility.
Comment D0113-4 (Sierra Club, Houston Regional Group) *The HSC requests that the DEIS be revised and put out again for a 60 day public review and comment period. The HSC appreciates this opportunity to comment.*	**Response 1.3-4** The Houston Regional Group Sierra Club has requested that the draft EIS be revised and reissued for public comment for reasons explained in comments D0113-1, D0113-2, and D0113-3 (see appendix N to read the entire document). As explained in responses 3.7.3.2-10, 4.2-2, and 4.2-3, DOE believes that the draft EIS provides a meaningful analysis and discussion of the potential impacts of DOE's proposed action (40 CFR 1502.9(a)). In response to comments on the draft EIS, DOE has provided additional clarifying information and analyses. None of the comments on the draft EIS, nor the additional analyses conducted in the final EIS, present new information that would significantly alter the results of DOE's analysis of the potential environmental impacts of the

COMMENT	RESPONSE
1. NEPA Procedural Issues	
1.3 Other	
[See comment D0113-4 text above]	proposed action. Therefore, DOE believes issuing a revised draft of the EIS is not required.
Comment D0114-2 (NPS, Natchez Trace Parkway) *Because of this change in our position, we now respectfully submit our request to be a cooperating agency on your proposed EIS for the proposed petroleum pipeline crossings of the Natchez Trace Parkway. A detailed section in the proposed EIS which describes the impacts to the Parkway including mapping is requested so that it will suffice for National Park Service (NPS) National Environmental Policy Act (NEPA) compliance to be attached to the right-of-way applications. A Statement of Findings will also be required if the proposed construction impacts any wetlands on Parkway land. Archeological clearance and the Section 106 of the National Historic Preservation Act compliance process will also be required regardless of which alternative you propose on Park lands.*	**Response 1.3-5** In response to this correspondence, DOE has contacted the National Park Service and reviewed the development of the EIS. Both agencies concluded that it is too late in the NEPA process for the National Park Service to effectively contribute as a cooperating agency (see appendix K, page K-23, for DOE's written response). If DOE selects one of the the Bruinsburg alternatives, DOE would consult with the National Park Service and provide the Service with project-specific information for its specific NEPA compliance requirements.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.1 Proposed Action: Comments Applicable to All Alternatives	
Comment D0077-34 (EPA Region 6) *Additionally, the facility will be hydrostatic tested when complete. Basically, the salt cavern is a large bottle shaped structure, taller than wide, holding from 275 to 500 million gallons liquid. The salt dome will not hold 100 percent oil, water will be used as a means to maintain pressure on the system. A single site may have several such domes at its location. EPA is interested in knowing what volume of water will be required for hydrostatic testing; the volume of water needed for pipeline infrastructure; and where the discharged is located and the rate of discharge. Please provide this information in the FEIS.*	**Response 2.1-1** After DOE has completed developing the caverns and before they are filled with oil, the caverns would contain a brine solution. For hydrostatic testing, as discussed in section 2.3-1, a small amount of brine (up to 0.022 MMB) would be withdrawn from the onsite brine pond and pumped into the cavern along with nitrogen to increase the pressure inside the caverns to complete the hydrostatic test where any loss of pressure would be recorded. After the test is complete, the excess water would be discharged back into the onsite brine pond as discussed in section 2.3.3. All water withdrawals and discharges would

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.1 Proposed Action: Comments Applicable to All Alternatives	
[See comment D0077-34 text above]	be within permitted withdrawal and discharge rates, and they would be far less in volume and duration than the volume withdrawn and discharged during cavern development. The volume of water needed to fill the pipeline from the RWI structure to the proposed storage site would be site-specific, and would depend on the diameter of the pipe and length of the pipeline. The volume would range from 0.04 MMB to 0.09 MMB. After the water is in the pipeline, it would be used for either solution mining or to displace oil during a drawdown event. In either situation, after the water would be displaced from the cavern, it would be disposed of through the brine disposal system. All water withdrawals and discharges would be within permitted withdrawal and discharge rates, and they would be far less in volume and duration than that withdrawn and discharged during cavern development.
Comment D0078-8 (DOI) *Alternative routes and directional drilling should be evaluated and the least environmentally damaging route/method should be selected. Installation of pipelines and other transmission lines have caused irreversible damage in coastal marsh environments. Damage is often not limited to the permitted ROW; damage occurs outside the ROW when construction equipment ranges through the marsh. Enclosed are specific pipeline conditions the FWS, in concert with the U.S. Army Corps of Engineers (USACE), Texas Parks and Wildlife Department, and National Oceanic and Atmospheric Administration - Fisheries (NOAA Fisheries), developed for pipeline installation and post-construction monitoring plans to reduce impacts to fish and wildlife habitats. These conditions should be included in the final project plans.*	**Response 2.1-2** As discussed in section 2.3.9, directional drilling would be one of the pipeline construction methods. The specific conditions when directional drilling would be performed are discussed in section 3.7.2.1.2, which includes rivers and streams greater than 100 feet (30-meters) wide. DOE did consider alternative ROWs to avoid wetlands impacts as described in section 3.7 and appendix B, section B.7. In addition, DOE attempted to co-locate new ROWs with existing ROWs to further reduce the potential impacts. The pipeline installation and postconstruction monitoring plans to reduce effects on fish and wildlife habitats would be included in the final project plans as appropriate.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.1 Proposed Action: Comments Applicable to All Alternatives	
Comment D0107-1 (Rick Lampard, individual) *Why not do like There doing now and take the salt out of the water before they pump it anywhere. That way it doesn't leave a dead spot in our Gulf !*	**Response 2.1-3** The flow rate required for cavern leaching is approximately 1.1 to 1.2 MMBD. DOE has not identified any demand for or capability to process that much brine and extract the salt. For example, Dow, the largest brine consumer of the Stratton Ridge salt dome, would not be able to use the brine as indicated in its comments on the draft EIS (see appendix N, comment document D0079). In addition, DOE has accumulated many years of experience in ocean disposal of brine. Disposal to the Gulf of Mexico through a pipeline has been accomplished at three existing SPR sites: Bryan Mound and Big Hill, TX, and West Hackberry, LA. DOE's specially designed diffusers and extensive monitoring programs have demonstrated that this method can be used with minimal effect on marine life.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2 Alternatives: Comments on Specific Alternatives	
Feasibility	
Comment D0074-1 (U.S. Army Corps of Engineers) *Clarify why the proposed new facility at Clovelly is not technically practicable. There is existing infrastructure, proximity to LOOP and appears compatible with petroleum support function and development trends in the Port Fourchon area. This alternative appears to be one of less environmentally damaging options.*	**Response 2.2-1** Subsequent to the publication of the draft EIS, DOE determined that the Clovelly 120-MMB alternative and the Clovelly 80- or 90-MMB and Bruinsburg 80-MMB alternatives are not feasible and therefore are not reasonable. After the draft EIS was published, DOE completed additional studies of the geotechnical suitability of the Clovelly salt dome for SPR development (Arguello et al. 2006; Rautman and Looff 2006). The dome's hourglass shape and its small size required that DOE propose to place new SPR caverns for 120-MMB capacity below and in between Clovelly's existing caverns. This configuration has been found to present several risk factors to the integrity of the Clovelly

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2 Alternatives: Comments on Specific Alternatives	
Feasibility	
[See comment D0074-1 text above]	caverns and infrastructure and overall operation of the proposed site. Because of the potential mechanical interaction of the SPR caverns with the LOOP cavern field in the Clovelly dome formation, the maximum operating pressures for the SPR caverns would be greatly reduced to avoid severely damaging the bonding of the well casing within the salt formation. This reduction in maximum operating pressures would cause the following effects: • Substantially limit the maximum rate of filling and withdrawing oil from the caverns, and • Reduce DOE's ability to maintain the storage volume of the cavern. (Caverns at the depth DOE had proposed would incur high geological pressures that would cause the cavern volume to close or shrink, unless high pressures within the cavern are maintained.) Because of these issues, development of the Clovelly 120-MMB alternative is no longer considered reasonable nor feasible. DOE has removed the alternative from detailed consideration in the EIS. In addition, DOE consulted with LOOP officials on whether an 80- or 90-MMB Clovelly facility, proposed in the draft EIS to be developed in conjunction with the Bruinsburg site, could be developed by constructing conventional SPR storage caverns entirely in the upper level of the unused portion of the salt dome around the existing LOOP caverns. LOOP indicated that it required space for three future caverns, which would leave space for only four to seven potential SPR caverns. That arrangement would provide only about 30 to 55 MMB of storage capacity. In addition, this concept would not meet DOE's minimum standoff distances from the edge of the dome and DOE's standard pillar-to-diameter ratio for the proposed caverns. Because of the small amount of overall capacity and the risk factors associated with cavern construction in the small salt dome, DOE does not consider this change

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2.2 Alternatives: Comments on Specific Alternatives	
Feasibility	
[See comment D0074-1 text above]	in the conceptual plan for the Clovelly 80-MMB–Bruinsburg 80-MMB and the Clovelly 90-MMB–Bruinsburg 80-MMB alternatives to result in reasonable alternatives. Thus, DOE has removed these alternatives from detailed consideration in the EIS.
Comment D0074-3 (U.S. Army Corps of Engineers) *Address alternative storage mechanisms (e.g., tanks).*	**Response 2.2-2** Alternative techniques for storing crude oil such as aboveground steel tanks and inground concrete reservoirs were considered during the SPR's early development in the mid-1970s. Salt domes, which have been used around the world for hydrocarbon storage for many decades, were determined to be the most advantageous method for long-term storage of very large volumes of crude oil in terms of cost, safety, environmental impacts, and security. For example, the size of a 160-MMB concrete reservoir site would be almost four times greater than the size of a 160-MMB site in a salt dome; a steel tank farm would be almost 25 times greater in size, and the cost of constructing a steel tank site would be at least twice that of a salt dome site. A concrete reservoir site or steel tank farm site would result in between 4 and 25 times as much land-disturbing impacts and it would present a far greater fire, spillage, and security risk. In addition, the depth of the salt dome caverns and the selfsealing characteristic of the formation make salt dome storage virtually immune to natural disasters (hurricanes and earthquakes) as well as to adversarial activities from a security perspective.
Comment D0084-6 (Frank Leach, Jackson County Board of Supervisors) *I am also very concerned about the fact that these -- that there is such a concern about life cycle costs and if you want to look at life cycle costs why couldn't we merely look at another investment as opposed to merely incurring all of this capital outlay of pipelines and terminals and such as that by looking at a public/private partnership within some*	**Response 2.2-3** The Energy Policy and Conservation Act of 1975, which is the authorizing legislation for the Strategic Petroleum Reserve, provides the Federal government with wide latitude for the design of the SPR. It includes authorization for an Industrial Petroleum Reserve that would shift the responsibility for ownership of the strategic stockpile to private refiners and importers. When the original Strategic Petroleum Reserve

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2. Proposed Action and Alternatives	
2.2 Alternatives: Comments on Specific Alternatives	
Feasibility	
of our refineries whereby I am certain that an arrangement could be made for them to store some of this needed reserve product and could probably be done in such a fashion that it would be much less costly and would be ever present for productivity at those refineries so that that product that is called "crude" could then certainly be converted to something that would be consumable by the citizens of the United States?	Plan was formulated in 1976, the option of decentralized storage was given serious consideration; however, at that time, however, the analysis showed that centralized storage of crude oil in very large facilities would be significantly less expensive than any other option. The Plan also noted that, from a philosophical perspective, the SPR is meant to benefit the whole economy and all citizens; it was not meant to primarily support the U.S. refining industry. In 1997, DOE revisited major assumptions regarding the composition, location, and ownership of the SPR. These issues were presented to the public for comment in the Federal Register "Opportunity for Public Comment on Strategic Petroleum Reserve Policy" (62 FR 23437, April 30, 1997). Neither DOE analysis nor any public comments made a case for changing the philosophy underpinning the current plan for SPR development. Federal government ownership assures that the SPR will be used only in the public interest and that the costs and benefits will be public. The cost of the SPR would be minimized by building very large storage caverns in salt domes located on the coast of the Gulf of Mexico.
Comment D0084-7 (Frank Leach, Jackson County Board of Supervisors) *I would ask that the prior Environmental Impact Statement that was developed in the 90's be returned to the website or that copies of that specifically be made available as far as a CD ROM or such so that we could compare what prior findings were made as compared to today's Environmental Impact Statement. That we probably are just merely recreating the wheel and all of this has been studied and studied and studied again, so it would be my opinion that we probably ought to quit studying and we ought to just try to get down to the brass tacks of the matter of the fact that there are some alternatives other than*	**Response 2.2-4** The 1992 draft EIS can be found at: http://www.fossil.energy.gov/programs/reserves/publications/. It will remain on the Web site.

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2. Proposed Action and Alternatives	
2.2 Alternatives: Comments on Specific Alternatives	
Feasibility	
Mississippi becoming this process of having oil stored in our salt domes and then have to be concerned with this brine sludge or whatever is going to come down this pipeline for introduction into the Gulf of Mexico.	**[See response 2.2-4 above]**

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2 Alternatives: Comments on Specific Alternatives	
Capacity	
Comment D0074-2 (U.S. Army Corps of Engineers) *Explain limitations regarding maximizing expansion of the all existing SPR facilities, whether technical or administrative (e.g., 250 million barrel cap).*	**Response 2.2-5** Each existing SPR site does not have a cap of 250 MMB. As discussed in the EIS, several site-specific factors dictate the capacity at a site. In section 2.2.3 of the EIS, DOE states that, "In developing the range of reasonable alternatives to fulfill its proposed action, DOE first considered expansions of the three existing storage sites, which would capitalize on existing site infrastructure and operations and thereby minimize development time and construction and operations costs. DOE, however, cannot reach its goal of 273 MMB simply by expanding capacity at existing sites. The amount of new capacity that could be developed at each existing site is limited by the physical size of the salt dome, the site's infrastructure for cavern development, the capacity of the commercial petroleum distribution infrastructure to handle an increased rate of oil withdrawal from the site, and other constraints. DOE has determined that, at most, it could create up to 153 MMB of new capacity by expanding existing SPR sites: DOE's site at Bayou Choctaw, LA, could be expanded by up to 30 MMB; Big Hill, TX, by up to 108 MMB; and West Hackberry, LA, by up to 15 MMB. Accordingly, DOE must develop one or more new SPR storage sites to

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2. Proposed Action and Alternatives	
2.2 Alternatives: Comments on Specific Alternatives	
Capacity	
[See comment D0074-2 text above]	meet its 273 MMB target and the alternatives discussed below are various proposals for combinations of expanded sites and new sites.”
Comment D0013-5 (Gulf Restoration Network) *DOE asserts that 160 MMB is needed to provide capability to store two types of crude oil and support a drawdown rate of 1 million barrels per day. (DEIS at p. S-3). It is unclear from the DEIS why this is necessary, or why 160 MMB was not included in setting the target (i.e. a target of 313 MMB would include the 160 MMB). What is clear, however, is that by making this claim DOE eliminates from possibility the selection of one of the least environmentally damaging sites (Clovelly, LA) unless combined with another site. (i.e. Clovelly has capacity for 120 MMB but not 160 MMB).*	**Response 2.2-6** As discussed in section 2.2.3 of the EIS, DOE cannot reach its goal of 273 MMB of expanded capacity simply by expanding capacity at the existing SPR sites. The expansion of the existing sites could create up to 153 MMB of additional capacity, which would result in a 120-MMB shortfall in capacity. See response 2.2-5 for more details. According to additional studies completed by DOE (see response 2.2-1), the alternatives involving cavern development at Clovelly are no longer considered reasonable alternatives. They are discussed in Section 2.7 Alternatives Eliminated from Detailed Study in the final EIS.

COMMENT	RESPONSE
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2.2 Alternatives: Comments on Specific Alternatives	
Water Withdrawal and Brine Disposal	
Comment D0106-2 (USFWS) *In addition, the DEIS discusses only alternatives that use surface water to develop caverns in salt domes. The Service believes that serious consideration should be given to an alternative that utilizes ground water to develop caverns*	**Response 2.2-7** The flow rate required for cavern leaching is approximately 1.2 MMB per day. A typical water well can be expected to yield an average rate of 0.026 MMBD (760 gallons per minute). At this rate, a field of about 75 wells (50 operating and 25 spare) would be required. As a result of such large water volume consumption, depletion of water reserves and subsidence can occur. In addition, during the June 22, 2006, agency consultation meeting, MDEQ indicated that local aquifers are already in

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2. Proposed Action and Alternatives	
2.2 Alternatives: Comments on Specific Alternatives	
Water Withdrawal and Brine Disposal	
Comment D0106-7 (USFWS) *Page 2-1, Chapter 2, Proposed Action and Alternatives. This chapter provides a detailed discussion on development and selection of alternatives. The alternatives being considered in detail for Mississippi include surface water withdrawal to construct caverns in the salt domes for crude oil storage. Agency representatives during an interagency meeting on June 22, 2006, reached consensus that the surface water withdrawal from the Leaf River would be damaging to aquatic resources including listed species, and other water sources including ground water should be given detailed consideration for dissolution of the caverns. Geologists with the State of Mississippi provided locations of potential wells to provide water for cavern construction. The Fish and Wildlife Service recommends that the DOE develops and give detailed consideration to an alternative that would use primarily groundwater, or water from reservoir storage, to construct the caverns during low flow conditions.*	high demand from public utilities and other industries. During the permitting and Biological Assessment process, DOE would work with the regulatory and resource agencies to refine the water withdrawal and conservation plan, refine the concept plan for the RWIs, and identify additional supplemental sources of water if necessary. To further mitigate the impacts of the RWI on the Leaf River, DOE has modified the conceptual design for the RWI on the Leaf River to reduce the potential for impingement and entrainment of aquatic organisms. The revised conceptual plan would use cylindrical screens located in the water column and oriented parallel to the river flow (see section 2.4.3 and figure 2.4.3-3). To minimize the likelihood of entrainment and impingement, this design takes advantage of the sweeping velocity of the river, whereby the velocity of the water flows parallel and adjacent to the RWI screen surface (Gowan et al. 1999). DOE would use a relatively low intake velocity of 0.5 feet/second and relatively small screen size of 0.5 inches to further reduce impingement and entrainment. DOE would refine the conceptual plan for the RWI and water withdrawal during the Section 7 Consultation with the USFWS, NOAA Fisheries, and the Mississippi Natural Heritage Program and coordination with the USACE and MDEQ for the Section 404/401 permit and the water withdrawal permit. To reduce DOE's dependence on the Leaf River, DOE has added in the final EIS a RWI structure on Singing River Island in Pascagoula, which would withdraw water from the Gulf of Mexico to reduce withdrawal from the Leaf River during low-flow conditions. See response 2.2.2-1 and section 3.6.5.1.2 in the EIS for a summary of the modified Richton alternatives.

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Water Withdrawal and Brine Disposal	
[See comment D0106-7 text above]	See response 3.6.2.2-1 for a discussion of impacts to water resources and 3.7.4.2-18 for a discussion of impacts to biological resources.
Comment D0013-3 (Gulf Restoration Network) *The DOE has already identified alternatives to ocean dumping at some sites. For example, expansion of the Bayou Choctaw and West Hackberry sites would involve disposal of the brine in underground injection wells (DEIS at pp. 2-10, 2-11). Similarly, construction of a storage site at Clovelly and/or Bruinsburg would involve disposal of brine via underground injection. Accordingly, it is clear that discharge of brine to the Gulf is not the only disposal option. Yet, despite the potential for harmful impacts to marine species, the DEIS does not consider alternative disposal scenarios for brine at the other sites. The final EIS must fully analyze alternatives to disposal of brine in the Gulf of Mexico at other sites, and if no other alternative exists, should eliminate those sites from consideration.*	**Response 2.2-8** DOE has accumulated many years of experience in both underground injection and ocean disposal of brine. Injection into deep underground formations incurs technical and operational challenges as described in response 3.7.2.1-1. As described in section 2.5.1, a new brine injection well field would be constructed at Bayou Choctaw to dispose of the brine associated with cavern development and cavern filling operations. The existing brine injection wells could not dispose of the brine at the rate generated during solution mining. At West Hackberry, DOE would acquire existing caverns that would be tied into the existing brine disposal wells. Disposal to the Gulf of Mexico by pipeline has been accomplished at three existing SPR sites: Bryan Mound, Big Hill, and West Hackberry. Currently brine injection wells are used to dispose of the limited amount of brine at West Hackberry during cavern filling, but during cavern development when large volumes of brine were generated an offshore brine diffusion system was used. DOE's specially designed diffusers and extensive monitoring programs have shown that this method can be used with minimal effect on marine life. For these reasons, ocean disposal is the preferred method of brine disposal. Underground injection is considered only when a candidate site is so far inland as to make constructing a large disposal pipeline impractical, such as in the case of a new SPR facility at Bruinsburg, MS.

COMMENT	RESPONSE
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2.2 Alternatives: Comments on Specific Alternatives	
Location	
Comment D0013-1 (Gulf Restoration Network) *The GRN believes that the Draft Programmatic Environmental Impact Statement (DEIS) does not meet the requirements of the National Environmental Policy Act (NEPA). We recognize that Congress, in section 303 of the Energy Policy Act of 2005, required that not later than 1 year after the date of enactment of this Act, the Secretary shall complete a proceeding to select, from sites that the Secretary has previously studied, sites necessary to enable the acquisition by the Secretary of the full authorized volume of the Strategic Petroleum Reserve.* *Nonetheless, the GRN would argue that circumstances surrounding the DOE's decision have changed substantially, particularly in light of the 2005 hurricane season and the prediction of increasing hurricane severity in the Gulf of Mexico over the next ten years. Although the DEIS notes that its existing facilities and the proposed sites survived the storm, existing storm barriers (wetlands, barrier islands, etc) in Louisiana, Mississippi, and Texas are being lost, putting coastal facilities at greater risk. It is not, therefore, in the national interest to expand the SPR in the coastal areas of the Gulf states. Instead, the DOE should request that Congress revisit the provisions of the Act to allow consideration of sites outside the coastal area of the Gulf that were not previously considered.* **Comment D0083-1 (Becky Gillette, Sierra Club)** *First I would like to make a comment that's not really directed to the Department of Energy, but to Congress. And it seems to me that it's -- at a time when global warming is a huge concern and when we've had evidence of that through Hurricane Katrina and are now facing*	**Response 2.2-9** In accordance with NEPA, its implementing regulations (40 CFR Parts 1500 to 1508) and the DOE regulations for implementing NEPA (10 CFR Part 1021), DOE evaluated a range of reasonable alternatives. In Section 303 of the Energy Policy Act, Congress directed DOE to "consider and give preference to the five sites which the Secretary previously addressed in the [1992] Draft Environmental Impact Statement, DOE/EIS-0165-D. However, the Secretary, in his discretion may select other sites as proposed by a State where a site has been previously studied by the Secretary to meet the full authorized volume of the Strategic Petroleum Reserve [1 billion barrels]." Section 2.3.6 Storm Protection Measures discusses the effects of hurricanes on the existing SPR sites and explains that the operation of the existing SPR sites was able to be restored immediately after the hurricanes. In addition, the analysis presented in sections 3.3, 3.6, 3.7, and 3.8 supports the conclusion that hurricanes are not a threat to the safe and secure operation of existing and proposed facilities. In addition, two noncoastal sites, Bruinsburg and Richton, are evaluated in the EIS. In 1998, DOE revisited major assumptions regarding the composition, location, and ownership of the SPR. These issues were presented to the public for comments (DOE 1998). Neither DOE analysis nor any public comments made a case for changing the philosophy underpinning the current plan for SPR development. Federal government ownership assures that the SPR will be used only in the public interest, and that the costs and benefits will be public. The cost of the SPR would be minimized by building very large storage caverns in salt domes located on the coast of the Gulf of Mexico. Because

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
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stronger hurricanes as a result, the fact that the government would spend billions of dollars to store more oil rather than investing in the renewable energy and energy conservation is a shame and it's an outrage. That's where our efforts need to be placed, not squirrelling away more oil while we spend it like there's no tomorrow. **Comment D0084-5 (Frank Leach, Jackson County Board of Supervisors)** *I am very also much interested in the fact that we are -- are looking for alternatives for storage and why are the locations all within a three-state area of the southern United States on the Gulf of Mexico. It would seem as though to me with regard for a need -- we certainly have a great need in the northeastern quadrant of the United States as well as the West Coast, so would it not be appropriate to establish some other location as opposed to a concentration of strategic petroleum reserve being stored in such close proximity to each other? I do not have any earthly idea what the impact from a security standpoint may be, but with the fact that this is all around the Gulf, it would seem as though to me it could be better if it were spread out into other jurisdictions and this were not basically crammed down a couple or three states' throats as it appears as though we sometimes become the whipping posts for our government.* **Comment D0084-3 (Frank Leach, Jackson County Board of Supervisors)** *We further, I believe, would be concerned about the fact that here we are about to -- it appears as though if this were found to be the right site --incur a significant capital outlay into an area that is right on the face of the Gulf of Mexico and with the onslaught of the various and*	Congress directed DOE to consider specific locations and results of the review conducted in 1998, DOE concluded that it should not request Congress to revisit the Act to allow consideration of sites outside the Gulf Coast area.

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sundry not only tropical storms, but catastrophic hurricanes it would appear as though to me we will be in a constant state of maintenance with regard to a marine terminal that is going to be placed within the brunt of a zone that would be impacted by each and every hurricane that enters the Gulf and comes our way. **Comment D0088-1 (Jack Moody, Mississippi Development Authority)** *Mississippi feels like it would be a strategic move for the Strategic Petroleum Reserve to spread the geography out on this reserve, because when something comes up, whether it's a natural disaster or something else, and we need it, it would be good -- and in our pocket: We're trying to sell Mississippi -- it would be good to have us up and away from that concentration and be able to supply those crude oils that are going to go up to the Midwest and to the center part of the United States, coming out of what we hope would be this Bruinsburg location.* **Comment D0100-1 (Janice Edwards, Individual)** *And my question to you-all is -- I understand we need strategic oil reserves. But looking at the map where they all are, they all reside in the Gulf Coast. I realize most of our refineries are here; but the problem I see is if we have a major disaster like a Katrina and a Rita again and you cannot get to the strategic oil reserves, it'd do you no good. I suggest that you consider some place a little bit further inland that would not be impacted by the hurricanes that we are going to continue to receive down in the Gulf Coast.*	**[See response 2.2-9 above]**

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Comment D0016-1 (Senators Thad Cochran and Trent Lott) *While the recently-filed Draft EIS sets forth a number of options to accomplish this capacity expansion of the SPR, including the possible construction of five potential new sites and/or the expansion of three existing sites, we believe that the two sites under consideration in Bruinsburg and Richton, Mississippi, respectively, are two of the best values for the federal government in terms of cost, efficiency, and security, and one or both should ultimately be selected in any expansion of the SPR.* **Comment D0016-2 (Senators Thad Cochran and Trent Lott)** *First, these sites are located significantly further inland than other sites being considered, and substantially further away from the vulnerable coastline, the selection of which would effectively diversify our currently homogenously and centrally-located SPR. The devastating catastrophes last year in the forms of Hurricanes Katrina and Rita should have taught us the importance of locating our emergency stockpiles of petroleum in alternative, diverse locations throughout the Gulf Coast region. The current vulnerability of the SPR from potential hazards, whether natural disasters because of the proximity of SPR facilities to the coastline or, even terrorist acts because of the closely clustered locations of SPR facilities, is unacceptable. Correcting this potential liability, however, can begin by selecting an expansion site for SPR at Bruinsburg or Richton, thus alleviating to a substantial degree this continuing potential for hazards to the SPR. With the recent predictions of major hurricanes with increased frequency, it is imperative that DOE choose a site that is more inland and better insulated from such disasters. By not choosing an inland site such as Bruinsburg or Richton, we are perpetuating the vulnerability of the SPR to such disasters, including potentially devastating damage and possible closure of SPR facilities in emergency situations when the SPR*	**Response 2.2.1-1** DOE did not have a preferred alternative at the time the draft EIS was issued, but now it has designated Richton with expansion at Bayou Choctaw, Big Hill, and West Hackberry as the preferred alternative based on crude oil distribution system capabilities, environmental factors, project risks, and project costs. However, the three commercial caverns at the West Hackberry site were recently sold to Sempra Pipelines and Storage and ProLiance Transportation and Storage. As a result, DOE may not be able to acquire the West Hackberry site caverns at a reasonable cost. DOE will weigh the cost of expansion at the West Hackberry site as a factor in selecting sites. DOE will identify the environmentally preferable alternative in the Record of Decision. DOE did not select one of the Bruinsubrg alternatives after comparing the crude oil distribution needs, environmental factors, project risks, and project costs with the other proposed alternatives. See also section 2.4.1 for a discussion of uncertainty regarding the size and shape of the Bruinsburg salt dome.

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is needed most. *Second, the geography, geology and topography presented by these two new sites at Bruinsburg and Richton are superior to other new sites being considered. These sites are located in the highlands, avoiding environmental and economic problems associated with constructing or expanding in expansive coastal wetlands or sensitive areas. This will not only be much more cost-effective to the federal government, but will also be more environmentally sound for future generations. Further, the geologic structure of the potential domes is better suited for SPR expansion, resulting in lower cost cavern construction, cavern integrity and easier petroleum distribution. These sites also can be completely under DOE control, maximizing security at what will be one of the nation's most important energy installations.* *Finally, these sites also have numerous other attributes that make their selection optimal. For instance, the Bruinsburg site is strategically located on the Mississippi River and only a short distance from a major pipeline - the Capline system. This strategic location along the river gives the site many advantages, through an abundance of resources in raw water intake as well as opportunities for lower costs in construction and distribution of petroleum through the use of marine transportation. Further, easy and efficient access to the Capline system gives the Bruinsburg site a major resource for distribution. With both marine and pipeline alternatives of distribution, the Bruinsburg site has maximum flexibility to use this strategic energy resource and provide the most economic and functional security for the SPR, ensuring the continued access and availability of SPR resources to the rest of the country when SPR facilities located on or near the coast are closed due to natural disasters. The Richton site also has many beneficial characteristics, including a distribution alternative at a new location*	**[See response 2.2.1-1 above]**

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along the Gulf Coast away from current SPR locations which contributes to the diversification of SPR locations generally; its utilization of the Calpine pipeline at a point less vulnerable than coastal alternatives; and its proposed raw water intake which would not cause upstream migration of salinity gradient as it would in some other alternative sites being considered. *Mr. Secretary, we firmly believe the sites being considered in Mississippi are the most strategically-located sites and the best value for the federal government, and strongly urge the selection of one of these sites in any expansion of the SPR. Thank you again for your generosity and assistance as the State of Mississippi recovers. We look forward to working with you on this and additional projects as we continue to move forward in rebuilding the Gulf Coast and the State of Mississippi.*	**[See response 2.2.1-1 above]**
Comment D0015-1 (Clairborne County Board of Supervisors) *As stated in our letter dated December 14, 2005, the Clairborne County Board of Supervisors supports the efforts of the Department of Energy to expand our nations Strategic Petroleum Reserve (SPR). The Energy Policy Act of 2005 set out a number of initiatives to address this country's present dependency. The expansion of the SPR is one of these positive responses.* *The Bruinsburg site here in Clairborne County is well suited for emergency distribution to the middle USA refineries using not only the Capline pipeline but the Mississippi River as well. The Bruinsburg site also appears to have substantial merit for the 160-million barrel expansion site or the 80-million barrel expansion set out in the Department of Energy's options for expansion.*	**Response 2.2.1-2** See response 2.2.1-1 for discussion of the preferred alternative. In addition, Section 3.8 Socioeconomics discusses the potential socioeconomic benefits of developing an SPR facility at Bruinsburg.

<table>
<tr><th>COMMENT</th><th>RESPONSE</th></tr>
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<tr><td>With the expected multi-million dollar investment, several hundred construction jobs and high payment permanent jobs to be created, coupled with the limited impact on the environment as outlined in the Draft Environmental Impact Statement, this board continues to support the efforts of Governor Haley Barbour and our congressional delegation in selecting Bruinsburg as a potential site to expand the United States Strategic Petroleum Reserve.

Comment D0090-1 (James Miller, Claiborne County Board of Supervisors)
I want to first and foremost say the Claiborne County Board of Supervisors totally supports this effort. And, as a matter of fact, we, the county, we have been talking to our congressional delegation about this particular endeavor for the last couple or three years. Congressman Pickering, I think, was very instrumental in bringing this to the forefront, in terms of Claiborne County being included in the process, as well as Governor Barbour. So the Claiborne County Board of Supervisors is totally committed to doing whatever it needs to do to support this.</td><td>[See response 2.2.1-2 above]</td></tr>
<tr><td>Comment D0087-1 (Jack Moody, Mississippi Development Authority)
First of all, I would like to acknowledge the very thorough job that Dave and his people have done in Mississippi and Mississippi is delighted to have two candidates for consideration in this expansion.

As he pointed out, there was a second candidate put into it and, really, we've got two features in Mississippi, very very different, and can serve two different purposes, in a sense. Where we are, it's got the biggest, prettiest, shallowest piece of salt anywhere in Mississippi. It's a fabulous natural resource with tremendous storage capacities, but as</td><td>Response 2.2.1-3
See response 2.2.1-1 for a discussion of the preferred alternative.</td></tr>
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you saw, the plumbing involved in this is quite extensive, so it would take two different views of our two different sites. *One would be a very long term, very major, strategic decision here, money going in up front, investing in something very big, but that's what y'all live on top of in the Richton salt dome; tremendous capabilities.* *We've got room in there.* *Our state geologist and one of his staff is with us. They've put out publications. I think Stan published a summary of all of our salt domes here in Mississippi just a few years ago and that document puts about 5,800 acres under -- above 2,000 feet in the salt. That's a lot of storage capability. So, again, the Richton site, you would have to think of almost building an interstate. It's the type of investment the government looked at, and yes, it's big; yes, it's expensive, but oh, when it gets done, it's going to do a great job.* *The other site that we have at Bruinsburg on the river, as Dave pointed out, is a smaller site. On a good day, you could put 160 million barrels in it. That's a yawn for the Richton site. Oh, yeah, it's a good beginning, but when we're really going to get going, you know.* *But there are two different sites and it will be up to his office and the amount of monies that they have going.* *But we, in Mississippi, are also saying we think it's a good idea. As you saw from those maps, the Strategic Petroleum Reserve is located on the coast and both of our sites are geographically removed from the coast,*	**[See response 2.2.1-3 above]**

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geographically removed from surge influence that the hurricanes will bring. NOAA, which is the National Oceanic and Atmospheric Administration, has put out on its site that hurricane seasons are cyclical, just like everything else in life, and we have been in one of those really nice, low-intensity cycles for about 30 years and we are embarking -- starting about two seasons ago, on our next high-intensity, high-frequency cycle. *So, that goes back to, we would politely -- we're going to put our best foot forward, that we would hope the DOE would take that into consideration. The Strategic Petroleum Reserve, we think it would be a strategic move to geographically pull part of that off of the coast and be able to serve the Midwest in the event that we had a repeat of a Katrina-type situation, but something, whether it would be a foreign import interruption or whether it would be domestic difficulties from natural disasters. But nevertheless, we would be removed from the coast and be able to continue to contribute to the stability of the country while they're dealing with whatever problems developed.* *But again, we really appreciate the thoroughness of the review the DOE has given Mississippi and we certainly wish them -- as a country, we wish them the best decision for the good of the country.*	**[See response 2.2.1-3 above]**
Comment D0089-2 (Vernon Phillips, Anabasis) *I would ask the Department of Energy to consider the following advantages that the Bruinsburg site offers: Number 1 is geographic distribution. The Bruinsburg site lies 100 miles north of existing storage sites to offer strategic supply advantages to the PADD, (spelling) P.A.D.D. Number 2 and removes the site from all possibilities of hurricane storm surge. Furthermore, the Bruinsburg site offers the strategic disbursement from other sites acquired by the original enabling legislation of the United States Strategic Petroleum*	**Response 2.2.1-4** See response 2.2.1-1 for a discussion of the preferred alternative.

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Reserve. *Number 2 is the minimal environmental impact. The Bruinsburg offers the shortest possible pipeline routes of all the candidate sites with the facilities completely under the Department of Energy's security procedures.* *The Bruinsburg site offers raw water availability out of the fragile brackish marsh environment.* *The Bruinsburg site offers highland pipeline construction for minimal environmental impact and least of cost.* *The Bruinsburg site offers abundant availability of disposal zones underground, which completely protect the underground fresh water supplies and result in no discharge to the environment of hyper-saline brine.* *The Bruinsburg site offers cost-effective construction options with excellent distribution by pipeline and barge to PADD, PADD II, and PADD III.*	**[See response 2.2.1-4 above]**
Comment D0089-1 (Vernon Phillips, Anabasis) *I commend the DOE for consideration of the Bruinsburg site as a candidate for expansion of the United States Petroleum Strategic Reserve.*	**Response 2.2.1-5** See response 2.2.1-1.
Comment D0103-1 (Charlotte Randolph, Lafourche Parish) *Because LOOP had been a good environmental storage for many years, we feel that any expansion could actually be best achieved in that site. We feel that LOOP would certainly be a good monitor of the situation,*	**Response 2.2.1-6** Cavern development at the Clovelly salt dome is no longer considered reasonable, as explained in response 2.2-1. Also see response 2.2.1-1 for a discussion of the preferred alternative.

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as well.	**[See response 2.2.1-6 above]**
Comment D0047-1 (Fred Cummins, individual) *Concerning expansion of the oil reserve in the Stratton ridge area of Clute, Texas. There is some other reason that Dow opposes this project obviously. They seem to have a lock on the Texas environmental People so it may be that they have injected something that they do not want exposed. I have lived here and worked on the Gulf as a Sea Captain for fifty years. I have seen this coast destroyed by the Chemical industry.* *The community wets itself if Dow makes rumors of moving or laying off. I suggest you take the country into account and let the chips fall for Dow and the Community as they will. Dow is not a trustworthy company but it has a good PR department and the local newspaper is their cheerleader.* *This is one citizen's opinion. Do what is best for the Country.*	**Response 2.2.1-7** Comment noted.
Comment D0075-1 (Dominion Natural Gas Storage) *Dominion Natural Gas Storage, Inc. (DNGS) hereby submits comments on the U.S. Department of Energy (DOE) Draft Environmental Impact Statement (DEIS) "Site Selection for the Expansion of the Strategic Petroleum Reserve." Specifically, DNGS reiterates its support for the environmental compatibility of DNGS's salt cavern storage facilities located in West Hackberry, Louisiana adjacent to DOE's existing West Hackberry Strategic Petroleum Reserve (SPR) facility.* **Comment D0075-2 (Dominion Natural Gas Storage)** *The DEIS considers the expansion of the existing DOE West Hackberry facility through the annexation, or acquisition, of the DNGS salt cavern storage facilities. A summary of the benefits of the DNGS/West*	**Response 2.2.1-8** See response 2.2.1-1 for a discussion of the preferred alternative.

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Hackberry site, as described in the DEIS, are highlighted below: *1) DOE's West Hackberry site can be readily expanded into the existing DNGS storage facilities since they are immediately adjacent to each other.* *2) The DNGS storage facility can expeditiously provide 15 million barrels of storage within approximately six months after being selected.* *3) The existing DOE-SPR West Hackberry facility currently has all of the required infrastructure in place to integrate the three DNGS salt caverns at minimal expense.* *4) As detailed in the DEIS, there are no significant environmental impacts associated with the DNGSNI West Hackberry site and it is the least environmentally invasive expansion option under consideration.* *5) The DNGSI West Hackberry site is the most economical expansion option under consideration.* **Comment D0101-1 (David Kohler, Dominion Natural Gas Storage)** *I'm with Dominion. We own the Hackberry facility. It's one of the facilities that is pre-existing. I'll just comment further on Dave Johnson's comments, that our facility actually has three completed caverns, five million barrels each that have already been bleached and are just sitting empty. So as far as meeting the criteria -- or the four criteria that were outlined, one of them being cost effectiveness, expeditiously, you know, in service, and the third one being the least impact.* **Comment D0101-3 (David Kohler, Dominion Natural Gas Storage)** *Dominion is very interested in pursuing and hoping that our alternative is considered. It does make a lot of sense. Obviously it could be put in*	**[See response 2.2.1-8 above]**

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service probably the quickest of any of the alternatives. Although it is small, it certainly meets the criteria.	**[See response 2.2.1-8 above]**

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Comment D0106-28 (USFWS) *…the FWS recommends that the Richton alternative as planned not be selected as the preferred alternative. However, the Richton site would be acceptable if groundwater is used for dissolution of caverns instead of surface water from the Leaf River.*	**Response 2.2.2-1** In accordance with NEPA, its implementing regulations (40 CFR Parts 1500 to 1508), and the DOE regulations for implementing NEPA (10 CFR Part 1021), DOE has designated Richton and expansion at Bayou Choctaw, Big Hill, and West Hackberry as the preferred alternative in the final EIS, and DOE will identify the environmentally preferable alternative in the Record of Decision. See response 2.2.1-1 for a discussion of the preferred alternative. DOE acknowledges that withdrawal of water from the Leaf River may result in adverse impacts on water resources (see 3.6.5.1.2) and aquatic resources, such as endangered species (see 3.7.5.1.2). To reduce DOE's dependence on the Leaf River, DOE has added to the Richton alternatives a RWI structure on Singing River Island in Pascagoula, which would allow DOE to withdraw water from the Gulf of Mexico to reduce withdrawal from the Leaf River during low-flow conditions. If DOE selects one of the Richton alternatives, DOE would develop a Water Conservation Plan for water withdrawal during cavern creation, drawdown, and maintenance. During cavern creation, drawdown, or maintenance, withdrawal from the Leaf River would be used during normal and high-flow conditions. Under low-flow conditions in the Leaf River, the withdrawal would be supplemented by a secondary

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[See comment D0106-28 text above]	source, the Pascagoula RWI, which would withdraw water from the Gulf of Mexico. The Pascagoula RWI would be designed to handle about 0.5 MMBD of the total required volume, which is 1.2 MMBD. During construction or maintenance, when flows in the Leaf River reach the Minimum Instream Flow that is designated by the regulatory agencies to protect special status species, withdrawal from the Leaf River would be reduced or terminated until the Minimum Instream Flow in the Leaf River is reached. During this period, DOE would withdraw water from the Gulf of Mexico. If necessary, during Section 7 Consultation with the regulatory agencies, DOE would consider possible supplemental sources including possible groundwater sources, withdrawals from other surface water bodies, and a possible onsite off-stream reservoir. If low-flow conditions exist in the Leaf River during emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico, and, as necessary to reach the water withdrawal rate of 1.2 MMBD, from the Leaf River. To further mitigate the impacts of the RWI on the Leaf River, DOE has modified the conceptual design for the RWI on the Leaf River to reduce the potential for impingement and entrainment of aquatic organisms. The revised conceptual plan would use cylindrical screens located in the water column and oriented parallel to the river flow (see section 2.4.3 and figure 2.4.3-3). To minimize the likelihood of entrainment and impingement, this design takes advantage of the sweeping velocity of the river, whereby the velocity of the water flows parallel and adjacent to the RWI screen surface (Gowan et al. 1999). DOE would use a relatively low intake velocity of 0.5 feet/second and relatively small screen size of 0.5 inches to further reduce impingement and

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[See comment D0106-28 text above]	entrainment. DOE would refine the conceptual plan for the RWI and water withdrawal during the Section 7 Consultation with the USFWS, NOAA Fisheries, and the Mississippi Natural Heritage Program and coordination with the USACE and MDEQ for the Section 404/401 permit and the water withdrawal permit. See response 3.6.2.2-1 for a discussion of impacts to water resources for the Richton site.
Comment D0009-1 (June Havens, individual) *Richton, MS is inappropriate for a Strategic Petroleum Reserve storage site. The salt domes are not stable and the ground water for the coastal area could be in jeopardy. Hasn't the Coast suffered enough.* **Comment D0011-1 (Nan Johnson, individual)** *I am writing in opposition to the proposed expansion of the Strategic Petroleum Reserve in the Richton Salt Domes....especially as it would impact on the Leaf and Pascagoula Rivers.* **Comment D0012-1 (Bruce Browning, individual)** *This sounds, at best, a very flaky project......Please reconsider this theory and do more research on how to solve your problem.....water and air are quite possibly the most important assets to life here in Mississippi - and elsewhere! There must be a better way!!* **Comment D0014-1 (Tony Bland, individual)** *I am writing to let you know of my opposition to the proposal to expand the nation's Strategic Petroleum Reserve in the Richton Salt Domes. I am concerned about the environmental impact of the project.*	**Response 2.2.2-2** See response 2.2.1-1 for discussion of the preferred alternative and 2.2.2-1 for a discussion of sources of water withdrawal for the Richton site. See response 3.4-1 and response 3.6.2.2-1 for a discussion of geology and water resources at the Richton site, respectively.

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Comment D0085-6 (Fred Lemon, individual) *But let's don't screw this salt dome up with petroleum. It needs to go somewhere. Let's put it back in the ground where it came out of, but let's don't put it there[Richton].* **Comment D0085-9 (Fred Lemon, individual)** *I think that's mainly the points I wanted to get in and I hope they'll be taken with -- seriously. So I would like to close with one word. No.* **Comment D0085-1 (Fred Lemon, individual)** *They just took the wrong trail, especially when it came to Richton. I don't think that the Richton deal -- it's kind of like the pleasure is not worth the pain. You know, I just don't think it's a good idea at all.* **Comment D0084-12 (Frank Leach, Jackson County Board of Supervisors)** *And I personally do not believe it would be in our best interest and the State of Mississippi necessarily to have this million barrels of oil stored here when it could be stored other ways and other places. Thank you very much.*	**[See response 2.2.2-2 above]**
Comment D0097-1 (Diane Kile, Office of Congressman Ron Paul) *I want to join with others tonight in expressing my concerns regarding the Stratton Ridge expansion of the Strategic Petroleum Reserve. In the recent past, President Bush has stated the need to judiciously diminish the reserve in order to reduce non-market demand, thus helping to reduce energy costs. In light of that, we should seriously consider not only where but also whether or not to increase the reserve. Certainly if high energy prices are a legitimate concern -- and they clearly are at this time -- we should not undertake such an expansion in a way that*	**Response 2.2.2-3** Response 2.2-9 discusses the history of SPR and a DOE study directed by Congress. The socioeconomic impacts of each alternative are addressed in Section 3.8 Socioeconomics. DOE is required by law to select sites to expand the SPR. On August 8, 2005, the President signed the Energy Policy Act of 2005 (EPACT). Section 303 of EPACT states that "Not later than 1 year after the date of enactment of this Act, the Secretary shall complete a proceeding to

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could negatively impact any component of the petrochemical industry. Any federal action that would threaten to raise costs to business, which would be passed along to consumers, is a bad policy at any time. However, this is a particularly bad time for any such policy to be enacted. **Comment D0079-14 (Dow Chemical Company)** *I want to join with others tonight in expressing my concerns regarding the Stratton Ridge expansion of the Strategic Petroleum Reserve (SPR). In the recent past President Bush has stated the need to judiciously diminish the reserve in order to reduce nonmarket demand, thus helping to reduce energy costs. In light of that, we should seriously consider not only where, but also whether or not, to increase the reserve.* *Certainly, if high energy prices are a legitimate concern (and they clearly are at this time) we should not undertake such an expansion in a way that could negatively impact any component of the petro-chemical industry. Any federal action that would threaten to raise costs to business, which would be passed along to consumers, is a bad policy at anytime. However, this is a particularly bad time for any such policy to be enacted.* **Comment D0102-2 (Sybil Guidry, individual)** *Well, I feel that it would impact severely the fragile ecosystem that's already wounded from exploitation by oil companies, by some thoughtless locals, as well as the natural forces.* *Terrebonne Parish has been negatively impacted by Hurricanes Katrina and Rita. And so that's my concern, is that, here goes some*	select, from sites that the Secretary has previously studied, sites necessary to enable acquisition by the Secretary of the full authorized volume of the Strategic Petroleum Reserve." In Section 303 of EPACT, Congress directed DOE to "consider and give preference to the five sites which the Secretary previously addressed in the [1992] Draft Environmental Impact Statement, DOE/EIS-0165-D. However, the Secretary, in his discretion may select other sites as proposed by a State where a site has been previously studied by the Secretary to meet the full authorized volume of the Strategic Petroleum Reserve [1 billion barrels]."

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more wetlands, some more destruction. And I'd just like to see the funding that DOE would expend on building the petroleum oil reserves in the development of alternative sources of clean energy. Thank you.	**[See response 2.2.2-3 above]**
Comment D0079-13 (Dow Chemical Company) *The Board of The Economic Development Alliance for Brazoria County unanimously passed the attached resolution opposing expansion of the Strategic Petroleum Reserve at Stratton Ridge in our meeting of June 12, 2006 for the following reasons:* *1. The SPR uses underground salt formations as the basis for their oil storage operations. For their purposes they remove the salt and discharge it into the ocean. Placing the SPR at Stratton Ridge would waste salt that the chemical industry could use to make useful products in the future. The DoE time line to remove the salt from the salt dome and other operational considerations would not allow this salt to be used to make products and thus would be wasted. As I understand it, the other sites under consideration do not have co-located salt based production facilities, so the salt wasted into the ocean isn't salt that can be made into useful products, as can the salt at Stratton Ridge.* *2. There is also concern over the government taking of Stratton Ridge property and perhaps even closure of Stratton Ridge Road. We have experienced this sort of thing in the past, and it runs contrary to everything America stands for.* *3. At a time when the chemical industry is struggling with high energy and feedstock fuel costs and high construction costs, this waste of Stratton Ridge salt and concern over the government commandeering private property could dissuade industry from locating new jobs in the area and it may even negatively affect business decisions to make any further investments in support of current operations.* *4. The 40 or so jobs created for managing the SPR site could*	**Response 2.2.2-4** The analysis contained in the EIS accounts for the various attributes of each alternative including socioeconomics and land use. Specifically, see response 3.8-3 for further discussion of socioeconomic impacts and responses 3.3-1 and 3.3-2 for further discussion of land use impacts. Also, see response 5.1 for a discussion of the value of salt waste through solution mining of SPR caverns. DOE has designated Richton with expansion at Bayou Choctaw, Big Hill, and West Hackberry as the preferred alternative in the final EIS. DOE will identify the environmentally preferable alternative and announce its selection in the Record of Decision. Also, see response 5-1 for a discussion of the value of salt lost through solution mining of SPR caverns.

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jeopardize literally thousands of direct chemical industry jobs and four to eight times that many of indirect jobs with contractors and suppliers. *5. We also understand that Bryan Mound was removed from consideration because it did not have adequate capacity for expansion and that the plans for Stratton Ridge would include facilities to off-load foreign crude in Texas City and bring the oil in through pipeline. So it seems this would not even benefit Port Freeport.* **Comment D0017-1 (Charlie Singletary, individual)** *I oppose the DOE selecting the Stratton Ridge Site in Texas. I feel this will eliminate jobs in Brazoria County. I'm not opposed to having more oil for reserve, just not in Brazoria County.* **Comment D0021-2 (Brazoria County Commissioner)** *As County Commissioner of Brazoria County Precinct 1, I do not support the use of Stratton Ridge for the expansion of the SPR.* **Comment D0050-1 (D.L. Vaughn, individual)** *I am not opposed to more oil reserves. I am opposed to having them in Brazoria County, Texas as I feel that using the underground storage facility at Stratton Ridge will be detrimental to our local economy. I am afraid that it will cause local jobs to be lost over the long term.* **Comment D0054-1 (Jeanette Bumpers, individual)** *As a concerned citizen of Brazoria County, I am asking you not to choose Stratton Ridge as the location of the petroleum reserve. This will completely ruin the lives of so many people and the future economy of this area. Please choose one of the locations that is more receptive to this project. This decision would be very devastating to the 6,000*	**[See response 2.2.2-4 above]**

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2.2 Opposition	
employees of Dow Chemical and their families. This would effect every business in Brazoria County and leave this area extremely depressed. **Comment D0076-1 (Bill Logan, individual)** *We in the Brazoria County, TX, area are concerned that the plan to take over Dow's Stratton Ridge facilities would do a great deal of harm to our economy. According to an editorial in The Facts, the people near the proposed Mississippi sites are generally in favor of having storage facilities there.* **Comment D0079-9 (Dow Chemical Company)** *Let me start by stating that while we are not opposed to expanding the Strategic Petroleum Reserves, Dow DOES NOT support the use of Stratton Ridge for this expansion. The reasons for this are fairly straight forward.* **Comment D0079-16 (Dow Chemical Company)** *Again, I wish to join with the Economic Development Alliance for Brazoria County, the Dow Chemical Company, and other concerned members of the community in expressing my concern regarding the sitting of an SPR expansion at Stratton Ridge.* **Comment D0079-17 (Dow Chemical Company)** *We wholeheartedly support the expansion of the Strategic Petroleum Reserve, which already includes a site in Brazoria County at Bryan Mound. But it is with just as much vehemence that we join others in Brazoria County in asking the federal government to choose a site other than Stratton Ridge at which to store the oil in underground caverns.*	**[See response 2.2.2-4 above]**

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2.2 Opposition	
This is not simply another tired case of "not in my backyard." Rather, the caverns near Clute already are filled with a precious resource to industry in this area: salt. **Comment D0079-36 (Dow Chemical Company)** *RESOLUTION NO. R-06-516* *RESOLUTION OF THE CITY OF LAKE JACKSON, TEXAS, INOPPOSITION TO A STRATEGIC PETROLEUM RESERVE ATSTRATTON RIDGE* *WHEREAS, it is understood that the Energy Policy Act of 2005 directs the Secretary of Energy to fill the Strategic Petroleum Reserve to its one billion barrel capacity, and this will require the Department of Energy to expand the Strategic Petroleum Reserve, such plans to include adding one new storage site, and* *WHEREAS, Stratton Ridge, Texas is one of the new sites being considered from the group of sites previously assessed in the Draft Environmental Impact Statement, and Stratton Ridge is located within Brazoria County, Texas, and* *WHEREAS, the proposal to locate a Strategic Petroleum Reserve storage operation at Stratton Ridge, Texas would have an adverse affect on the area's chemical manufacturing industry which constitutes the very foundation of the economy of South Brazoria County with over five thousand direct jobs and as many as four to eight times that number of indirect jobs among contractors and suppliers; and* *WHEREAS, the City of Lake Jackson and other cities in Southern Brazoria County would be harmfully affected by expansion of the Strategic Petroleum Reserve at Stratton Ridge, Texas, since much of the annual revenue for the cities flows from the Chemical Manufacturing*	**[See response 2.2.2-4 above]**

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2.2 Opposition	
Industries; and *WHEREAS, the expansion of the Strategic Petroleum Reserve at Stratton Ridge would create virtually no significant economic benefit that could conceivably compensate for the potential harm it would do the local economy; and* *WHEREAS, the Department of Energy has other options to meet its mandated expansion of the Strategic Petroleum Reserve capacity;* *NOW, THEREFORE, BE IT RESOLVED, that the Council of the City of Lake Jackson, Texas hereby opposes said location of a Strategic Petroleum Reserve at Stratton Ridge, Texas.* *APPROVED AND ADOPTED by the Council of the City of Lake Jackson, Texas, this 3rd day of July, 2006.City of Lake Jackson, Texas City Secretary.* **Comment D0099-1 (Shane Pirtle, Lake Jackson)** *I say that -- as you've already heard, Dow Chemical is a major -- the primary employer in this community, largest employer in this community; and obviously it's a substantial contributor to this community.* *So, with that being said, we wouldn't want to see anything that jeopardizes what we've seen as a great partner in this community both as an employer and contributing in a number of other activities. So, I think that would -- and as well as the cities -- all those -- most of the large cities are members of The Economic Development Alliance and we're a part of this resolution.*	**[See response 2.2.2-4 above]**

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2.2 Opposition	
Comment D0092-1 (David Stedman, Economic Development Alliance) *And so, on the 12th of June, our board met to represent the entire business community of Brazoria County and unanimously adopted this resolution, the Resolution, In Opposition to the Strategic Petroleum Reserve At Stratton Ridge.* **Comment D0092-3 (David Stedman, Economic Development Alliance)** *And so, I urge you to look at all your alternatives and pick some place other than Stratton Ridge for the Strategic Petroleum Reserve expansion.* **Comment D0094-1 (Vick Wade, individual)** *My name is Vick Wade. I'm coming to you as a local, long-time Brazoria County resident. And I -- I mean, I'm just here to express -- I'm not going to give you a long speech or anything but I'm just putting my vote in and my vote would be that we don't -- do not have you-all come in. I just -- I see it as an eminent domain thing that -- and I do have a small business here, and I have long-term interests in our area. And I don't see it as a -- this as a long-term positive for our area.* **Comment D0095-2 (Donald Payne, Brazoria County Commissioner)** *Now, therefore be it resolved, that Brazoria County hereby opposes any location of a Strategic Petroleum Reserve at Stratton Ridge, Texas.*	**[See response 2.2.2-4 above]]**

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2.2 Opposition	
Comment D0104-1 (Cindy Suggs, individual) *As a lifetime resident of the greater Brazosport area, I am terribly concerned about the proposed Strategic Energy Reserve at Stratton Ridge.* **Comment D0097-3 (Diane Kile, Office of Congressman Ron Paul)** *Again, I wish to join with The Economic Development Alliance for Brazoria County, the Dow Chemical Company, and other concerned members of the community in expressing my concern regarding the siting of an SPR expansion at Stratton Ridge.*	**[See response 2.2.2-4 above]]**

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2.3 Environmentally Preferred	
Comment D0077-28 (EPA Region 6) *The DEIS identifies the Clovelly site as least environmentally damaging to wetlands. Section 404 of the Clean Water Act requires the least damaging practicable alternative be selected. It appears from the information provided by DOE that the proposed Clovelly site plus the expansion of the 3 existing facilities (Bayou Choctaw, Big Hill and West Hackberry) should be selected as the preferred alternative.* **Comment D0073-12 (NOAA Fisheries)** *NMFS has carefully reviewed the potential impacts associated with the three alternatives to expand SPR capacity by 273 MMB. Because no major new pipeline segments would be required for the Clovelly site, NMFS believes that impacts to tidally influenced wetlands and EFH would be minimized by the selection of the alternative that would include increasing storage capacity to 120 MMB at the Clovelly*	**Response 2.2.3-1** The alternatives involving cavern development at Clovelly are no longer considered reasonable alternatives, as explained in response 2.2-1. In accordance with NEPA, its implementing regulations (40 CFR Parts 1500 to 1508), and the DOE regulations for implementing NEPA (10 CFR Part 1021), DOE has designated Richton and expansion at Bayou Choctaw, Big Hill, and West Hackberry as the preferred alternative in the final EIS, and DOE will identify the environmentally preferable alternative and selection in the Record of Decision.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2.3 Environmentally Preferred	
terminal.	**[See response 2.2.3-1 above]**
Comment D0013-4 (Gulf Restoration Network) *The goal of the Energy Act of 2005 is to expand the SPR to 273 MMB. The final EIS should develop as their preferred alternative one that includes those site decisions that would lead to the least environmentally destructive options.* *It is evident from review of the DEIS that expansion of existing SPR sites would require minimal additional infrastructure and minimal impact, over and above that associated with initial construction, on environmental resources. Expansion of these sites could account for 153 MMB of the 273 MMB target (DEIS at p. S-3). Expansion of existing sites, should therefore, be part of the preferred alternative.* *With regard to the remaining 120 MMB short fall, the question then becomes identification of new sites which would be the least environmentally damaging (See Footnote 1). Although the 6 sites considered for a new facility could all - singly or in combination - meet the target, it is clear that some carry significantly greater potential environmental impact than others. Specifically, there are at least 3 sites that have the potential to inflict significant and irreparable (non-mitigable ?sp?) environmental impacts. These sites should be excluded from consideration and should not be included in any preferred alternative. These sites are:* (1) The Chacahoula, LA site… (2) The Richton, MS site… (3) The Stratton Ridge, TX site…	**Response 2.2.3-2** As discussed in section 2.2.3, DOE cannot reach its goal of 273 MMB of expanded capacity by expanding capacity at the existing sites. The expansion of the existing sites could create up to 153 MMB, which would result in a 120-MMB shortfall in capacity. See response 2.2-5. As further described in response 2.2-1, the alternatives involving cavern development at Clovelly are no longer considered reasonable alternatives. In accordance with NEPA, its implementing regulations (40 CFR Parts 1500 to 1508), and the DOE regulations for implementing NEPA (10 CFR Part 1021), DOE has designated Richton and expansion at Bayou Choctaw, Big Hill, and West Hackberry as the preferred alternative in the final EIS, and DOE will identify the environmentally preferable alternative in the Record of Decision. See response 2.2.2-1 for a discussion of sources of water withdrawal for the Richton site.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2.3 Environmentally Preferred	
Comment D0013-10 (Gulf Restoration Network) *In the opinion of the GRN, the site with the least environmental impacts is the Clovelly, LA site. The proposed Clovelly SPR site is located at the existing site of the Louisiana Offshore Oil Port (LOOP) dome storage facility. Except for the new RWI structure, the facility would, with the exception of a new RWI and 0.1 mile access road, rely on existing LOOP infrastructure, thereby reducing construction impacts. Although brine disposal in the Gulf is contemplated, there few, if any, additional environmental impacts from the selection of this alternative that are not already associated with the LOOP facility (DEIS, pp. 2-35-2-39). Although some dredging and filling of wetlands is contemplated, the impacts to jurisdictional wetlands associated with this site are much less than are those at other sites being considered. The GRN would argue, therefore, that if a new site in the coastal area of the Gulf states must be selected from those already considered by the DOE, Clovelly should be the chosen as the preferred (least environmentally destructive) alternative.* *We recognize that Clovelly only has the capacity for 120 MMB, and that DOE asserts that 160 MMB is required. However, under the Energy Act of 2005 the fully authorized volume for the SPR is 263 MMB, not 313 MMB. The Clovelly site if chosen would provide capacity for the fully "authorized" volume and thus should not be excluded from consideration on the basis that it does not have sufficient capacity. In the event that DOE persists in its assertion that it must have 160 MMB, some combination of the Clovelly site and the Bruinsburg, MS site should be considered. Although the Bruinsburg site involves unacceptable environmental impacts, it is evident that those impacts are not as egregious as are those associated with the three sites discussed above and thus must be considered the lesser of the evils presented by the restrictions placed on site selection by the*	**Response 2.2.3-3** See responses 2.2-1, 2.2-5, 2.2.3-1, and 2.2.3-2. As presented in section 2.2.3, DOE recognizes that to reach the fully authorized volume of 1 billion barrels, DOE would need to expand the existing 727 MMB of capacity by 263 MMB, not 313 MMB. The total capacity of the new site and the expansion sites would be developed and filled as presented in table 2.2.3-1.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.2.3 Environmentally Preferred	
Energy Act of 2005.	**[See response 2.2.3-3 above]**
Comment D0103-2 (Charlotte Randolph, Lafourche Parish) *The Chacahoula site is straddling the border between Lafourche and Terrebonne, and certainly we would be somewhat concerned about the ecosystem there, but at the same time -- we're open to discussion about that site, but certainly we would favor more a site that has already been developed, already been established, already been represented as a group that will certainly make certain that everything that is necessary to protect the environment, as well as to provide the storage for this very important American oil -- I think it would be best served at LOOP. Thank you very much*	**Response 2.2.3-4** See response 3.7.3.1-6 for information regarding concerns over the Chacahoula ecosystem. The alternatives involving cavern development at Clovelly are no longer considered reasonable alternatives, which is explained in response 2.2-1.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.3 Site-Specific Issues	
2.3.1 Bruinsburg	
Comment D0077-3 (EPA Region 6) *Pages 2-27 to 2-30, Section 2.4.1, Bruinsburg Storage Site: The Figure 2.4.1-5 is incorrect or at best misleading. The ExxonMobil Refinery is not on the west side of the Mississippi River as depicted. It is almost due east of the Placid Oil Refinery, but on the other side of the river. If there is a new crude oil pipeline planned to run from the proposed Anchorage Tank Farm under the Mississippi River to the ExxonMobil Refinery this should be discussed in the FEIS*	**Response 2.3.1-1** The "ExxonMobil Refinery" label on figure 2.4.1-5 has been corrected to read "ExxonMobil Tank Farm." The tank farm is located on the west side of the Mississippi River and, as noted in the comment, the refinery is located on the east side of the river. The ExxonMobil tank farm is connected to the refinery by existing pipelines. Other than the current proposed pipeline from the proposed DOE SPR site at Bruinsburg to the proposed DOE tank farm, which would cross the Mississippi River, there would be no additional river crossings for the development of the Bruinsburg site and associated infrastructure. The proposed DOE tank farm would connect to the ExxonMobil Refinery through existing pipelines.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.3 Site-Specific Issues	
2.3.1 Bruinsburg	
Comment D0077-8 (EPA Region 6) *Page 3-108, Section 3.6.2.1.3, Impacts Associated with Constructing Pipelines: The FEIS should identify any special procedures to be employed for the Mississippi River crossing from the Baton Rouge area to the proposed Anchorage tank farm included in the Bruinsburg proposal.*	**Response 2.3.1-2** As discussed in section 2.3.9, directional drilling would be one of the pipeline construction methods. The specific conditions when directional drilling would be performed are discussed in section 3.7.2.1.2, which includes rivers and streams greater than 100 feet (30 meters) wide. Therefore, the pipeline from Bruinsburg to the Anchorage tank farm would cross the Mississippi River in the Baton Rouge area, and directional drilling would be used to build the pipelines. The detailed design for Bruinsburg would include technical details for the crossing such as spotting of existing pipelines, length of new crossing, depth of crossing, location of directional drilling rig, area for pipe welding, and placement of pipe on rolls.
Comment D0089-3 (Vernon Phillips, Anabasis) *By locating the new road along the common right-of-way of the proposed power line, which the Department of Energy depicted on the southeast side of the facility, the visual impact of the historic Civil War landscape, which is alluded to in Section 2.3 of the Summary Draft EIS, will be totally eliminated.*	**Response 2.3.1-3** If one of the Bruinsburg alternatives is selected, the placement of the ROWs and roads as described in section 2.4.1 would be the proposed design. Rather than create a new ROW and road along the proposed power line, DOE would improve the existing access road to the site. As described in Section 3.9 Cultural Resources, DOE is preparing a programmatic agreement with the Mississippi SHPO and the Advisory Council on Historic Preservation to address potential impacts on the historic Civil War landscape. If one of the Bruinsburg alternatives is selected, DOE and the Mississippi SHPO would enter into a programmatic agreement to cover the additional actions that would be required to identify and resolve adverse effects to historic properties.
Comment D0089-4 (Vernon Phillips, Anabasis) *Structure of a brine disposal system with a pipeline paralleling the raw water supply line and constructing disposal wells perpendicular to the pipeline will allow minimal environmental impact.*	**Response 2.3.1-4** The proposed brine injection well field would run parallel to the raw water supply line; however, the location of the wells would not be perpendicular to the pipeline. The location and spacing of the wells were designed to maintain high individual well discharge rates that

<table>
<tr><th>COMMENT</th><th>RESPONSE</th></tr>
<tr><td colspan="2">2. Proposed Action and Alternatives</td></tr>
<tr><td colspan="2">2.3 Site-Specific Issues</td></tr>
<tr><td colspan="2">2.3.1 Bruinsburg</td></tr>
<tr><td>[See comment D0089-4 text above]</td><td>would not affect the operation of the other wells and to widely distribute the brine discharge into the formations. Placing the brine disposal wells perpendicular to the raw water supply line would not achieve a wide distribution of the brine discharge and the required spacing between the wells (minimum of 1,000 feet [300 meters]) would not reduce the environmental impacts over the current design.</td></tr>
<tr><td>Comment D0089-5 (Vernon Phillips, Anabasis)
Additionally, by using both the Sparta and Wilcox formations for brine disposal, the capacity of each well can be doubled or increased fourfold, thus reducing the number of disposal wells required, reducing the wellhead pressure of each well, and increasing injection runtime between workovers, which will commensurate reduced cost and enhance environmental safety

Both the Sparta and Wilcox formations have proven to be safe, well known, and commonly used disposal zones in Mississippi with excellent disposal capacity. Both zones can be used at the same time in each well-bore further enhancing safety and the disposal capacity</td><td>Response 2.3.1-5
DOE has determined that brine injection into multiple formations simultaneously is not technically feasible for the reasons discussed below.

Brine injection into multiple formations through one wellhead is not standard practice primarily because of the lack of hydraulic control on the injection process. Although access would be available for disposal in both formations, the pressure differentials in the formations would determine which formation the brine actually enters. Because there would be no controls on the rate of discharge into each formation, there is the possibility that injection into one of the formations could be overpressured and result in fracturing. In addition, the following issues are of concern to DOE:
• Crossflow through the well between the formations would occur during any periods when the injection well was not operating;
• Properly installing a well into multiple formations would be difficult; and
• Cleaning out the well screens and assuring that the screens in each formation are adequately clean to allow for flow into the formations would be difficult and hard to control.</td></tr>
</table>

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.3 Site-Specific Issues	
2.3.1 Bruinsburg	
Comment D0089-6 (Vernon Phillips, Anabasis) *Additionally, by constructing a dock at the Mississippi River, near the old ferry site, less than three miles to the southwest of the site, a short crude oil distribution line can be also laid parallel to the raw water supply pipeline and the brine disposal pipeline. To do this will minimize environmental impact. A dock there will also be available to be accessed by the old ferry road.*	**Response 2.3.1-6** The objective of the proposed crude oil distribution system associated with Bruinsburg would be to take advantage of existing infrastructure in lieu of building and maintaining additional government-owned facilities. In addition, the volume of crude oil that could be transferred from the dock location referenced in the comment would be far less than could be transferred from the existing facility in Anchorage, LA, as presented in the EIS. This is because crude oil tanker access is not possible north of Baton Rouge, and the new dock at the suggested location could serve only barges at a low pumping rate. Therefore, changing the alternative by developing a dock at the suggested location would not meet DOE's volume distribution requirement.
Comment D0089-7 (Vernon Phillips, Anabasis) *The 30-inch crude oil distribution pipeline to the Capline can be laid parallel to the proposed power line right-of-way and our proposed access road to the southeast side of the site. The pipeline then can be parallel to the Energy power line, which runs from the Grand Gulf Power Plant to Peetsville.*	**Response 2.3.1-7** As indicated in the comment, the ROW for the proposed 30-inch (76 centimeter) crude oil distribution pipeline from the Bruinsburg site to the Capline pipeline would follow the ROW of the power line from the Grand Gulf Power Plant to Peetsville; therefore, the proposed pipeline ROW is no different than the ROW suggested in the comment (see section 2.4.1).
Comment D0089-8 (Vernon Phillips, Anabasis) *As the DOE mentioned in the Summary Draft EIS on page S-23, the natural landscape can be preserved by placing pipelines underground and otherwise working with agencies to minimize impact. The issues addressed in the Summary Draft EIS on concerns with the Homochitto National Forest can be eliminated by routing the pipeline around the forest to the north for short distances necessary to avoid any problems on the east end of the Bruinsburg and Peetsville line.*	**Response 2.3.1-8** If one of the Bruinsburg alternatives is selected, the placement of the proposed pipelines as described in section 2.4.1 of the EIS would be the proposed conceptual design. The ROW for the proposed 30-inch (76 centimeter) crude oil distribution pipeline to the Capline would follow the ROW for the power line from the Grand Gulf Power Plant to Peetsville. The pipeline would be an underground pipeline that would follow an existing ROW through the Homochitto National Forest rather than create a new ROW around the forest.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.3 Site-Specific Issues	
2.3.1 Bruinsburg	
Comment D0089-9 (Vernon Phillips, Anabasis) *By moving the caverns and service facilities as far west on the site as practical, the maximum subsurface safety as to the geologic control and operational effectiveness can be obtained. By constructing a facility in that manner, visual resources, endangered species, cultural resources impact can be minimized or eliminated. The affected area will be less than 700 acres. This will result in an environmentally sound, very cost-effective site. I would like to submit to you for the record a proposal incorporating all of these features.*	**Response 2.3.1-9** If one of the Bruinsburg alternatives is selected, the conceptual design as described in section 2.4.1 of the EIS would be the proposed design. The proposed layout of the site is based primarily on the geologic characteristics of the salt dome, which dictate where the caverns could be located. The proposed onsite infrastructure would be located on the upland portion of the site to minimize the construction and impacts on the floodplain.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.3 Site-Specific Issues	
2.3.3 Clovelly	
Comment D0002-1 (Greater Lafourche Port Commission) *It seems to me that the existing infrastructure at this site which is already in place, would present a tremendous savings to the Government and me as a tax payer. I'm sure use of the existing 30 inch brine discharge line and the brine reservoir among many other things could be negotiated with LOOP, or better, a turn key contract for storage and delivery of oil could be negotiated. Loop is currently planning the addition of a new line from the offshore terminal to the dome as I type this. Now would be the time to plan for this expansion as well, which would greatly reduce costs and environmental impacts.*	**Response 2.3.3-1** Section 2.4 of the draft EIS describes the infrastructure associated with each proposed new site. At Clovelly, this would include the existing offshore brine disposal system. However, as a result of additional studies completed by DOE following the publication of the draft EIS (see response 2.2-1), the alternatives involving cavern development at Clovelly are no longer considered reasonable alternatives. They are discussed in section 2.7 in the final EIS.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.3 Site-Specific Issues	
2.3.3 Clovelly	
Comment D0002-2 (Greater Lafourche Port Commission) *Additionally, when I look at the drawing entitled Figure S.3.5.3-1: Proposed Location of Clovelly Storage Site and DOE Facility, on page S-10, I see the existing LOOP Storage Facility and Proposed SPR Storage Site and a proposed DOE Off-Dome Facility near Bayou Lafourche. I also see that you have the area due south of the dome (rectangular area) labeled as marsh.* *Please be advised that this is a 1500 acre industrial park which is owned by this Commission and houses the South Lafourche Airport (which we own) and several additional facilities including the newly constructed LOOP Tank Farm, which has 6- 500,000bbl tanks. The Industrial Park has direct connectivity to LOOP and presents huge opportunities for additional storage and any Off Dome Facilities. The adjacent airport is presently undergoing a runway extension to 6500ft. and strengthening. This area is not only not a wetland, but is enclosed within its own protection levee system as well as the South Lafourche Hurricane Protection Levee System (the only one that did not experience flooding during the hurricanes of 2005).*	**Response 2.3.3-2** Figure S.3.5.3-1 of the draft EIS was meant to show the general features around the proposed location; however, after DOE completed additional studies (see response 2.2.-1), the Clovelly alternatives involving cavern development at Clovelly are no longer considered reasonable alternatives. They are discussed in Section 2.7 Alternatives Eliminated from Detailed Study.**]**

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.3 Site-Specific Issues	
2.3.6 Stratton Ridge	
Comment D0077-4 (EPA Region 6) *Page 2-52, Section 2.4.6, Stratton Ridge Storage Site: Figure 2.4.6-1 should reflect the proposed Freeport LNG underground gas storage*	**Response 2.3.6-1** Figure 2.4.4-1 has been updated to show the proposed Freeport LNG underground gas storage facility.

COMMENT	RESPONSE
2. Proposed Action and Alternatives	
2.3 Site-Specific Issues	
2.3.6 Stratton Ridge	
facility that either overlaps or immediately adjoins the proposed Stratton Ridge facility	**[See response 2.3.6-1 above]**
Comment D0079-37 (Dow Chemical Company) *See Figure "Proposed SPR Expansion- Stratton Ridge TX" in DOW's comments* [In the figure, Dow shows that the proposed Stratton Ridge Caverns would be co-located with proposed Dow caverns. Dow indicated that an early layout of the proposed Stratton Ridge Caverns may avoid the potential conflict.]	**Response 2.3.6-2** The cavern layout for Stratton Ridge DOE presented during the scoping process consisted of three rows of caverns oriented north-south. Because of environmental concerns, DOE changed the layout during draft EIS preparation to avoid the riparian hardwood forest along Oyster Creek. Three caverns originally located along Oyster Creek were relocated to the west of the site. The current layout shows four rows of caverns oriented north-south. DOE was not aware of any proposed Dow caverns during the development of the current cavern layout, and therefore, did not consider such caverns. See response 3.3-1 for additional information on potential conflict resulting from the current cavern layout.

COMMENT	RESPONSE
3. Affected Environment and Potential Impacts	
3.2 Environmental Risks and Public and Occupational Safety and Health	
Comment D0106-15 (USFWS) *Page 3-13, paragraph 3, lines 1 through 9. This section discusses the impacts of a large brine spill in the Gulf Intracoastal Waterway. The discussion implies that the brine spill did not have a significant impact on fish and wildlife resources, and thus, any future large brine spills would not have significant impacts on the environment. However, the last two sentences state that decay of organic matter in some ponds depressed dissolved oxygen levels and increased water temperature. Further elaboration is needed on these statements to better assess impacts of this large brine spill. For example, it should be stated what*	**Response 3.2-1** The detailed report of the damage associated with this spill (Final Bryan Mound Environmental Monitoring Status Report Brine Disposal Pipeline Leak Incident, October 12, 1990, Boeing Petroleum Services) determined that effects on vegetation were limited to an 8.3-acre (3.4-hectare) area. (See table 4, extracted from that report, which gives the requested physical properties.) The spill occurred in May 1989, and plant growth was observed by September. A severe freeze in December killed a significant quantity of vegetation. By April 1990, the new growth had reversed most of this damage in all but 2.5 acres (1 hectare).

COMMENT	RESPONSE
3. Affected Environment and Potential Impacts	
3.2 Environmental Risks and Public and Occupational Safety and Health	

COMMENT

percentage of the vegetation in the ponds was killed by the brine spill and how long was required for the area to revegetate. The document should also mention to what extent was dissolved oxygen levels depressed, and the ambient water temperature increased. If the brine spill killed a significant percentage of the vegetation and resulted in severely depressed oxygen levels and significantly increased water temperature, the spill had significant impacts on fish and wildlife resources.

RESPONSE

Extracted from Boeing Petroleum Services, Inc. 1990b

TABLE 4

Additional Surface Water Physicochemical Parameters

Parameter	Station	1989 Jun[A]	Jul[A]	Aug[A]	Sept[A]	Oct	Nov[A]	Dec	1990 Jan	Feb	Mar	Apr
Temperature (°C)	MP-1	29	28	27	29	24	21	5	12		16	28
	MP-2	28	28	27	30	24	20	5	13		17	28
	MP-3	28	28	28	30	24	20	6	14		17	30
	MP-4[B]	28	28	28	30	25	21	6	14		18	27
	MS-1[B]	30	31	28	29	25	21	4	13		16	29
	MS-2	27	31	27	29	25	21	3	16		16	28
	MS-3	28	27	30	31	24	21	9	14		16	30
pH (SU)	MP-1	7.0	8.4	7.8	7.8	6.9	7.3	7.7	8.0	8.1	7.7	7.6
	MP-2	7.6	8.4	7.9	7.7	7.2	7.2	7.6	8.1	4.0	8.0	7.7
	MP-3	7.6	8.6	8.0	7.8	7.3	7.2	7.8	7.9	3.5	7.8	7.8
	MP-4[B]	7.8	8.0	8.0	7.8	7.3	7.7	7.7	8.0	4.4	8.0	7.7
	MS-1[B]	7.1	8.5	7.8	7.3	6.7	7.0	7.3	7.0	6.3	7.4	7.7
	MS-2	7.4	8.1	7.5	7.4	6.8	7.0	7.6	7.3	7.4	7.4	7.6
	MS-3	7.6	7.8	7.4	7.6	7.2	7.0	7.6	7.7	6.0	7.5	7.8
Dissolved Oxygen (mg/l)	MP-1	2.0	5.8	2.6	3.2	1.1	1.0	8.3	10.2		6.2	5.1
	MP-2	5.9	3.5	7.0	8.6	5.0	2.4	8.1	10.5		7.4	5.9
	MP-3	6.4	6.9	7.6	10.0	6.2	2.2	8.5	7.7		6.5	7.4
	MP-4[B]	6.4	4.0	6.8	7.2	4.5	4.8	7.5	8.1		7.9	6.1
	MS-1[B]	3.5	6.4	7.0	2.4	0.7	1.9	9.2	5.1		6.1	6.8
	MS-2	4.4	4.9	4.4	4.5	0.9	2.2	8.7	6.3		7.4	6.3
	MS-3	5.9	4.6	6.5	6.1	5.2	2.3	11.0	10.6		6.0	7.4

A: Data represents an average of up to four data points these months.
B: Control stations.
SU: Standard units.
MP: Marsh pond.
MS: Tidal ditches.

Depressed oxygen was observed in only one pond, and the effects were observable through October 1989 (see table 4). Frequent heavy rains or tides, or both, in the summer and fall contributed to the flushing of brine from the area.

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Comment D0079-31 (Dow Chemical Company) *The EIS needs to evaluate the potential adverse impact the established security zone that will be established around the new SPR facility will have on planned and existing industrial facilities. The well developed Stratton Ridge salt dome will have more extensive potential adverse impacts than would location of the new SPR facility at a less well developed site.* **Comment D0079-33 (Dow Chemical Company)** *IV. Public Health and Safety* *Dow raises one concern in the Public Health and Safety section of the EIS. The Stratton Ridge potential site for the new SPR facility is very close to existing security from existing and planned industrial facilities. The EIS has to evaluate the potential for the security of the new facility adversely interacting with the existing security from existing and planned industrial facilities and resulting in a decrease in the safety provided both by the new SPR facility and the existing industrial facilities.* **Comment D0079-24 (Dow Chemical Company)** *The EIS needs to fully evaluate the impact of the security zone on the planned and established local industry.*	**Response 3.2-2** The need for additional security because of SPR operations offers an opportunity to enhance overall security rather than compromise current security. A more regional or geographic approach to implementing security measures (as opposed to individual facility-based measures) is discussed and promoted in the National Infrastructure Protection Plan (DHS 2006) and various Department of Homeland Security assessments such as its Comprehensive Reviews. The approach is to optimize infrastructure protection across adjacent or interacting sites, or many nonadjacent sites in the same general area. Sites can benefit from broader approaches to protection that encompass regional resources and not just those available at or for a single site. If one of the Stratton Ridge alternatives is selected, DOE would work with Dow and other owners of facilities on or near the salt dome to ensure that the proposed security measures enhance each other.
Comment D0106-13 (USFWS) *Page 3-5, Table 3.2.1-1. This table provides information on brine spills at existing SPR sites from 1982 through 2003. The table should also mention whether the spills occurred in freshwater or a marine environment.*	**Response 3.2-3** Table 3.2.1-1 focuses on the frequency and size of SPR brine spills to help predict future events. Providing the specifics of each historic release is not necessary for this purpose; however, spills were to the ground and did not reach either fresh water or the marine environment.

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Comment D0021-3 (Brazoria County Commissioner) *The SPR uses underground salt formations as the basis for their oil storage operations. For their purposes they remove the salt and discharge it into the ocean. Placing the SPR at Stratton Ridge, would waste salt that the chemical industry could use to make useful products in the future. The DoE time line to remove the salt from the salt dome and other operational considerations would not allow this salt to be used to maker products and thus would be wasted.. As I understand it the other sites under consideration do not have co-located salt based production facilities, so the salt wasted into the ocean isn't salt that can be made into useful products, as can the salt at Stratton Ridge.* **Comment D0079-10 (Dow Chemical Company)** *Over 50% of the more than 6,000 Dow employee and contractor jobs in our Freeport plant exist because of the salt we mine at Stratton Ridge. This salt is the critical raw material for our Chlor-Alkali production, which in turn is critical for our downstream user plants that are dependent on chlorine and caustic, as well as several fence line customer plants.* *From this Stratton Ridge salt, we make thousands of different products worth over $5 billion annually. We also use the Stratton Ridge area to store raw materials and products. Approximately half of the $120 million a year that we pay in state and local taxes for Dow's Texas Operations are dependent upon these assets.* *On the other hand, the SPR uses underground salt formations as the basis for their oil storage operations. For their purposes, they remove the salt and discharge it into the ocean. Placing the SPR at Stratton Ridge would waste salt that Dow could otherwise mine and convert into*	**Response 3.3-1** DOE acknowledges that the proposed SPR storage facility at Stratton Ridge has the potential to conflict with other current and future land uses at the Stratton Ridge site, including the operations of Dow Chemical. The EIS text has been modified to provide additional information on this topic in the discussion of land use in section 3.3. See the discussion in section 3.8 on the potential socioeconomic impact of proposed development of the Stratton Ridge site. Also see response 3.3-5 on eminent domain. Response 5-1 and section 5.3 discuss the economic value of salt lost because of SPR cavern development. Also, response 2.1-3 discusses why salt from solution mining cannot feasibly be recovered. DOE acknowledges that its proposed layout of caverns on the Stratton Ridge salt dome has changed since its initial presentation during the scoping process. See response 2.3.6-2.

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useful, value added products that support the economy of this region. *The use of seawater for mining, the speed of mining the caverns in the salt dome, and the lack of a fully saturated brine solution as a discharge, precludes this salt from being consumed by Dow to make useful products. This salt would simply be wasted into the ocean.* *We understand that the other sites under consideration to locate the SPR facility, DO NOT have co-located salt-based production facilities. So that salt wasted into the ocean IS NOT salt that could be used otherwise as a feedstock for manufacturing purposes.* **Comment D0079-11 (Dow Chemical Company)** *In addition, we have concerns about our current Stratton Ridge operations, as these assets are critical to the economic operation of our Freeport site, which happens to be Dow's largest manufacturing facility globally. We experienced the concept of eminent domain first hand when the US government used its power to take Bryan Mound - now the local SPR site - from us, when we were an unwilling seller.* *Allow me to demonstrate this impact with some numbers. At the moment - without the SPR at Stratton Ridge- we estimate that Dow has access to salt reserves that should last for more than 30 years. The 16 proposed SPR caverns would waste 130 billion pounds of salt, or the equivalent of 7 years of Dow salt consumption. But it does not stop there!* *When the Department of Energy presented its initial plan in the fall of 2005, two of Dow's planned wells on Dow land would have been directly impacted, wasting another 4 years of salt that Dow could use for raw material.*	**[See response 3.3-1 above]**

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Since that initial plan, the DoE has expanded the area that it needs for the SPR. This impacts another 3 planned Dow wells, thus reducing Dow's potential salt consumption up to 11 years. *So, under the DoE's current proposal, 18 years of equivalent Dow salt consumption is wasted.* *The waste of Stratton Ridge salt, and the possibility that the government may take some business critical property from Dow, is a grave concern for our internal business analysts, who make investment recommendations to Dow's leaders.* **Comment D0079-13 (Dow Chemical Company)** *The Board of The Economic Development Alliance for Brazoria County unanimously passed the attached resolution opposing expansion of the Strategic Petroleum Reserve at Stratton Ridge in our meeting of June 12, 2006 for the following reasons:* *1. The SPR uses underground salt formations as the basis for their oil storage operations. For their purposes they remove the salt and discharge it into the ocean. Placing the SPR at Stratton Ridge would waste salt that the chemical industry could use to make useful products in the future. The DoE time line to remove the salt from the salt dome and other operational considerations would not allow this salt to be used to make products and thus would be wasted. As I understand it, the other sites under consideration do not have co-located salt based production facilities, so the salt wasted into the ocean isn't salt that can be made into useful products, as can the salt at Stratton Ridge.* *2. There is also concern over the government taking of Stratton Ridge*	**[See response 3.3-1 above]**

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property and perhaps even closure of Stratton Ridge Road. We have experienced this sort of thing in the past, and it runs contrary to everything America stands for. *3. At a time when the chemical industry is struggling with high energy and feedstock fuel costs and high construction costs, this waste of Stratton Ridge salt and concern over the government commandeering private property could dissuade industry from locating new jobs in the area and it may even negatively affect business decisions to make any further investments in support of current operations.* *4. The 40 or so jobs created for managing the SPR site could jeopardize literally thousands of direct chemical industry jobs and four to eight times that many of indirect jobs with contractors and suppliers.* *5. We also understand that Bryan Mound was removed from consideration because it did not have adequate capacity for expansion and that the plans for Stratton Ridge would include facilities to off-load foreign crude in Texas City and bring the oil in through pipeline. So it seems this would not even benefit Port Freeport.*	**[See response 3.3-1 above]**
Comment D0079-17 (Dow Chemical Company) *We wholeheartedly support the expansion of the Strategic Petroleum Reserve, which already includes a site in Brazoria County at Bryan Mound. But it is with just as much vehemence that we join others in Brazoria County in asking the federal government to choose a site other than Stratton Ridge at which to store the oil in underground caverns.* *This is not simply another tired case of "not in my backyard." Rather, the caverns near Clute already are filled with a precious resource to industry in this area: salt.*	

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Comment D0079-23 (Dow Chemical Company) *The EIS needs to fully evaluate the conflict of the SPR oil storage with the developing natural gas storage on the Stratton Ridge salt dome.* **Comment D0079-18 (Dow Chemical Company)** *The same brine the Department of Energy is contemplating siphoning out of 16 caverns at Stratton Ridge is vital to Dow Chemical Co., Brazoria County's largest employer. The method of brine removal for a petroleum reserve could waste about 130 billion pounds of salt, Dow Texas Operations Vice President Bob Walker said at a public meeting on the proposed expansion last week. The proximity of the project also would prevent Dow from using five planned wells on property the company owns at Stratton Ridge.* **Comment D0079-28 (Dow Chemical Company)** *First, the EIS needs to address the impact of wasting the chlorine from the Stratton Ridge salt dome. This is salt that is located near a major commercial chemical facility that is currently using salt solely from the Stratton Ridge salt dome to produce chlorine that is either itself in many products or used in the manufacturing of many products. In addition the chlorine produced from Stratton Ridge salt is used in products that are critical in providing many services. See Testimony for a discussion of the utility of Chlorine.* *All of the potential locations for the new SPR facility do not have the potential for use of the salt for chemical manufacturing. This location specific aspect of wasted essential natural resources needs to be evaluated in the Land Use section of the EIS.* *The magnitude of the potential salt diversion/waste can be calculated*	**[See response 3.3-1 above]**

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from two of the figures in the DoE's Proposed Action Information pamphlet distributed in the public meetings associated with the public comments this EIS scoping effort. On page 3 of that pamphlet, DoE says that the proposed new SPR facility will have up to 160 million barrel of oil storage capacity and that leaching a cavern generates approximately 8 barrels of brine for each barrel of created cavern space. This means that locating the new SPR facility in Stratton Ridge will potentially divert 1,280,000,000 barrels of brine from the US economy and waste it into the Gulf of Mexico.	**[See response 3.3-1 above]**
Comment D0079-30 (Dow Chemical Company) *The potential adverse impact of the locating of the new SPR facility on the Stratton Ridge on the developing natural gas storage industry related to the Freeport Liquid Natural Gas terminal (FLNG). While over a handful of Liquid Natural Gas terminals (LNG) have been proposed, the FLNG is the only one moving forward into the construction phase. There are commercial transactions related to the construction of storage wells. Given the well developed nature of the Stratton Ridge salt dome, taking the only large property remaining on the salt dome for oil storage prevents the expansion of natural gas storage on the Stratton Ridge salt dome. Given the even more critical need for natural gas development in the energy policy of the US, it would be an inappropriate use of DoE resources to quench this ongoing commercial development in the natural gas area in locating the new SPR facility on the Stratton Ridge salt dome. DoE has a greater ability to construct the pipelines and spend the capital needed to develop a salt dome farther from commercial pipelines than does industry. DoE needs to spend its resources in a way that supports the current and developing land use and that encourages developing industry in the natural gas storage area.*	**Response 3.3-2** DOE acknowledges that the proposed SPR storage facility at Stratton Ridge potentially could conflict with other current and future land uses at the Stratton Ridge site, including the proposed Freeport LNG terminal. The EIS text in section 3.3.6 has been modified to provide additional information on this topic in the discussion of land use at Stratton Ridge. See also response 2.3.6-1 on the Stratton Ridge alternatives.

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Dow incorporates as if set forth in full in these comments, the DoE discussion of the importance of natural gas storage on its web page http://www.fossil.energy.gov/programs/oilgas/delivery/index.html . Dow mentions the discussion in the attached Slack Letter of the impact of the energy crisis and the impact of natural gas pricing and availability on Dow, the chemical industry and the US industry in general. Dow also mentions the discussion of the energy crisis and the impact of natural gas pricing and availability on Dow and the chemical industry. **Comment D0098-1 (Tommy Soriero, Pinto Energy Partners)** *We have in the last year worked a deal with Freeport LNG. They are building their cavern -- both their caverns, and they are permitted on our property. We also have additional development underway on the property for additional caverns both for gas storage to support the LNG and the local consumption of the chemical facilities in the area. We also have, obviously, a very large interest in the mineral value of the salt that Mr. Walker alluded to in his speech that we hate to see that -- that mineral wasted and it seems like it'd certainly be a way to accomplish both goals both realizing the mineral value of the salt as it is mined and not being wasted since there is a consumer in the area that could take the salt and it's also something, I said, the company has owned for -- in the range of years -- maintain the ownership of this land for this specific reason. And we anticipate that there's probably going to be a difference in the economic value as being proposed by -- by the DOE versus our company and how long we've held the property with the development plans that we have and this would certainly interfere with all of those plans.*	**[See response 3.3-2 above]]**

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Comment D0085-2 (Fred Lemon, Individual) *Number one, we might want that salt [from the Richton salt dome] for something else.*	**Response 3.3-3** DOE acknowledges that salt contained within any of the potential SPR storage sites potentially could be used for other purposes, and use of the salt caverns for SPR purposes would preclude the future use of that salt for other purposes. DOE does not know of other proposed uses of the Richton caverns.
Comment D0001-1 (NPS, Natchez Trace Parkway) *The Natchez Trace Parkway was authorized by Congress May 18, 1938. The Parkway is an elongated park of 51,150 acres covering a distance of 444 miles in Mississippi, Alabama, and Tennessee between Natchez, Mississippi, and Nashville, Tennessee. The purpose, as set forth by Congress, of the Parkway is to provide and maintain a scenic and recreational motor road commemorating the historic Old Natchez Trace and to provide access to significant natural and cultural resources. The Natchez Trace Parkway is characterized by numerous prehistoric Indian mounds and Chickasaw village sites, a military road associated with General Jackson's famous victory over the British at New Orleans, and its historic sites associated with the westward expansion of the British Colonies and the United States from 1763 - 1898.* *As one of the four nationally recognized rural parkways, the Natchez Trace Parkway, in its entirety, is eligible for the National Register of Historic Places as a designed cultural landscape and as a tribute to Landscape Architectural design and road way engineering partnerships at their best.* *The Parkway is presently not authorized to grant an easement or right-of-way (ROW) for either pipeline crossing through Parkway land in accordance with Director's Order 53. The proposed pipelines would*	**Response 3.3-4** DOE recognizes the need for additional National Park Service evaluation of any proposed pipeline through the Natchez Trace Parkway and acknowledges the Service's approval process. EIS section 3.3.3.2.1 states that if one of the Bruinsburg alternatives is selected, DOE would coordinate with the NPS to obtain the proper ROW easements through the Natchez Trace Parkway. Also, see response 1.3-5 for more information on how DOE would consult with the National Park Service if one of the Bruinsburg alternatives is selected.

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require a Congressional authorization being as there is no current deed reservation for the use of US Government land for this purpose in either location. *Assuming that authorization is granted, a right-of-way cannot be approved at this level and would require approval by the Southeast Regional Director. Right-of-ways are not given freely and are scrutinized very closely by the National Park Service (NPS). Moreover, the NPS has a Congressional mandate to manage NPS lands in a manner that will not result in derogation of the values and purposes for which the park was established. It would be difficult, and perhaps impossible, to explain the relationship between the proposed development and the purpose and values for which the Parkway was established.* **Comment D0114-1 (NPS, Natchez Trace Parkway)** *In our June 02, 2006 correspondence, we stated that the Natchez Trace Parkway did not have the authority to grant a right-of-way across Parkway land. We requested clarification from our Regional Solicitor of an existing law which we felt could allow us the authority for granting pipeline crossings of the Natchez Trace Parkway. Our Regional Solicitor agrees that we do in fact have the authority to issue right-of-ways for new pipeline crossings of the Parkway.* **Comment D0114-4 (NPS, Natchez Trace Parkway)** *In general, rights-of-way and easements represent tools for managing and controlling access to, use of, and interest in National Park Service land in order to preserve limited park resources. It is the responsibility of the park Superintendent to see that these interests are granted or acquired in a way that will not cause the derogation of values and*	**[See response 3.3-4 above]**

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purposes for which the park was established. It is important to note that although park resource management professionals serve as key support to the Superintendent in evaluating right-of-way proposals, only the Southeast Regional Director of the National Park Service has approval authority for granting rights-of-way for the Parkway. Right-of-ways are not given freely and are scrutinized very closely by the National Park Service. Moreover, the NPS has a Congressional mandate to manage NPS lands in a manner that will not result in derogation of the values and purposes for which the park was established.	**[See response 3.3-4 above]**
Comment D0021-4 (Brazoria County Commissioner) *There is also concern over government taking of Stratton Ridge property and perhaps even closure of Stratton Ridge Road. We have local experience on the use of eminent domain by the government.* **Comment D0079-15 (Dow Chemical Company)** *In addition, it is always a concern of local property owners that federal activity will result in a taking of private property. Such takings have a direct negative impact not merely on the property owner, who has every right to expect that government will protect his property interests, but also upon economic activity. When property rights are in jeopardy property owners do not take the kinds of economic actions that benefit themselves as well as other economic actors.* *As a leading advocate of property rights, I share the strong concern of others in the area that locating this reserve expansion at Stratton Ridge will negatively impact property owners. Moreover, I join with the local government authorities and taxpayers who are always concerned about taking property off of the local tax roles. With many suffering from property evaluation inflation, further erosion of the tax base will only*	**Response 3.3-5** DOE acknowledges that the use of eminent domain powers is a public concern. DOE would negotiate with any current land owners for lands needed for SPR purposes. Powers of eminent domain would be used only if circumstances warrant, and the procedure would be conducted according to U.S. law and only for public use of land needed for SPR purposes. See section 3.8.3 for a discussion of socioeconomic impacts.

<table>
<tr><th>COMMENT</th><th>RESPONSE</th></tr>
<tr><td colspan="2">3. Affected Environment and Potential Impacts</td></tr>
<tr><td colspan="2">3.3 Land Use</td></tr>
<tr><td>serve to further increase property taxes upon already strapped homeowners and businesses.

Comment D0097-2 (Diane Kile, Office of Congressman Ron Paul)
It is always a concern of local property owners that federal activity will result in a taking of private property. Such takings have a direct negative impact not merely on the property owner who has every right to expect that government will protect its property interest but also upon economic activity. When property rights are in jeopardy, property owners do not take the kinds of economic actions that benefit themselves as well as other economic actors.

As a leading advocate of property rights, I share the strong concern of others in the area that locating this reserve expansion in Stratton Ridge will negatively impact property owners. Moreover, I join with the local government authorities and taxpayers who are always concerned about taking property off of the local tax rolls. With many suffering from property valuation inflation, further erosion of the tax base will only serve to further increase property taxes upon already strapped homeowners and businesses.</td><td>[See response 3.3-5 above]</td></tr>
<tr><td>Comment D0073-9 (NOAA Fisheries)
The Singing River Island site has been subjected to various activities, including the establishment of a dredged material disposal site, the development of the Port of Pascagoula Special Management Area Plan, and the construction of a U.S. Navy facility. The site also is incorporated into the Corps of Engineers' proposed Dredged Material Management Plan for the Port of Pascagoula and the federal channel. Accordingly, the Singing River Island site may not be available to construct a terminal, even if the DOE is willing to provide offsetting mitigation unavoidable impacts. The availability of this site as well as</td><td>Response 3.3-6
DOE acknowledges that there are many past and potential future land uses at the proposed Pascagoula terminal site and RWI structure. As noted in section 3.3.5.2.1, DOE expects no substantive land use effects associated with the Pascagoula terminal facilities and RWI structure. DOE met with representatives of the Pascagoula Naval Station, ChevronTexaco Pascagoula Refinery, and the Pascagoula Port Authority on July 18, 2006, to reaffirm availability of land on Singing River Island for potential use as a terminal site and to increase communication between DOE and the local government, businesses and</td></tr>
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other alternative sites in the Pascagoula area should be fully explored prior to DOE making a selection on terminal locations. **Comment D0084-2 (Frank Leach, Jackson County Board of Supervisors)** *I further am very concerned about the fact that there seems to be some idea that has been quote, unquote, concocted that we are going to build a marine terminal on Singing River Island that is in the process of base realignment and the closure process. And I think in that regard and the fact that we do have an organization that has been recognized in Jackson County by the federal government as being an organization that would work toward the adaptive reuse of the island and look at it as to what may transpire there in the future that even that organization, I do not believe, is aware of this proposed marine terminal. I think in that regard things that are up for discussion is the future ownership, maintenance and the adaptive reuse of the Singing River Island as we try to proceed and as we try to solidify economic development within Jackson County with regard to that island, which the State of Mississippi and the Jackson County citizens have certainly made significant investment toward.*	citizens of Pascagoula.
Comment D0078-7 (DOI) *National Wildlife Refuge (NWR) System: Since the raw water intake pipeline, brine disposal line, and oil distribution line are each greater than 24 inches in diameter, they would all require Congressional approval per 50 CFR 29.21-9(m) for an application for a ROW on the Brazoria NWR. The oil distribution line may be deemed a common-carrier per 50 CFR 29.21-9(j 1).* *Refuge compatibility issues must be addressed for all three lines regardless of size. If the oil distribution line can be located within the*	**Response 3.3-7** DOE agrees and acknowledges that use of National Wildlife Refuge lands associated with the Stratton Ridge pipelines would require approval by the USFWS. EIS text in section 3.3.6.2.1 states that if one of the Stratton Ridge alternatives is selected, DOE would coordinate with the USFWS to obtain the proper ROW easements as a mitigation measure. This text has been supplemented in the final EIS to include information on the need for congressional approval of the pipeline ROW. See also the discussion of this issue in section 3.7.6.2.2.

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existing, heavily disturbed 23 inch and greater pipeline corridor (commonly referred to as the Dow Corridor), compatibility issues and concerns can be better addressed. The raw water intake and brine disposal lines, however, occur in a nationally recognized declining habitat type - Gulf cordgrass and adjacent wetlands. The area in question (Freshwater Lake area) also has minimal to no disturbance; therefore, construction of two new lines and the resulting wide ROW (1150 feet in wetlands and 100 feet in uplands) would be of concern to the refuge during the compatibility determination. Compatibility stipulations may include boring of the two lines underground to minimize habitat loss or other means to replace refuge habitat lost.	**[See response 3.3-7 above]**
Comment D0081-1 (NPS, Gulf Islands National Seashore) *The GUIS was authorized by Congress in 1971 (P.L. 91-660,84 Stat. 1967, 16 U.S.C. 459h) "to preserve for public use and enjoyment certain areas possessing outstanding natural, historic, and recreational values." As part of the coastal barrier island system, the gulf islands are among the last surviving portions of a natural ecological continuum that once extended from Cape Cod to Mexico.* *The natural resources of GUIS are, in and of themselves, highly significant. The water areas are exceptional and, in conjunction with the salt marshes, bayous, and submerged grassbeds, play a crucial role in the economy and ecology of the entire area. The GUIS' estuarine areas serve as an important nursery for a majority of the fin and shell fish species of the greater Gulf.* *Of particular significance, the Mississippi islands are among the most pristine examples of intact coastal barrier ecosystems remaining. The significance of these resources is only amplified by the loss of similar habitats in the adjacent areas through development. Open space along*	**Response 3.3-8** DOE recognizes that development of the Richton site and associated infrastructure, such as the terminal and RWI structure at Pascagoula, could affect the GUIS. The text of section 3.3.5 has been modified to provide additional information on this topic. See also section 3.7.5.2.2 for further discussion of the potential biological impacts on GUIS.

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the coasts, accessible to the public, is at a premium. *In the Richton alternative, the DOE is considering diffused brine disposal approximately 13 miles offshore. In pursuing this disposal alternative, it appears that DOE would seek to locate the outfall pipeline across GUIS to reach waters of the Gulf of Mexico. While the Secretary of the Interior has clear authority under GUIS enabling statute to consider allowing new rights-of-way or easements for the transport of oil and gas pipelines to cross the park, this authority may not extend to a brine/waste disposal pipeline. The pertinent GUIS enabling provision is as follows:* *Any acquisition of lands, waters, or interests therein shall not diminish any existing rights-of- way or easements which are necessary for the transportation of oil and gas minerals through the seashore which oil and gas minerals are removed from outside the boundaries thereof; and, the Secretary, subject to appropriate regulations for the protection of the natural and recreational values for which the seashore is established, shall permit such additional rights-of-way or easements as he deems necessary and proper (16 U.S.C. 459h-3; P.L. 91- 660 4).* *Further, an examination of 16 U.S.C. $79 regarding rights-of-way for public utilities leads us to conclude that the brine pipeline does not fit under this public utility provision.* *If a right-of-way could be issued for the disposal pipeline to cross GUIS, National Park Service (NPS) permitting and consent would be necessary. This permitting would be in addition to full analysis under the National Environmental Policy Act and other statutes. Regulations found in 36 CFR Parts 9 and 14 provide standards which must be used*	**[See response 3.3-8 above]**

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in the determination of necessary and proper. Specifically, in order for the Secretary to grant a permit, sufficient justification must be provided to make a reasonable determination that it is necessary for this operation to pass through the boundaries of the Seashore and that the procedures utilized in construction and operation are proper, in that they provide adequate protection to the resources of the area. Most, if not all, of the natural resources and visitor use values for which GUIS was established have the potential to be adversely affected by construction of an outfall line and brine disposal in the vicinity of the seashore. *In 1978, Congress designated Horn and Petit Bois Islands as wilderness through the establishment of the Gulf Islands Wilderness Area (P.L. 95-625). The islands are managed to maintain their primeval character in accordance with the Wilderness Act of 1964 (P.L. 88-577) whose purpose is to establish an enduring and unimpaired wilderness resource, where nature predominates, for public use and enjoyment. Wilderness status places significant restraints on possible developments on or near the two islands and requires substantial measures be taken to guarantee an undisturbed, wilderness experience for visitors.* *Specific Comments* *Specific GUIS resources that are put at risk by the proposed pipeline and brine disposal include:* *Land Use* *The GUIS is not listed as a potentially affected property in the DEIS, thus no impacts were evaluated. In addition, GUIS is not listed as a Special Status Area. The DEIS Summary stated that the "proposed*	**[See response 3.3-8 above]**

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action will not affect the [Gulf Islands National] Seashore." Congressionally-designated areas of the NPS must be given a much higher degree of consideration and protection when considering potential impacts to park natural and cultural resources. This consideration is lacking in the DEIS. **Comment D0081-3 (NPS, Gulf Islands National Seashore)** *The brine disposal pipeline is proposed to traverse the pass between Horn and Petit Bois Islands. These islands were designated wilderness by Congress in 1978 and are managed to maintain their primeval character in accordance with the Wilderness Act of 1964 whose purpose is to establish an enduring and unimpaired wilderness resource, where nature predominates, for public use and enjoyment. Wilderness status places significant restraints on possible developments on or near the two islands and requires substantial measures be taken to guarantee an undisturbed, wilderness experience for visitors.* *Any significant construction near these islands must consider intangible wilderness values such as visibility, night sky conditions, acoustic conditions, and solitude, which have consistently been recognized as critical components of wilderness. Potential impacts include but are not limited to: pipeline construction activities and scheduling, pipeline inspections, and aircraft use.*	**[See response 3.3-8 above]**
Comment D0006-1 (NRCS, Texas Office) *We have previously rated the soils at the Big Hill, Stratton Ridge and the Texas City Terminal sites which are located in Texas. We developed composite rating for the soils at the SPR Sites and completed the AD-1006 and CPA-106 forms for each site. You have discussed Important Farmlands in Section S.6.2. Thank you for considering the importance of protecting soils in these projects. We know of no other environmental*	**Response 3.3-9** Comment noted.

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concerns.	**[See response 3.3-9 above]**

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Comment D0011-2 (Nan Johnson, individual) *I find the existing EIS to be inadequate, especially as it does not seem to address the stability of the salt domes with any new studies.* **Comment D0083-6 (Becky Gillette, Sierra Club)** *One point that I do take exception to is this idea that the salt domes are completely stable and nothing ever happens. That isn't true. It's my understanding there have been no new engineering studies at the Richton dome. These domes are inherently unstable. They do change and there should have been new engineering studies done before signing off on saying that this is a stable salt dome that would have no problems.* **Comment D0009-1 (June Havens, individual)** *Richton, MS is inappropriate for a Strategic Petroleum Reserve storage site. The salt domes are not stable and the ground water for the coastal area could be in jeopardy. Hasn't the Coast suffered enough.*	**Response 3.4-1** DOE revised the EIS to add two subsections, 3.4.1.5 and 3.4.2.5, that further explain why the salt domes are geologically stable; however, the final EIS has the same conclusion as the draft EIS—the salt domes considered for SPR expansion are geologically stable, and the geology would not threaten storage cavern integrity. Following is a list of specific reasons for this stability include the following: • Peak acceleration of an earthquake at any SPR site would likely be too small to endanger salt dome stability (see also response 3.4-4). • The faults in the region are either nonactive or active with movement that is very gradual along the fault. • The self-healing property of salt would minimize the formation of discontinuities in the salt dome because salt tends to fill in any cracks that develop. • The growth rate of salt domes is extremely slow in the Gulf Coast region, approximately 2.3×10^{-4} inches (5.8×10^{-3} millimeters) per year, meaning the salt domes in the Gulf Coast region are geologically stable and there would be no threat to cavern integrity. • The successful construction and operation of storage caverns during the past decades have shown the salt domes in the Gulf Coast region to be geologically stable.

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Comment D0079-22 (Dow Chemical Company) *b) The EIS needs to fully evaluate the potential that the new SPR facility will create a significantly larger creep and subsidence in an area near important brine, liquid storage and natural gas storage caverns and important commercial pipelines.* **Comment D0079-25 (Dow Chemical Company)** *a) The EIS need to fully evaluate the increased creep and subsidence that will be caused by locating the new SPR facility in Stratton Ridge directly under this section.* **Comment D0079-32 (Dow Chemical Company)** *Dow raises one important issue that the EIS needs to evaluate in the Geological and Soil Resources section of the EIS and consider the adverse impact that the new facility may have on Geological and Soil Resources. The Stratton Ridge, Texas salt dome has been extensively developed. The parcel of land proposed for the location for the SPR new location is the only large parcel of land not already developed or under development on the Stratton Ridge salt dome. Locating the same series of caverns for oil storage on such a well developed salt dome will increase both the creep and subsidence in comparison to the same series of caverns for oil storage on a salt dome that is not developed to the same extent. The EIS needs to take the existing and planned (permitted) wells on salt domes to have a valid comparison of the creep and subsidence between the various alternative locations for the new SPR location. First, the adverse impact on existing and planned salt, liquid storage and gas storage caverns on Stratton Ridge needs to be evaluated. Second the adverse impact on planned and existing pipelines, including those in the nearby existing commercial pipeline corridors needs to be evaluated.*	**Response 3.4-2** The draft EIS analyzed the potential for creep and subsidence and concluded that subsidence would not jeopardize other structures co-located on the dome. The construction and operation of the SPR caverns would increase subsidence only in an area that is close to the SPR caverns with the increment decreasing rapidly with distance from the cavern field. Because the DOE SPR Level III Design Criteria would ensure that the SPR caverns are located far from the existing structures on the dome, the subsidence increment in the area of the existing structures would be small and the existing structures would not be jeopardized. At Stratton Ridge, the proposed Freeport LNG caverns are more than 2,000 feet (610 meters) away from the SPR caverns and the incremental subsidence caused by construction and operation of SPR caverns would be small. Although the integrity of pipelines on the Stratton Ridge salt dome would be affected by the differential subsidence (ratio of subsidence difference to length between two locations along the LNG pipeline) because of the construction and operation of the SPR caverns, it would be small and likely would not damage the integrity of LNG pipelines. Therefore, the multiple-use impacts would be negligible for the SPR caverns at Stratton Ridge and the Freeport LNG facility.

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Comment D0077-5 (EPA Region 6) *Page 3.61, Section 3.4.8, Stratton Ridge (Multi-Use Impacts): There is no discussion of the proposed use of the Stratton Ridge dome by Freeport LNG as an underground gas storage site.*	**Response 3.4-3** DOE has augmented its discussion of the Freeport LNG storage facility. That discussion appears in section 3.4.6.2 of the final EIS. The proposed SPR caverns would be located more than 2,000 feet (610 meters) away from the Freeport LNG storage caverns, which is more than twice the cavern web thickness criterion (480 feet) set out in the DOE SPR Level III Design Criteria: therefore, the multiple-use impacts would be negligible. See also response 3.4-2.
Comment D0085-8 (Fred Lemon, individual) *Now, I was watching a program the other night on the earthquake. If you put that petroleum in there and we do have an earthquake -- because I think it's a New Madrid fault. Is that right, Frank and Becky? A New Madrid fault between Memphis and St. Louis and if it comes and breaks that thing open and dumps it into our water supply we've all lost, so, you know, it's not practical. It's not practical at all.*	**Response 3.4-4** The USGS map (figure 3.4.2.3-1) includes the strongest projected New Madrid earthquakes that would affect the Gulf Coast region. As stated in section 3.4.2.3, and based on this map, the peak acceleration with 2 percent probability of exceedance (i.e., frequency of exceedance of 0.0004) would be smaller than 7.5 percent *g* at all of the SPR sites, where *g* is the acceleration of gravity. Thus, an earthquake with peak acceleration smaller than 7.5 percent *g* likely would not result in damages at the SPR sites.

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Comment D0077-23 (EPA Region 6) *The DEIS provides a breakdown of emissions expected from each type of activity (i.e., pipeline construction, salt dome construction, emissions from worker vehicles, etc.) for each potential site. Please clarify in the final EIS that emissions for all co-located activities occurring within the same calendar year have been summed in general conformity applicability analysis. In other words, if the salt dome construction and pipeline construction are occurring in the same year and within the*	**Response 3.5.2-1** Additional clarifying statements have been added to the summary discussion for each potential site in section 3.5 to indicate that the annual emission rate totals include co-located sources of emissions for comparison with the general conformity applicability analysis.

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same nonattainment area, then these emissions should be summed in order to consider their impact on the airshed within the nonattainment area.	**[See response 3.5.2-1 above]**
Comment D0077-24 (EPA Region 6) *To compare VOC emissions to the conformity de minimis levels, a correction factor of 20 percent is applied to the total non-methane hydrocarbon emissions modeling results to essentially remove ethane from the equation. Please justify the use of 20 percent as a correction factor.*	**Response 3.5.2-2** VOC emissions exclude both methane and ethane because they have very little ozone-forming potential. NMHC by definition excludes methane. Solution mining emits significant amounts of ethane. SPR solution mining measurements have shown that ethane ranges from 6 to 39 percent of the total NMHC emissions (DOE 1981). The mean observed ethane fraction was 20 percent. Thus, VOC emissions were estimated from the NMHC emissions by applying this 20 percent reduction to account for the mean ethane fraction in the solution mining emissions. This issue is discussed in section 3.5.6.2 of the EIS.
Comment D0077-26 (EPA Region 6) *Appendix A indicates that construction equipment emission estimates were made with the assumption that any diesel equipment will meet the EPA Tier 1 emission standards, or, in other words, that relatively new (model year 2000 or newer) equipment will be used for construction activity on this project. Please clarify this assumption and explain whether this will be a requirement of the construction bidding process.*	**Response 3.5.2-3** DOE will specify that the bidding process for construction contractors requires the use of nonroad diesel-fueled equipment meeting the Tier 1 emission standards (generally model year 2000 or newer). This approach has been successfully used by various government agencies in several ozone nonattainment areas. This issue is described in a footnote in appendix A, section A.2.
Comment D0077-22 (EPA Region 6) *In Chapter 3, the potential emissions from backup diesel generators are estimated and provided for public review. However, it is unclear from the document whether or not the emissions from the backup generators are to be included in any necessary state or federal permits for the facility. Please note that if the backup generator emissions are not accounted for in a permit and occur in a nonattainment area, then these emissions must be part of the general conformity applicability analysis.*	**Response 3.5.2-4** In section 3.5.2.2 of the EIS, the concluding discussion on backup diesel generator emissions states that these emissions would be further evaluated together with other sources of emissions during operation and maintenance activities. The discussion in section 3.5.2.2 shows the potential permitted emissions for all sources (including diesel generators) at the Big Hill facility, which is used to estimate potential operations and maintenance emissions at the other proposed sites. The

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If the emissions from these backup generators are included in a permit, then they may be excluded from the general conformity applicability analysis. Please clarify this in the FEIS.	emissions from the backup diesel generators would be included in an operating permit for the facility. To clarify this issue, DOE added a footnote to section 3.5.2.2 stating that if the backup diesel generators are included in the permit process, they may be excluded from the general conformity applicability analysis.
Comment D0077-6 (EPA Region 6) *Page 3-70, Section 3.5.1-3, Greenhouse Gas Emissions: The analysis of the release of methane gas during the solution mining of the salt domes should be compared to the analysis conducted by the US Coast Guard and Sandia National Laboratories for the salt dome storage construction impacts at the proposed Main pass Energy Hub (pp. 4-1 03 and 4-1 04, Final EIS March 2006) off the coast of Louisiana.*	**Response 3.5.2-5** A comparison of the estimated greenhouse gas emissions from the expansion of the SPR and the development of three salt dome caverns to be used for natural gas storage at the proposed U.S. Coast Guard Main Pass Energy Hub to be located off the coast of Louisiana is relevant considering the location and recent nature of the EIS. A discussion of this issue has been added to section 3.5.2.3. The greenhouse gas emissions for the proposed SPR expansion would be three times the emissions from the proposed Main Pass Energy Hub project.

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Comment D0005-4 (Louisiana Department of Environmental Quality) *Currently, Iberville Parish is classified as nonattainment with the National Ambient Air Quality Standards. Currently, Lafourche, Cameron, and Calcasieu Parishes are classified as attainment parishes with the National Ambient Air Quality Standards for all criteria air*	**Response 3.5.3-1** The nonattainment air quality status is discussed at the beginning of each of the proposed SPR sites. In section 3.5.7.1 of the EIS, DOE states that the Bayou Choctaw site in Iberville Parish is located in an ozone nonattainment area. Similar discussion is presented in sections 3.5.4 for Chacahoula and 3.5.9 for West Hackberry, both of which are

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pollutants.	located in attainment areas for site locations in Louisiana.
Comment D0077-7 (EPA Region 6) *Page 3-92, Section 3.5.8.2, Construction Impacts: The discussion of State Implementation Plan (SIP) requirements incorrectly references Louisiana statutory and regulatory standards instead of the Texas standards that actually apply to Stratton Ridge. The Louisiana SIP would be applicable to part of the Bruinsburg proposal (pipeline construction/operation with the Baton Rouge air shed (Ascension, East Baton Rouge, Iberville, Livingston, and West Baton Rouge parishes in Louisiana) and the tank farm construction/operation at Anchorage) as well as the various proposals that include expansion of the Bayou Choctaw facility. The Texas SIP would apply to the proposed Stratton Ridge facility and the pipelines in the Houston-Galveston- Brazoria air shed (Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller counties in Texas) as well as the various proposals that include expansion of the Big Hill facility within the Beaumont-Port Arthur air shed (Hardin, Jefferson, and Orange counties in Texas).*	**Response 3.5.3-2** The commenter correctly noted that the State of Louisiana was incorrectly identified as the entity responsible for implementation of the SIP requirements for the Stratton Ridge facility, which is located in Texas. DOE has corrected this mistake in the final EIS.
Comment D0077-25 (EPA Region 6) *Since the Stratton Ridge emission estimates appear to be quite close to the conformity de minimis threshold, if this site is selected as the preferred alternative in the FEIS, we recommend inclusion of the updated applicability analysis and conformity determination (if necessary) in the FEIS.* **Comment D0079-2 (Dow Chemical Company)** *In Chapter 3 (Section 3.6) and Chapter 4, the Draft EIS addresses ambient air quality. The Draft EIS notes that Stratton Ridge is among three potential expansion sites that are in non-attainment for the 8-hour ozone standard. While this is not an unmanageable situation, it makes*	**Response 3.5.3-3** Several commenters noted that the Stratton Ridge facility is close to the 100-ton-per-year threshold trigger for full conformity determination. Section 3.5.6 states that an updated applicability analysis and conformity determination would be undertaken if DOE selects the Stratton Ridge alternative and DOE would take the necessary measures to confirm to the standards.

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no sense to choose the one site out of three which will have a minor adverse impact on the non-attainment area into which the facility is located. The other potential sites would not have the filling emissions placed in a non-attainment area.	**[See response 3.5.3-3 above]**
Comment D0079-4 (Dow Chemical Company) *On page 3-93, the Draft EIS notes that that the maximum VOC emissions are estimated to be only slightly (7.3%) below the threshold that triggers a full conformity determination. The Draft EIS also commits DOE to conduct an additional conformity review if the Stratton Ridge site is selected to ensure that the maximum VOC emissions are really below the threshold. This is the only potential expansion site that has this notation in the Draft EIS. This means that the selection of the Stratton Ridge site will, at best, require more effort and delay than would any other of the potential expansions sites. Further, if this additional conformity review failed to show that the current maximum VOC emission estimate was not sufficiently accurate and conservative; a full conformity determination would be required with the associated increased delays, costs and potential changes and constraints to the expansion and/or operation of the SPR facilities newly placed at Stratton Ridge, TX. None of the other potential expansion sites have this actual minor drawback or the potential for a much more significant drawback. Dow urges DOE not to under estimate these related drawbacks to the Stratton Ridge, TX site when determining which potential site to use to expand the SPR.*	

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3.6.2.1 General Impacts	
Comment D0005-1 (Louisiana Department of Environmental Quality) *The Office of Environmental Services recommends that you investigate the following requirements that may influence your proposed project :* *1. If your project results in a discharge to waters of the state, submittal of a Louisiana Pollutant Discharge Elimination System (LPDES) application may be necessary.* *2. If the project results in a discharge of wastewater to an existing wastewater treatment system, that wastewater treatment system may need to modify their LPDES permit before accepting the additional wastewater.* *3. LDEQ has storm water general permits for construction areas equal to or greater than one acre. It is recommended that you contact Aaron Cox at (225) 219- 3092 to determine if your proposed improvements require one of these permits.* *4All precautions should be observed to control nonpoint source pollution from construction activities.*	**Response 3.6.2.1-2** As discussed throughout the EIS, including section 3.6, DOE would obtain the required state and Federal permits for construction and operation of any new facilities, or for expansion of existing facilities. Table L-1 lists permits and other requirements. The States of Louisiana, Mississippi, and Texas each have a state program that administers the requirements of the Federal NPDES program under the Clean Water Act. These permits would be required for any discharges to surface water, including wastewater from onsite wastewater treatment facilities, stormwater runoff, construction-related runoff, and brine discharge into the Gulf of Mexico. DOE would obtain discharge permits where required. DOE would institute nonpoint source discharge controls where required during construction through the use of best management practices, required by the erosion and sedimentation control permit.
Comment D0077-10 (EPA Region 6) *Page 3-117, Section 3.6.2.1.9, Impacts from On-Site Wastewater Treatment Plants: Would new wastewater treatment plants or enhancements of existing wastewater plants at the 3 SPR facilities considered for expansion be necessary to handle the larger workforces?*	**Response 3.6.2.1-4** A review of current plant capacities and projected staffing does not indicate a potential need to expand or replace wastewater treatment plants at this time; however, this issue may be reassessed during the detailed design phase of the projects.

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<tr><td colspan="2">3.6.2.2 Site or Alternative Specific Impact</td></tr>
<tr><td>Comment D0014-2 (Tony Bland, individual)
My overwhelming concern is the impact on the Pascagoula River Basin by diverting the flow of the Leaf River. The Pascagoula, as one of the few remaining natural river systems in the U.S., is a national treasure. I do not want to see it affected by having the flow of one of its main tributaries diverted.

Comment D0083-3 (Becky Gillette, Sierra Club)
The Leaf River flows into the Pascagoula River which is one of the great river systems of the United States. It is the last large undammed river system in the entire U.S. It's incredibly important. The Leaf River is important. I lived up there near the Leaf River myself for 13 years and I can tell you that in periods of drought like now it gets very low and there is an impact from that, water usage.

Comment D0084-4 (Frank Leach, Jackson County Board of Supervisors)
Not only am I concerned about the fact that -- that is an issue, but with regard to what was described by Ms. Gillette as far as water resources and the extraction of water from a water supply that Jackson County has been concerned about for a long period of time. It would be my idea on S when it talks about water resources, we address surface water, and it says the proposed facilities would draw water from nearby surface water bodies for use in the cavern solution mining -- if I can read up here in the dark. Two of the proposed new sites would withdraw the water from the ICW the proposed, et cetera, et cetera.

Then you get down to the fact the new Richton site, the flow rate of the Leaf River is highly variable and there would be a potential for</td><td>Response 3.6.2.2-1
DOE acknowledges that withdrawal of water from the Leaf River may result in adverse impacts on water resources (see 3.6.5.1.2) and aquatic resources, such as endangered species (see 3.7.5.1.2). To reduce DOE’s dependence on the Leaf River, DOE has added to the Richton alternatives a RWI structure on Singing River Island in Pascagoula, which would allow DOE to withdraw water from the Gulf of Mexico to reduce withdrawal from the Leaf River during low-flow conditions.

If DOE selects one of the Richton alternatives, DOE would develop a Water Conservation Plan for water withdrawal during cavern creation, drawdown, and maintenance. During cavern creation, drawdown, or maintenance, withdrawal from the Leaf River would be used during normal and high-flow conditions. Under low-flow conditions in the Leaf River, the withdrawal would be supplemented by a secondary source, the Pascagoula RWI, which would withdraw water from the Gulf of Mexico.

The Pascagoula RWI would be designed to handle about 0.5 MMBD of the total required volume, which is about 1.2 MMBD. During construction or maintenance, when flows in the Leaf River reach the Minimum Instream Flow that is designated by the regulatory agencies to protect special status species, withdrawal from the Leaf River would be reduced or terminated until the Minimum Instream Flow in the Leaf River is reached. During this period, DOE would withdraw water from the Gulf of Mexico.

If necessary, DOE would consider possible supplemental sources during Section 7 Consultation with the regulatory agencies, including possible groundwater sources, withdrawals from other surface water</td></tr>
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withdrawing a significant fraction of the total river flow during drought periods. This withdrawal could exceed the minimum in stream flow levels established by the Mississippi Department of Environmental Quality during periods of low flow in the Leaf River. Well, we have certainly experienced low flow within that river system and the fact that the Jackson County Board of Supervisors is presently in the final stages of a water supply for industrial purposes as well as for potential potable water for drinking water for our municipalities, a project by which we would continue to withdraw sizable amounts of water from the Pascagoula River. I am concerned about the fact that all of this could certainly place quite a strain upon the water resources, so I would ask that some additional consideration with regard to that be given and the fact that we are presently -- have in the last five years, I know, had to purchase water from the Pat Harrison Waterway through the Port of Pascagoula in order to stabilize industrial water supply for the local industries. I think we need to reconsider the fact -- withdrawing from the local surface water supply as far as this cavern is concerned **Comment D0007-1 (Elizabeth Waldorf, individual)** *We are writing to oppose the use of Leaf River water in the Richton petroleum storage. This practice would create more problems than it solves.* **Comment D0007-2 (Elizabeth Waldorf, individual)** *South Mississippi is developing a vigorous ecotourism industry. Eliminating a large input to the Pascagoula River would imperil that pristine ecosystem.*	bodies, and a possible onsite off-stream reservoir. If low-flow conditions exist in the Leaf River during emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico, and, as necessary to reach the water withdrawal rate of 1.2 MMBD, from the Leaf River. The general 7Q10 requirement was developed by the State of Mississippi to protect surface waters in the State from overuse and depletion. The 7Q10 is the 7-day average low stream flow over a 10-year period. As discussed in section 3.6.5 of the EIS, DOE based its evaluation of potential impacts to the Leaf River on a review performed by the Mississippi Department of Environmental Quality of 52 years of hydrographic data from the Leaf River. Based on this review, DOE determined that a sustained period of low-flow in the Leaf River likely would not occur during the 4 to 5-year cavern dissolution phase, when the maximum volume of water would be withdrawn. However, DOE concluded that during a drought, the withdrawal could result in a flow below the 7Q10 and would have an adverse impact on the Leaf River. For the Richton alternatives, cavern creation and the associated brine discharge could last up to approximately 9 years if the flow in the Leaf River persists below the Minimum Instream Flow for 9 consecutive years and DOE draws water exclusively from the Gulf of Mexico to create the Richton caverns. It is highly unlikely, however, that flows would remain below the Minimum Instream Flow in the Leaf River for 9 consecutive years. More likely, only a portion of the water for cavern creation would come from the Gulf of Mexico. The length of time

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Comment D0008-1 (Alex Major, individual) *PLEASE don't turn the Leaf/Pascagoula rivers into dry streambeds! This is far worse a proposal than the dams on the Leaf proposed for flood control that was so successfully opposed by a large number of people in Hattiesburg.*	required for cavern creation and the associated brine discharges for the Richton site could be longer for two reasons: (1) the rate of withdrawal from the available water sources may be smaller than the planned rate of withdrawal from the Leaf River, and (2) each barrel of saltwater from the Gulf of Mexico has less capacity than each barrel of freshwater from the Leaf River to dissolve salt and therefore a larger volume of saltwater would be needed to create the 160 MMB of storage capacity at Richton. If the total rate of water withdrawal for solution mining is reduced, the rate of brine discharged into the Gulf of Mexico would be lower and the size of the brine plume would also be slightly smaller. During brine refill events, after emergency drawdown or maintenance, brine discharge may be slightly longer if water is withdrawn from the Gulf of Mexico, as compared to water from the Leaf River. The Mississippi Natural Heritage Program indicated during informal consultation that to protect the Gulf sturgeon, raw water withdrawal from the Leaf River may need to be discontinued when flow is 30 percent of the mean daily discharge (section 3.7.5.2.3). Based on review of 21 years of stream data from the Leaf River, DOE calculated that this flow would be approximately 1,131 cubic feet per second (32 cubic meters per second). This flow is higher than the 7Q10 of 503 cubic feet per second (14 cubic meters per second), but may be the permitted Minimum Instream Flow limit considering the Gulf sturgeon habitat. If one of the Richton alternatives is selected, DOE would initiate formal consultation with the USFWS and NOAA Fisheries under Section 7 of the ESA and initiate permit coordination with the MDEQ and USACE for the Section 404/401 permit and the surface water withdrawal permit.

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[See comment D0008-1 text above]	Withdrawal of raw water from the Leaf River on downstream surface water resources in the watershed, such as the Pascagoula River, could result in a cumulative adverse impact on water resources as discussed in section 4.5.4 of the EIS. Based on a review of existing withdrawal and discharge permits, DOE identified no significant industrial water removal from the Leaf River. Although the Eaton Plant of the Mississippi Power Company withdraws large volumes of water from the Leaf River, its discharge back into the river is roughly equivalent, resulting in no net loss of water. See response 3.7.4.2-18 for a discussion of impacts to biological resources.
Comment D0106-27 (USFWS) *Page 3-256, paragraph 1 and 2. These paragraphs provide the conclusions regarding the impacts of the Richton RWI on endangered and threatened species. It is our understanding that the impacts would occur when the Leaf River is at average annual low-flow discharge of 720 cubic feet per second or near the 7Q10 discharge (503 cfs). During the June 22 interagency meeting, DOE mentioned that removal of water from the Leaf River would continue when river flows reached the 503 cfs discharge. Pumping of water from the Leaf River when flow is below 503 cfs would have severe impacts on listed and non threatened and endangered aquatic species. Impacts resulting from pumping water when flow is below 503 cfs should be discussed in the EIS.*	**Response 3.6.2.2-2** See responses 3.6.2.2-1 and 3.7.4.2-18 for a discussion of impacts to water resources and biological resources, respectively.

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3.6.2.2 Site or Alternative Specific Impact	
Comment D0106-3 (USFWS) *Moreover, the DEIS does not adequately address potential for destabilization of the channel structure of Bayou Pierre consequent to installation of the Bruinsburg facility in its floodplain near its confluence with the Mississippi River. There may be no significant problem, but considering the history of channel destabilization in Bayou Pierre, the subject should be discussed in the document.* **Comment D0106-17 (USFWS)** *In addition, Bayou Pierre has a serious headcutting problem, which causes bank sloughing and sedimentation. The headcutting problem is having adverse impacts on the endangered Bayou darter. As the Bruinsburg alternative may potentially exaggerate the head cutting problem, we recommend measures to address the head cutting problem be considered as an option for stream mitigation.* **Comment D0106-31 (USFWS)** *If the plan is selected as the preferred alternative, the Service recommends the following measures be considered for inclusion in the plan: 1) directional drilling from outside the Bayou Pierre floodplain to create and service the storage caverns, 2) within the floodplain structural engineering to protect the Bayou Pierre system from future rounds of head-cuts, 3) co-location of pipes within existing ROWs, 4) directional drilling beneath sensitive streams, and*	**Response 3.6.2.2-3** Pipelines in the Clovelly-Bruinsburg alternatives would have crossed Bayou Pierre; however, this alternative is no longer under consideration in the final EIS (see response 2.2-1). In the current Bruinsburg alternatives, an overhead power line would cross Bayou Pierre. The current Bruinsburg alternatives would not involve construction in or directly adjacent to Bayou Pierre and the likelihood of direct effects from construction on the floodplain would be low. The engineering design of the Bruinsburg project would consider any methods to protect Bayou Pierre from headcutting (erosional downcutting of the stream channel that begins at the stream mouth and progresses upstream and up tributary streams). DOE would co-locate pipes where possible to minimize overall impacts. As stated in the EIS, DOE would use directional drilling to cross surface waters where possible, and DOE would follow all permit requirements. If one of the Bruinsburg alternatives is selected in the ROD, DOE would work with the USFWS and other state and Federal agencies during the Section 404/401 permit process to develop a compensation plan for impacts to streams and jurisdictional wetlands. If the plan were deemed appropriate compensation by the permitting agencies, DOE would consider measures to further minimize the potential for project-related headcutting in Bayou Pierre, which is an existing issue for this water body. Directional drilling cannot be used to create the storage caverns. The wells must be installed vertically to control the cavern shape during leaching. See figure 2.3.1 for a representation of typical cavern

COMMENT	RESPONSE
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3.6.2 Surface Water	
3.6.2.2 Site or Alternative Specific Impact	
[See comment D0106-31 text above]	construction. See also response 3.7.4.2-12.
Comment D0081-5 (NPS, Gulf Islands National Seashore) *Surface and bottom water current data should be included to define seasonal velocities and direction as well as an analysis of seasonal variations in the potential extent of turbidity plumes and sedimentation. This will assist in assessing the potential impacts as a result of the turbidity plume created by pipeline burial. It will also help determine the potential of creating a new tidal pass which could serve as a source of excess suspended matter for a protracted time.* *To evaluate properly the extent of downstream turbidity and sedimentation, the effectiveness of proposed turbidity control devices needs to be determined. This information is critical in assessing the expected environmental impacts. In addition, a turbidity monitoring program should be conducted during and for a period of time following construction. The program design and time period should be determined by subject-matter experts.*	**Response 3.6.2.2-4** DOE acknowledges that the model used to assess the extent and nature of the brine discharge does not consider seasonal variation and surface current data, but the model does include bottom current direction and velocity. DOE believes that the model adequately represents the nature and extent of the brine impacts and acknowledges that site-specific or temporal conditions could affect the results of the brine plume. The model does not address the sedimentation plume from pipeline construction. After DOE identifies a selected alternative in the ROD, DOE would conduct additional modeling of the brine plume using a model such as EPA's CORMIX discharge model. DOE would conduct the modeling as part of the NPDES permit for the brine discharge. If one of the Richton alternatives is selected, DOE would continue to coordinate with the NPS and GUIS to ensure that the effects from brine discharge and sedimentation resulting from pipeline construction are minimized. Data on seasonal current velocities are included in appendix C of the EIS. DOE acknowledges in section 3.7.2.1.2 that pipeline construction would create temporary increases in turbidity and sedimentation as a result of offshore pipeline construction. DOE would minimize these potential impacts by implementing best management practices as discussed below and in section 3.7.5.2. DOE's subject matter specialists would work with various permitting agencies involved in the permitting process. This group would calcu-late required preconstruction analyses and develop mitigation measures

COMMENT	RESPONSE
3.6 Water Resources	
3.6.2 Surface Water	
3.6.2.2 Site or Alternative Specific Impact	
[See comment D0081-5 text above]	and monitoring programs. Installation of buried pipelines would require a permit pursuant to Section 10 of the Rivers and Harbors Act of 1899 and the Clean Water Act Section 404 and a Section 401 Water Quality Certificate. DOE would comply with all requirements of these permits, including construction monitoring as required. DOE would use appropriate best management practices to reduce the effects of turbidity during pipeline construction, including installing silt curtains and monitoring water quality during construction to identify and resolve turbidity and sedimentation problems as required by the permits.
Comment D0077-11 (EPA Region 6) *Pages 3-120 to 3-122, Section 3.6.3.1.1, Bruinsburg Surface Water: Table 3.6.3-1 includes a footnote (a) in the header, but the explanation given is only applicable to surface water bodies in Mississippi. There is no corresponding reference to the use designations or classifications for water bodies in Louisiana, although several Louisiana water bodies are included in the table. The table would be more helpful if the surface water bodies were listed by geographic order (north to south) so that those surface water bodies crossed by the Bruinsburg to Anchorage crude oil pipeline could be designated as being in Mississippi or Louisiana*	**Response 3.6.2.2-5** The surface waters are in both Louisiana and Mississippi. Table 3.6.3-1 now includes the Louisiana designations, and the water bodies are listed in the table in north-to-south order.
Comment D0077-12 (EPA Region 6) *Page 3-124, Section 3.6.3.1.1, Bruinsburg Surface Water: An incorrect inference could be drawn (2nd paragraph) that all of the impaired water bodies crossed by the crude oil pipeline are in Mississippi. But according to the information in Table 3.6.3-1 (portion on p. 3- 12 I), some of the impaired water bodies are in Louisiana.*	**Response 3.6.2.2-6** The crude oil pipeline would pass through Louisiana as well as Mississippi, and it would cross water bodies in both states. Section 3.6.3.1 of the EIS has been revised to more clearly reflect this.

COMMENT	RESPONSE
3.6 Water Resources	
3.6.2 Surface Water	
3.6.2.2 Site or Alternative Specific Impact	
Comment D0077-13 (EPA Region 6) *Page 3-146, Section 3.6.7.1.2, Richton Surface Water: While the surface water bodies crossed by the crude oil pipeline going to the Liberty tank farm are in Mississippi, several of them drain into Louisiana. The FEIS should explain whether potential impacts to designated uses in Louisiana have been incorporated into the environmental analysis.*	**Response 3.6.2.2-7** The analysis presented in the EIS of potential impacts to surface waters from crude oil pipelines is also applicable to downstream water bodies. Only the water bodies that would be crossed have been identified. Because these water bodies are within the Mississippi River drainage area, any contaminants that migrated from the original point of discharge at the crude oil pipeline would drain toward the Mississippi River. Designated uses of surface waters located in Louisiana are listed in table 3.6.3-1, and they have been analyzed for potential impacts. See response 3.6.2.2-5 above.
Comment D0077-14 (EPA Region 6) *Page 3-162 to 3-165, Section 3.6.9.1, Bayou Choctaw Surface Water: Bayou Bourbeaux and Bayou Borbeaux appear to be used interchangeably throughout this section. For example, Bayou Borbeaux is on Table 3.6.9-1, but Bayou Bourbeaux is on Figure 3.6.9-1. The text on p.3-162 uses both spellings in different paragraphs. Are both references to the same water body or are there actually two different bayous? If the latter is correct, the table and figure should be revised to reflect two different water bodies.*	**Response 3.6.2.2-8** The EIS has been revised to use the correct name, Bayou Bourbeaux.
Comment D0077-33 (EPA Region 6) *Region 6 EPA would have oversight on the two sites in the State of Texas, new site Stratton Ridge, and expansion at Big Hill. Our concern is that while the activity does not fall under the 316(b) regulations for cooling water intake structures, it seems that EPA could possibly make a case-by-case determination using Best Professional Judgement (BPJ) to use equivalent technology. The facility will need 50.4 MGD for solution mining, and they will withdraw the water from the intercostal*	**Response 3.6.2.2-9** As stated in section 3.7.2.2.2 of the EIS, RWI structures would be equipped with screens with openings of approximately 0.5 inches (1.3 centimeters). No chemicals would be used to inhibit marine growth on the RWI structures.

COMMENT	RESPONSE
3.6 Water Resources	
3.6.2 Surface Water	
3.6.2.2 Site or Alternative Specific Impact	
waterway off the Texas coast. The DEIS states that they will have the structure in a shipping channel maintained by the COE. The intake structure will have rotating marine removal screens, and the velocity would be maintained at 0.5 feet per sec. *EPA is interested in knowing what size openings are on the screens and whether any chemicals will be used to inhibit marine growth on the intake structures.*	See response 3.7.2.1-9 for a discussion of the potential impacts to biota resulting from the RWI operations for Stratton Ridge.
Comment D0077-9 (EPA Region 6) *Page 3-111, Section 3.6.2.1 -5, Impacts of Oil Spills to Surface Waters: There is only a reference made to Louisiana SPCC regulations. Are there Mississippi and Texas SPCC regulations that would be applicable to one or more proposals?*	**Response 3.6.2.2-10** A SPCC plan is required by Federal law (40 CFR 112) and the plan would be required for all SPR facilities. The SPR facility SPCC plans would also meet the requirements of the applicable regulations of Louisiana, Mississippi, and Texas.

COMMENT	RESPONSE
3.6 Water Resources	
3.6.4 Groundwater	
3.6.4.1 General Impacts	
Comment D0005-3 (Louisiana Department of Environmental Quality) *6. All precautions should be observed to protect the groundwater of the region (SEE ATTACHMENT).*	**Response 3.6.4.1-1** DOE would follow all permit requirements and appropriate best management practices to protect groundwater resources.

COMMENT	RESPONSE
3.6 Water Resources	
3.6.4 Groundwater	
3.6.4.2 Site or Alternative Specific Impact	
Comment D0007-3 (Elizabeth Waldorf, individual) *Currently excess water pumping is mining ground water from Mississippi soils. On average over the state our water table drops a foot a year. Your proposed withdrawals would combine with this excess.*	**Response 3.6.4.2-1** DOE proposes to withdraw water from the Leaf River and/or the Gulf of Mexico to solution mine caverns and maintain and operate the SPR during drawdown, maintenance, and fill events. See section 3.6.5.1.2 and response 3.6.2.2-1 for a discussion of an additional source of water withdrawal for the Richton alternatives, which was not presented in the draft EIS. The incremental impacts on groundwater from surface water withdrawal from the Leaf River would be negligible. Because recharge typically flows from groundwater toward the surface waters at all of the proposed new and expansion sites, the proposed pumping of surface water would not affect groundwater or the groundwater table under most hydraulic conditions. A slight impact on groundwater could be expected during short periods of high water following extended periods of heavy precipitation. During these conditions, surface water would recharge aquifers. In addition, withdrawal from surface water during periods of low water could result in an increase in hydraulic gradient and flow from the aquifer to the surface water. Even during these nontypical conditions, the effect on the groundwater table would be very small at Richton. DOE would follow state permitting requirements and adhere to monitoring or withdrawal restrictions. DOE added section 3.6.2.2.3 to the EIS to discuss the potential impacts of surface water withdrawal on groundwater.

COMMENT	RESPONSE
3.6 Water Resources	
3.6.4 Groundwater	
3.6.4.2 Site or Alternative Specific Impact	
Comment D0009-1 (June Havens, individual) *Richton, MS is inappropriate for a Strategic Petroleum Reserve storage site. The salt domes are not stable and the ground water for the coastal area could be in jeopardy. Hasn't the Coast suffered enough?* **Comment D0014-4 (Tony Bland, individual)** *I am also concerned about the inherent lack of stability of salt domes and the potential for groundwater contamination from oil stored there.* **Comment D0085-5 (Fred Lemon, individual)** *But let's get on back to our water. Our water comes through those salt domes. How much of it comes out, how much of it gets salted because our water down here -- and I've traveled this country from one end to the other and crisscrossed in a camper and in only one-third of the sites would I put the water in that campground in my camper it was so bad and we have good water. Are we are going to take a chance -- are we going to take a chance in polluting it with this petroleum? I don't think it's -- I don't think it's worth it.* **Comment D0083-7 (Becky Gillette, Sierra Club)** *I am also concerned about the ability of the Mississippi Department of Environmental Quality to adequately monitor any problems that might be associated with the salt dome if it leaked oil or if it leaked salt. I believe that some of our drinking water actually comes from up in that area in the underground flow, so I would be concerned about the drinking water quality.*	**Response 3.6.4.2-2** As discussed in section 3.6.2.2.2, the probability of oil leaking from the salt cavern would be very low for the reasons listed below: • The salt is essentially impermeable, and it would not allow the oil to flow through it. • Although it is unlikely that leaks would occur through fractures in the salt, the caverns would be geophysically surveyed and pressure tested to check for fractures before oil was injected. The oil would be injected into the cavern through wells drilled from the surface down thousands of feet to the caverns. Following is a list of measures that would guard against oil leaking from the wells: • Wells would be installed with features designed to prevent leakage. They would be double cased and grouted. • After installation and before oil is introduced, the wells would be pressure tested. In addition, the water surrounding the domes is thousands of feet below ground surface, and it is high salinity; therefore, it is not suitable for drinking water. DOE does not plan to monitor deep groundwater at the depth of the caverns for oil or salt leaks. Based on the factors presented above and in the EIS, there is a very low probability of leakage from the caverns themselves. The probability of leaks, although also low, is greater along the length of the injection well. DOE would monitor shallow water quality at the proposed SPR facilities, as it does at existing SPR facilities.

COMMENT	RESPONSE
3.6 Water Resources	
3.6.4 Groundwater	
3.6.4.2 Site or Alternative Specific Impact	
Comment D0085-7 (Fred Lemon, individual) *Let's see. There's a couple of other points I would like to get if I can see them. We've got to have good drinking water and we have good drinking water.*	See response 3.4-1 for additional information on the stability of the salt dome.
Comment D0089-5 (Vernon Phillips, Anabasis) *Additionally, by using both the Sparta and Wilcox formations for brine disposal, the capacity of each well can be doubled or increased fourfold, thus reducing the number of disposal wells required, reducing the wellhead pressure of each well, and increasing injection runtime between workovers, which will commensurate reduced cost and enhance environmental safety.* *Both the Sparta and Wilcox formations have proven to be safe, well known, and commonly used disposal zones in Mississippi with excellent disposal capacity. Both zones can be used at the same time in each well-bore further enhancing safety and the disposal capacity*	**Response 3.6.4.2-3** DOE has determined that brine injection into multiple formations simultaneously is not technically feasible for the reasons discussed below. Brine injection into multiple formations through one wellhead is not standard practice primarily because of the lack of hydraulic control on the injection process. Although access would be available for disposal in both formations, the pressure differentials in the formations would determine which formation the brine actually entered. Because there would be no controls on the rate of discharge into each formation, there is a possibility that injection into one of the formations could be overpressured and result in fracturing. DOE would not inject brine into multiple formations for the following additional reasons: • Crossflow through the well between the formations would occur during any periods when the injection well was not operating. • It is difficult to properly install a well into multiple formations. • It is difficult and hard to control cleaning the well screens and assuring that the screens in each formation are adequately clean to allow for flow into the formations.

<table>
<tr><th>COMMENT</th><th>RESPONSE</th></tr>
<tr><td colspan="2">3.6 Water Resources</td></tr>
<tr><td colspan="2">3.6.5 Brine Discharge</td></tr>
<tr><td colspan="2">3.6.5.1 General Impacts</td></tr>
<tr><td>Comment D0106-10 (USFWS)
Page 2-80, Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative. This table compares impacts of the new sites, the three expansion sites, and the no-action alternative. The Richton site would discharge brine into the Gulf of Mexico through 75 diffusers placed about 60 feet apart. Modeling indicates that there would be a small increase in water salinity (about 4 parts per thousand) and this increase is within natural salinity variation.

The Service believes there should be further elaboration on this conclusion. The brine discharged in the Gulf of Mexico would be released near the bottom and would have a salinity of over 235 parts per thousand (ppt). The salinity of the water in the vicinity of the release is 35 ppt. Since the brine is denser than the surrounding water, the brine would flow along the bottom and there would be considerable time before mixing is complete. Therefore, we believe there would be a mixing zone over a large area with elevated salinity levels. The mixing zone would be avoided by highly mobile animals such as fish and shrimp, and could seriously impacts benthos dwelling in the mixing zone. In short, the mixing zone could potentially be a depressed zone for aquatic life. The Service believes that brine water released into the Gulf should be closely monitored for effects on aquatic life.

Comment D0013-2 (Gulf Restoration Network)
The DOE must fully analyze the potential impacts of, and where possible, avoid alternatives that would require disposal of brine in the Gulf of Mexico. Depending on the season, a salinity change of 4.23 may or may not be a "normal' variability as claimed by the DOE. In</td><td>Response 3.6.5.1-1
Although the brine would have a salinity of 235 parts per thousand, field studies at active SPR brine diffusers and modeling efforts indicate that the initial mixing caused by the high velocity of discharge through the brine diffuser would reduce the salinity of the discharge within the mixing zone.

The maximum resultant salinity would be 4.3 parts per thousand, which is usually within the normal salinity variability reported in the Gulf of Mexico, as stated in section 3.6.2.1.2 of the EIS; however, a condition could occur where resultant salinities were 4.3 parts per thousand above the normal maximum salinity. See response 3.7.2.1-1 for a discussion of potential impacts to biota and sections 3.7.2.1.5, 3.7.4.2.4, and 3.7.5.2.6 and appendix E.

As discussed in appendix C, the two most important factors determining the mixing zone are the brine discharge rate and the bottom current velocity. The brine would be discharged at a high flow rate of 30 feet (9.2 meters) per second, which would enhance the mixing process in the immediate vicinity of the diffuser. After this initial mixing phase, the bottom current would be the main determinant. The bottom current used for the models is representative of the site, and the data should provide a reasonable estimate of the mixing zone. The model was developed based on field salinity data at active SPR brine diffusers in the Gulf of Mexico. The model indicates that the highest resultant increase in salinity would be less than 5 parts per thousand. Salinity increases would be 4 parts per thousand at 0.60 to 0.80 nautical miles (1.11 to 1.48 kilometers) from the brine diffuser, and less than 4 parts per thousand beyond this area.</td></tr>
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COMMENT	RESPONSE
3.6 Water Resources	
3.6.5 Brine Discharge	
3.6.5.1 General Impacts	
either case, during the summer, discharge near the bottom can contribute to low oxygen, which in turn, can affect finfish and other marine species. **Comment D0085-3 (Fred Lemon, individual)** *Number two, are we going to change the salinity?* **Comment D0086-2 (Lin Jacobson)** *I would like to learn a lot about the brine situation as a result of the salt dome. Brine to me is a concentrated, concentrated salt water solution and I don't think that needs to be pumped out into our front yard in the Gulf, but I will need further information* **Comment D0106-29 (USFWS)** *Also, measures should be included to avoid elevated salinity levels at the end of the outflow pipe in the Gulf.* **Comment D0081-8 (DOI)** *Brine disposal from the Richton, Mississippi site is estimated to be 1,280,000,000 barrels (53,760,000,000 gallons) of hypersaline water. Brine disposal will be at an average rate of 1.2 million barrels per day over a 3-to-4 year period. The brine plume is expected to cover an area of 19.5 square nautical miles. The disposal site is proposed to be located approximately 1.5 miles south of the park boundary in the Gulf of Mexico. The brine will have a salt content of 263 parts per thousand (ppt) and be disposed of in seawater with a salt content of 35 ppt resulting in an increase of ambient salinity. In addition, the introduction of metals and other inorganic contaminants is highly*	Additional modeling using the CORMIX model would be required to further evaluate the mixing zone before a discharge permit is issued. Also, NPDES permitting through the appropriate state agency would include requirements for monitoring during the operational period. Regarding possible discharge of metals and inorganics in the brine, state pollution discharge permits would establish discharge limits for inorganics and initiate a monitoring program to demonstrate compliance. The primary method that would be used to avoid elevated salinity levels at the end of the outflow pipe in the Gulf of Mexico would be the high velocity of the discharge through multiple ports that enhances initial mixing of the brine and significantly decreases the resultant salinities.

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3.6.5 Brine Discharge	
3.6.5.1 General Impacts	
possible.	**[See response 3.6.5.1-1 above]**

COMMENT	RESPONSE
3.7 Biological Impacts	
3.7.1 Methodology	
Comment D0073-1 (NOAA Fisheries) *3.0 AFFECTED ENVIRONMENT AND POTENTIAL IMPACTS* *3.7 Biological Resources* *3.7.1 Methodology* *3.7.1.3 Essential Fish Habitat* *Page 3-184, paragraphs 1 and 2. This section of the document describes methods to identify essential fish habitat (EFH) associated with this project at the brine diffuser and offshore pipeline rights-of-way (ROW) only. Onshore components of some of the various new and proposed expansion sites would potentially impact EFH for various federally managed species as well. Methods to identify and quantify onshore impacts of SPR expansion activities should be included in this section of the DEIS.*	**Response 3.7.1-1** DOE acknowledges that it failed to identify the onshore component of EFH in the draft EIS. In the final EIS, DOE has identified and described the potential site development effects on onshore EFH at each site. The onshore EFH generally comprises tidally influenced streams, estuaries, and wetlands, which are considered EFH for early life stages of brown shrimp, white shrimp, and red drum. DOE has modified appendix E and the relevant sections of the EIS (section 3.7, chapter 4, and chapter 2) to reflect the impacts to onshore EFH not originally discussed in the draft EIS.

COMMENT	RESPONSE
3.7 Biological Impacts	
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3.7.2.1 General Impacts	
Comment D0083-8 (Becky Gillette, Sierra Club) *We have very productive, important natural estuaries here on the Gulf Coast and if you dump salt water into that you can kill it for years. These are important to our seafood industry and it can take a long time to recover.*	**Response 3.7.2.1-1** DOE has expanded its presentation in the EIS where it identified the important estuaries and fisheries resources in the project area and assessed potential effects on both that could result from the proposed alternatives. See response 3.7.1-1 concerning onshore fisheries resources. In section 3.7.2.1.5 and appendix E, DOE examined the effect of brine discharge into the Gulf of Mexico. DOE concluded that there would be no significant adverse effect on the Gulf, estuaries, or managed fisheries because the potential increase in salinity would usually be within the typical range of salinity. The impact to estuarine species would occur for 4 or 5 years or less during cavern development. The area effected by a slight increase in salinity would be localized. For example, salinity would increase 4 or more parts per thousand in 1.2 square miles (4.1 square kilometers) or less surrounding the brine diffuser (see appendix C). For the Richton alternatives, cavern creation and the associated brine discharge could last up to approximately 9 years if the flow in the Leaf River persists below the Minimum Instream Flow for 9 consecutive years and DOE draws water exclusively from the Gulf of Mexico to create the Richton caverns. It is highly unlikely, however, that flows would remain below the Minimum Instream Flow in the Leaf River for 9 consecutive years. More likely, only a portion of the water for cavern creation would come from the Gulf of Mexico. The length of cavern creation and the associated brine discharges could be longer for two reasons: (1) the rate of withdrawal from the available water sources

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3.7.2 Plants and Wildlife	
3.7.2.1 General Impacts	
[See comment D0083-8 text above]	may be smaller than the planned rate of withdrawal from the Leaf River, and (2) each barrel of saltwater from the Gulf of Mexico has less capacity than each barrel of freshwater from the Leaf River to dissolve salt and therefore a larger volume of saltwater would be needed to create the 160 MMB of storage capacity at Richton. If the total rate of water withdrawal for solution mining is reduced, the rate of brine discharged into the Gulf of Mexico would be lower and the size of the brine plume would also be slightly smaller. During brine refill events, after emergency drawdown or maintenance, brine discharge may be slightly longer if water is withdrawn from the Gulf of Mexico, as compared to water from the Leaf River. Previous analyses examining the effect of brine disposal on fish from brine contaminants discharged at existing SPR sites showed that some brine contaminants can be present at slightly elevated levels around the diffusers, but that fish populations do not suffer adverse effects because fish are mobile and contaminant salt concentrations are low and below established water quality criteria (Hann et al. 1984). Previous studies examining the effect of brine diffusion on benthic biodiversity at the West Hackberry and Bryan Mound diffusion sites indicated a localized reduction in benthic biomass within a range of 656 to 6,889 feet (200 to 2,100 meters) from the diffusers during operation of the discharge (Hann et al. 1984; see appendix E, section E.5). These effects generally persist for a short period after the discharge terminates. Recovery of the macroinvertebrate and fish community could be expected. Appendix E describes for each site the direct and indirect effects of the construction of brine disposal pipelines, periodic maintenance of offshore pipeline ROWs, and discharge of brine and brine diffusion on

COMMENT	RESPONSE
3.7 Biological Impacts	
3.7.2 Plants and Wildlife	
3.7.2.1 General Impacts	
[See comment D0083-8 text above]	EFH (see section E.5) for the managed fish species and their major food sources (see section E.3). The EIS also notes in section 3.6.2.1.2 that all discharges would comply with the NPDES and associated state permit regulations, which were established to protect aquatic resources as well as human health.
Comment D0106-12 (USFWS) *Page 3-5, paragraph 1. This paragraph discusses brine spills in marine environments at existing SPR sites, and concludes by stating that these spills had little impact on fish and wildlife habitat. We recommend that the paragraph also discuss impacts of brine spills in freshwater habitats. Brine spills in freshwater habitats are usually more damaging than spills in marine habitats.*	**Response 3.7.2.1-2** Section 3.2.1.2 and table 3.2.1-1 in the EIS contain data for reported brine spills to freshwater and marine habitats. The effects of brine spills on freshwater habitats are discussed in section 3.2.2.2; section 3.6.2.1.6, and section 3.7.2.2.5.
Comment D0106-14 (USFWS) *Page 3-11, paragraph 4. The document discusses that oil spills would occur during operation of the proposed project. It further mentions some ways oil cleanup could be handled to reduce impacts to the environment. This section should also discuss compensation responsibilities for oil spill injuries to our trust resources (e.g. migratory waterfowl, wetlands, endangered and threatened species, etc.) and state trust resources. This information allows for a more complete disclosure and discussion of impacts to the natural environment.*	**Response 3.7.2.1-3** The EIS describes in section 3.7.2.2.5 the response and mitigation actions for biological resource effects resulting from brine or petroleum release. DOE has expanded the material presented in the EIS to more fully describe the response and mitigation actions for oil spill effects to trust resources.
Comment D0013-2 (Gulf Restoration Network) *The DOE must fully analyze the potential impacts of, and where possible, avoid alternatives that would require disposal of brine in the Gulf of Mexico. Depending on the season, a salinity change of 4.23 may or may not be a "normal" variability as claimed by the DOE. In*	**Response 3.7.2.1-4** As stated in section 3.6.2.1.2 of the EIS, the maximum resultant salinity would be 4.3 parts per thousand, which is typically within the normal range of salinity reported in the Gulf of Mexico. This section also states, however, that a condition could occur where resultant salinities

COMMENT	RESPONSE
3.7 Biological Impacts	
3.7.2 Plants and Wildlife	
3.7.2.1 General Impacts	
either case, during the summer, discharge near the bottom can contribute to low oxygen, which in turn, can affect finfish and other marine species.	would be 4 parts per thousand above the normal maximum salinity (i.e., if current velocities are low and ambient bottom salinities are high). The potential effects of this increased salinity on biota are evaluated in section 3.7 and appendix E. Brine injection wells were not proposed for use at sites other than Bruinsburg, Bayou Choctaw, and West Hackberry for the following reasons: • Injection wells can be difficult and expensive to operate, the geology must be appropriate for wells to be drilled, and the receiving aquifer must be hydrologically suited for injections. Dispersion of brine into the Gulf of Mexico has been successful at existing SPR sites. The alternative of brine injection into underlying aquifers has not been widely used, especially at the volumes generated by cavern leaching. Underground injection of brine presents technical, operational, and hydrogeological obstacles, and typically it is used only when the distance between a salt storage site and the Gulf of Mexico is large, as is the case for the Bruinsburg site, or when brine volumes are relatively small (as is the case at Bayou Choctaw and West Hackberry). • Brine injection wells pose some risk to overlying drinking water sources such as freshwater aquifers. For example, potential effects of brine injection could include readjustment of surrounding strata and displacement of existing fluids due to pressure changes, displacement of saline water to fresh water zones, and fracturing of geological formations causing migration of brine into overlying fresh aquifers. • Building injection wells requires a significant amount of land, which

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[See comment D0013-2 text above]	can have adverse environmental impacts. • Injection wells can be more costly than building pipelines for brine disposal in the Gulf of Mexico, especially if the caverns are located relatively close to the Gulf. This discussion has been expanded in the final EIS (section 2.3.3). See response 3.6.5.1-1 and 3.7.2.1-1 for a discussion of the potential effects resulting from the proposed brine discharge. As noted in section 3.6.2.1.2, DOE would apply for NPDES permits, which are required for any discharges to surface waters including the Gulf of Mexico. NPDES permits require that all regulated discharges are within water quality standards as set by EPA and state agencies. Because oxygen concentration is regulated through NPDES permits, discharges would operate within permitted effluent limits, which are designed to be protective of aquatic organisms. The EIS acknowledges that aquatic resources would occur because of the brine discharges. DOE concluded that there would be no significant adverse effect on the Gulf, estuaries, or managed fisheries because the potential increase in salinity would usually be within the typical range of salinity. The impact to estuarine species would occur for 4 or 5 years during cavern development. Impacts would also occur for six months or less during sporadic maintenance and drawdown events. The area effected by a slight increase in salinity would be localized. For example, salinity would increase 4 or more parts per thousand in 1.2 square miles (4.1 square kilometers) or less surrounding the brine diffuser (see appendix C). See response 3.7.2.1-1 for a discussion as to why brine

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[See comment D0013-2 text above]	disposal may last slightly longer and the brine plume would be slightly smaller for the Richton alternatives.
Comment D0077-33 (EPA Region 6) *Region 6 EPA would have oversight on the two sites in the State of Texas, new site Stratton Ridge, and expansion at Big Hill. Our concern is that while the activity does not fall under the 3 16(b) regulations for cooling water intake structures, it seems that EPA could possibly make a case-by-case determination using Best Professional Judgment (BPJ) to use equivalent technology. The facility will need 50.4 MGD for solution mining, and they will withdraw the water from the intercostal waterway off the Texas coast. The DEIS states that they will have the structure in a shipping channel maintained by the COE. The intake structure will have rotating marine removal screens, and the velocity would be maintained at 0.5 feet per sec. EPA is interested in knowing what size openings are on the screens and whether any chemicals will be used to inhibit marine growth on the intake structures.*	**Response 3.7.2.1-5** The concept plans for the RWI calls for a mesh diameter that would be approximately 0.5 inches (1.3 centimeters). See section 3.7.2.2.2. DOE does not plan to use biocides to inhibit marine growth on RWI structures at this time. As stated in section 3.7.2.2.2 of the EIS, DOE would coordinate with the appropriate state and Federal agencies during the Section 404/401 process for the selected alternative. DOE would refine the concept plan for the RWI to meet any conditions required by the resource agencies for the RWI to ensure protection of aquatic resources. See response 3.6.2.2-1 for a discussion on the effects resulting from the raw water withdrawal and RWI design.
Comment D0078-1 (DOI) *The DOI brings to DOE's attention the potential significance of impacts to fish and wildlife habitat that would be caused by the expansion and new construction of the SPR sites, associated pipelines, marine terminals, facilities, and other infrastructure, and offers to cooperate with DOE on actions that may help alleviate these concerns. The Draft EIS should consider what compensatory measures may help minimize the unavoidable losses which may occur. The U.S. Fish and Wildlife Service (FWS) is currently working with the DOE to evaluate the extent of the permanent losses that may occur and to develop an appropriate*	**Response 3.7.2.1-6** DOE acknowledges that the draft EIS did not include a detailed compensation plan for wetlands, EFH, and fish and wildlife impacts for each alternative; however, a conceptual compensation plan was included (section 3.7.2.1.3; appendix B, section B.4; and appendix E, section E.5). DOE has expanded on this information in the final EIS by creating appendix O, a more detailed conceptual plan for compensation to wetlands. DOE will continue to work with the USFWS, USACE, EPA, NOAA Fisheries, and other appropriate state and Federal agencies to develop detailed compensation plans for the selected alternative.

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compensation plan; however, we believe this information should be included in the Final EIS before issuance of a Record of Decision (ROD).	DOE welcomes input from regulatory and conservation agencies on means to avoid and minimize the effects that might be caused by the expansion and new construction of the SPR sites, associated pipelines, marine terminals, facilities, and other infrastructure and ways to protect fish and wildlife resources throughout the NEPA and permitting process. A discussion of effects on fish and wildlife resources and proposed mitigation practices is included in chapter 3.7 and appendices B, E, F, G, H, and I of the EIS. Appendix O provides some information on possible mitigation sites that could be used. DOE has not developed a detailed compensation plan for wetlands and EFH impacts for each alternative, nor has it included a comprehensive mitigation plan in the final EIS because developing such plans for each alternative was not practicable. Moreover, the mitigation plan will be developed for the selected alternative after wetlands and waters delineations and jurisdictional determination are completed and a functional assessment of affected wetlands is completed. After that, it will be possible to develop a detailed compensation plan. If an alternative other than the no-action alternative is selected, after the ROD is issued DOE would develop the compensation plan for wetlands and EFH impacts and complete the consultation and coordination on special status species that may be affected (sections 3.7.1.1 and 3.7.1.2) because DOE and other agencies could then focus on a single alternative. DOE would include measures in the mitigation plan to protect and preserve upland forest and coastal habitat to the extent that it would be practical within the compensation plan for effects on wetlands, EFH, and special status species.

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<tr><th>COMMENT</th><th>RESPONSE</th></tr>
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<tr><td>Comment D0078-4 (DOI)
Migratory Bird Concerns:
The DOI is concerned with the impacts on migratory birds caused by the construction of the large storage tanks, the electrical transmission lines, and any other tall structures proposed for the SPR facilities and work associated with the pipeline installation activities. Migratory birds (e.g., waterfowl, shorebirds, passerines, hawks, owls, vultures, falcons) are afforded protection under the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712). To ascertain potential effects, the Final EIS should identify locations and heights of storage tanks, transmission lines, and all tall structures proposed for the project sites. Transmission lines often pose a hazard to migratory birds in flight and can pose a threat to nesting birds attracted to the site; therefore, we recommend the burial of the transmission lines to significantly reduce bird strikes in the area.

Comment D0115-3 (Audubon Society, Houston)
We also share the FWS concerns about the impacts to migratory birds caused by the construction of large storage tanks, the electrical transmission lines and other tall structures. Insufficient information has been provided in the DEIS to determine the potential impacts. We agree with the recommendation that the transmission lines need to be buried to avoid bird strikes. We also agree that documented bird rookeries and colonial waterbird nesting sites must be left undisturbed, and a monitoring plan documenting this must be developed.</td><td>Response 3.7.2.1-7
DOE considered the effects on migratory birds in section 3.7.2.2 and in each description of site-specific effects in section 3.7. DOE would follow the voluntary guidelines developed by Edison Electric Institute's Avian Power Line Interaction Committee to reduce hazards to migratory birds (section 3.7.2.2.3). At the proposed Stratton Ridge site, DOE would bury transmission lines to avoid harm to migratory birds in and around Brazoria National Wildlife Reserve as stated in section 3.7.6.2.2.

Power lines would be 75 feet (23 meters) tall (see section 3.7.2.1). The exact heights of transmission lines, storage tanks, and other tall buildings at proposed sites have not been determined because designs are still in the conceptual stage. During the development of designs for the selected alternative, DOE would continue consultation with USFWS to minimize or avoid impacts to migratory birds.</td></tr>
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Comment D0078-6 (DOI) *Previous pipeline projects have used bright lighting on associated above-ground pipeline structures such as meter stations, compressor stations, connection stations, main line valve stations, and other small facilities associated with the pipeline projects. The SPR water intake structure may be an example of this type of small above-ground facility. We recommend all bright lighting associated with these above-ground structures be down-shielded to significantly reduce disturbance to resident and migratory birds and other resident wildlife. In addition, security lighting for on-ground facilities and equipment, such as storage tanks, should be downshielded to keep light within the boundaries of the site.*	**Response 3.7.2.1-8** As stated in section 3.7.2.2.1, DOE would use downshielded lights and low mast lighting where possible to minimize the visual and disturbance to birds and wildlife.
Comment D0078-11 (DOI) *Depending upon their configuration, electrical transmission lines can present electrocution hazards to raptors and other birds protected under the Migratory Bird Treaty Act. According to the Draft EIS, the proposed electrical transmission lines would be spaced wider than the largest local raptor's wingspan. DOE would also follow guidelines recommended by the Edison Electric Institute's Avian Power Line Interaction Committee (APLIC). The FWS, in cooperation with the APLIC, released those voluntary guidelines designed to help electrical utilities protect and conserve migratory birds, and we fully support the implementation of those guidelines to reduce bird mortality.*	**Response 3.7.2.1-9** As stated in section 3.7.2.2.3, DOE would follow these guidelines for transmission lines to reduce the risk of bird mortality. See response 3.7.2.1-4 above for more details on this issue.
Comment D0078-14 (DOI) *The Draft EIS should more thoroughly address several important issues involving the reduction of impacts and protection of fish and wildlife resources. We offer to assist you in developing conservation features to be incorporated into the project plans to further reduce impacts. The*	**Response 3.7.2.1-10** The analysis of impacts to fish and wildlife resources and a plan for compensation are described in response 3.7.2.1-3. DOE looks forward to continued coordination with USFWS.

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Final EIS should contain a comprehensive mitigation plan to compensate for the cumulative loss of the coastal habitats and forested areas found along the proposed project facilities and pipeline. These issues should be addressed before the Final EIS is approved or a ROD is issued. *Commen D0115-1 (Audubon Society, Houston)* *This letter is submitted on behalf of the Houston Audubon Society, 440 Wilchester Blvd., Houston Texas 77079. Our mission is to promote the conservation and appreciation of birds and wildlife habitat. Accordingly, we share the concerns of the U.S. Fish and Wildlife Service (FWS) with regard to the Draft Environmental Impact Statement (DEIS) for the site selection for the expansion of the Strategic Petroleum Reserve in Texas. Houston Audubon concurs with the letter submitted by Stephen Spencer, Regional Environmental Officer, Department of the Interior dated July 7, 2006. We specifically agree with comments made concerning the potential habitat loss and detrimental effects on wildlife at the proposed Stratton Ridge Strategic Petroleum Reserve expansion site.*	**[See response 3.7.2.1-10 above]**
Comment D0106-18 (USFWS) *Page 3-193, paragraphs 3 and 4. These paragraphs present the findings of several studies regarding the effects of brine discharges in marine environments at existing sites. It is concluded that brine discharges were having "no significant biological impacts." However, it was stated that researchers found that fish avoided the brine discharge areas, a decrease in abundance of benthic organisms was found within 31 to 2,000 acres of the brine diffusers, and shrimp species would avoid the discharge areas. These findings indicate that the brine*	**Response 3.7.2.1-11** As noted in section 3.7.2.1.4 and appendix E, DOE analyzed and reported impacts on biological resources from brine discharge by examining the result of relevant studies (i.e., DOE 1992a; DOT 1976 V.2; Barry A. Vittor & Associates 2002) and conducting DOE's own analysis by modeling the predicted size and concentration of the brine plume when brine is released during cavern development (appendix C). For example, the modeling indicated that the maximum increase in salinity would be approximately 4.3 parts per thousand, using conservative assumptions. This increase in salinity is usually within the

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discharges have a significant impact on biological resources.	typical range of salinity. Previous analyses examining the effect of brine disposal on fish have shown that some brine contaminants can be present at slightly elevated levels around the diffusers, but that fish populations do not suffer significant adverse effects because fish are mobile and contaminant concentrations are low and below established water quality standards (Hann et al. 1984; see appendix E and below for established water quality standards). Construction, operations, and maintenance of the brine diffuser would affect EFH and benthic organisms (appendix E); however, these effects would be limited to the area surrounding the diffuser. For example, previous studies examining the effect of brine diffusion on benthic biodiversity at the West Hackberry and Bryan Mound diffusion sites indicated a localized reduction in benthic biomass within a range of 656 to 6,889 feet (200 to 2,100 meters) from the diffusers during operation of the discharge (Hann et al. 1984; see appendix E, section E.5). These effects generally persist for a short period after the discharge terminates. Recovery of the macroinvertebrate and fish community could be expected. See responses 3.7.2-1 and 3.7.2.1-1 and response 3.6.5.1-1 for more information.
Comment D0106-19 (USFWS) *Page 3-195, Raw Water Intake Structure, paragraph 1, lines 13 through 16. The DEIS states that studies have shown that large volume water intake structures can impinge and entrain thousands of fish during the course of the year, but effective traveling screens and bypass systems can ensure a survival rate of 80 to 90 percent of the impinged fish. We fail to see how the traveling screens and bypasses would work to ensure the survival of up to 90 percent of the impinged fish. Impingement, especially for the small fish, would be expected to result in death. The*	**Response 3.7.2.1-12** DOE cites a reference paper (Henderson and Seaby 2000) in section 3.7.2.2.2 that describes the effects of RWIs and an 80- to 90-percent survival rate for impinged fish at existing RWIs, many of which are associated with power plants. DOE acknowledged in section 3.7.2.2.2 that “the severity of the impact from impingement and entrainment due to large volume intakes depends on the site-specific conditions at the intake site, the composition and life history of aquatic species, and whether those species disperse eggs in the water column or lay eggs in a

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Service requests further elaboration to understand how the traveling screens and bypass systems would be expected to result in such a high survival rate for impinged fish. A drawing of a typical traveling screen and bypass system in the technical appendices would also be helpful.	nest," and it states that entrained organisms would be lost (see 3.7.2.2.2, 3.7.3.2.3, and 3.7.4.2.3). DOE developed a conceptual design for the RWI structure, discussed in EIS section 2.3.2. Its design features include a traveling screen, escape route, 0.5 foot per second (0.15 meters per second) intake velocity, and 0.5-inches (1.3-centimeters) mesh diameter on the intake screen. In the final EIS, DOE modified the conceptual design from that presented in the draft EIS for the RWI on Mississippi River for the Bruinsburg site and the RWI on the Leaf River for the Richton site, the only two RWIs on naturally flowing rivers. The modified RWIs are designed to reduce potential effects on aquatic resources by proposing a series of cylindrical screens located in the stream channel that would be oriented parallel to the river flow (see sections 2.4.1 and 2.4.3 and figure 2.4.3-3). This conceptual plan is typically recommended for river intakes because it uses the river flow to create a sweeping velocity across the screen surface to minimize the likelihood of impingement of organisms (Gowan et al. 1999). The screens would be fitted with air back flow systems to reduce clogging and reduce the likelihood of impingement of organisms. In addition, the intake system would be constructed within a cofferdam to minimize the potential for water quality impacts during construction. DOE also modified the final EIS by proposing a RWI in Pascagoula for the Richton alternatives. This RWI was added to reduce DOE's dependence on the Leaf River, which can have variable flow and provides habitat for endangered species (see 3.6.5.1.2 and responses 3.6.2.2-1 and 3.7.4.1-2). If one of the Richton alternatives is selected, DOE would use a similar RWI conceptual plan for the RWI structure in

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[See comment D0106-19 text above]	Pascagoula, as that described for the RWI structure associated with the Chacahoula and Stratton Ridge alternatives (see section 2.4.3 and figure 2.4.3-4). In section 3.7.2.2.2, DOE addressed the effects of the RWI on aquatic resources and included mitigation measures to protect those resources. DOE would continue to coordinate with the USFWS, NOAA Fisheries, and state agencies responsible for fish and aquatic resources to incorporate their recommendations into the design of the RWI (where feasible) during the Section 404/401 permit process. Final designs for the traveling screen and bypass systems would be based on permit requirements and specific conditions onsite.
Comment D0106-20 (USFWS) *Page 3-245, paragraph 2, last line. The sentence states that darters along with a host of fish species "adapt well to changes in the environment." The document should explain how darters adapt well to changes in the environment. Darters are freshwater species that are very sensitive to changes in their environment such as head cutting, increase in sedimentation, and changes in water quality.*	**Response 3.7.2.1-13** In section 3.7.5.1.2, DOE intended to state that *common* freshwater species are often not sensitive to changes in the environment. DOE included darters in this statement because some species of darters are abundant and considered common species. It was not DOE's intention for the statement to suggest that all species of darters are common. The pearl darter is a Federal candidate species, and it is identified as such in section 3.7.5.1.3 and section 3.7.5.1.4. The EIS states that the pearl darter is very sensitive to slight changes in the environment such as increased turbidity or changes to habitat from head cutting (section 3.7.5.2.3). Because the pearl darter is relatively rare and sensitive to changes in the environment, DOE determined that construction of the RWI on the Leaf River for the Richton site (section 3.7.5.2.3) and conventional construction of pipelines (section 3.7.5.2.2) would affect the pearl darter and that the operation of the RWI on the Leaf River

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[See comment D0106-20 text above]	may have an adverse effect on the species.

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Comment D0013-9 (Gulf Restoration Network) *The authors of the DEIS admit that some "wildlife would be killed or displaced to surrounding areas during construction at the Stratton Ridge." Due to the fact that forested wetland habitat is uncommon in the area, some wildlife species may be unable to find suitable habitat, including migrating neo-tropical birds that use palustrine forested wetlands as stopover habitat. Reduction in the quantity of forested habitat available to these birds would add to the stress of annual migration (DEIS at p. 3-266). In short, selection of this site would result in potential irretrievable injury to increasingly rare forested wetland habitats in the area and the bird species dependent upon those habitats, and will potentially undermine the purposes of an established NWR.*	**Response 3.7.2.2-1** DOE addresses the impacts to forested wetlands, migratory birds, and the pipeline through the Brazoria National Wildlife Refuge in the EIS (section 3.7.6.2.2). DOE acknowledges that it would coordinate with the USFWS and Brazoria National Wildlife Refuge for the easements for the pipeline, and it would continue to incorporate reasonable measures to protect important resources in the Brazoria National Wildlife Refuge. The EIS also describes the forested wetlands from this site and recognizes the "important ecological resource" they represent for the region (section 3.7.6.2.1).
Comment D0106-30 (USFWS) *The Bruinsburg alternative as planned would also result in significant impacts to fish and wildlife resources.*	**Response 3.7.2.2-2** DOE acknowledges this comment, and in section 3.7.3 describes the impacts to fish and wildlife resources by the proposed Bruinsburg site.

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Comment D0005-2 (Louisiana Department of Environmental Quality) *The Office of Environmental Services recommends that you investigate the following requirements that may influence your proposed project: […]* *5. If any of the proposed work is located in wetlands or other areas subject to the jurisdiction of the U.S. Army Corps of Engineers, you should contact the Corps to inquire about the possible necessity for permits. If a Corps permit is required, part of the application process may involve a Water Quality Certification from LDEQ, observed to control nonpoint source pollution from construction activities.*	**Response 3.7.3.1-1** As discussed in the EIS, DOE would apply for all required permits from the USACE and appropriate state agencies such as LDEQ for construction of RWI, ROWs, onsite facilities, and for RWI withdrawal (section 3.6.2.1.1). DOE has met with the USACE to discuss permitting issues. DOE would apply for Louisiana Pollutant Discharge Elimination (LPDES) permits for any discharges resulting from construction activities. In addition, Clean Water Act Section 404/401 permits for all impacts to waters including wetlands, a LPDES discharge permit, and possibly a Rivers and Harbors Act of 1899 Section 10 permit for potential impacts to navigable waterways would be obtained from USACE and the State for construction of the diffuser and brine diffuser pipeline and for brine diffuser discharge (section 3.6.2).
Comment D0077-27 (EPA Region 6) *Section 2.2.3: The FEIS should identify a preferred alternative without relegating avoidance, minimization and mitigation of wetlands to a later decision via the Section 404 process.*	**Response 3.7.3.1-2** In the final EIS, DOE has designated the Richton alternative with three expansion sites as the preferred alternative. As stated in section 3.7.2.1.3; appendix B, section B.4; and appendix E, section E.5, and appendix O of the EIS, DOE has included a detailed discussion of avoidance and minimization measures and a conceptual plan for compensation to waters of the United States, including wetlands. In sections 3.7 and B.7 of the EIS, DOE describes how additional avoidance and minimization measures would continue as design proceeds for the selected alternative, which DOE will announce in the Record of Decision. For example, DOE would evaluate the practicability of directional drilling under wetlands and stream crossings greater than 100 feet (30 meters) (see section 2.3.8). Site-specific analysis of each possible crossing would be part of the design and permitting for the selected alternative.

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[See comment D0077-27 text above]	A discussion of avoidance, is covered in minimization, and compensation for impacts to wetlands, in response 3.7.2.1-3.
Comment D0077-29 (EPA Region 6) *Appendix B.4: The DEIS states that DOE would prepare a compensation plan and submit it with the application (404 permit). EPA recommends that a preference be made by DOE to look first for restoration opportunities where possible. Restoration of wetlands such as reforestation of prior converted cropland along with restoration of hydrology would more likely result in successful mitigation and would help meet the Administration's "No-Net-Loss" Policy.*	**Response 3.7.3.1-3** DOE is interested in pursuing wetlands restoration opportunities for wetlands compensation. If EPA or other agencies have ideas or knowledge about specific restoration opportunities within the watershed of the selected alternative, DOE would appreciate such information. DOE will also seek information on specific restoration opportunities from USACE, USFWS, state agencies, and NOAA Fisheries.
Comment D0077-30 (EPA Region 6) *Section 3.7.2.1.1: Page 186, paragraph 4, states that "only wetlands regulated under Section 404 and 401 of the Clean Water Act would be delineated." NEPA has a broader reach than Section 404 of the Clean Water, accordingly, EPA recommends that DOE more fully and accurately account for project impacts to the environment by delineating all wetlands and potential impacts that may occur as a result of the project. All impacts to aquatic resources should be identified and mitigated for regardless of jurisdictional status. DOE should submit maps showing the extent of all wetlands and differentiate those areas it perceives as jurisdictional and non-jurisdictional for final assessment under Section 404 and 40 1. Wetlands found to be jurisdictional and impacted directly or indirectly by the project would be evaluated according to Section 404 and 401 of the Clean Water Act. Wetlands identified and confirmed to be nonjurisdictional (isolated) should be mitigated for to fully offset project impacts and to comply with the Administration's "No-Net-Loss" and the President's 2004 Earth*	**Response 3.7.3.1-4** DOE acknowledges that wetlands delineations and jurisdictional determinations for each alternative have not been completed for the NEPA process. If DOE selects an alternative other than the no-action alternative, delineations would be completed after the ROD is issued. DOE used National Wetland Inventory data and spot checks in the field to identify wetlands for this EIS, and specifically its wetlands assessment, and described the effects on all mapped wetlands regardless of whether they are jurisdictional. Field-based delineations for all alternatives for the NEPA process are not practicable considering the distances covered by the alternatives (including, for example, the complexity of securing right of access). Consistent with Executive Order 11990, the Administration's "No-Net-Loss," and the President's "Net Gain" goals for the Nation's wetlands, DOE has included measures to avoid and minimize effects on nonjurisdictional and jurisdictional wetlands. Section B.7 of the EIS

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Day Goal of a "Net-Gain" of the Nations Wetlands.	discusses in more detail the avoidance, minimization, and mitigation measures that would be used to reduce, avoid, and compensate for the impacts to wetlands. Appendix O of the EIS describes a conceptual compensation plan for impacts to wetlands. DOE will continue with this strategy as it proceeds with design and permitting for the selected alternative. See also response 3.7.2.1-3.
Comment D0077-31 (EPA Region 6) *Section 3.7.2.1.1: Page 186, last paragraph, states that "The USACE and state agency would review and approve the compensation plan through the Section 404/401 permit process". Section 404 affords both Federal and state resource agencies the opportunity to review and comment on any and all proposed compensatory mitigation plans prior to final approval. EPA recommends that the DEIS statement above be revised to read "Federal and state resource agencies would have the opportunity to review and comment on the proposed mitigation plan prior to final approval."*	**Response 3.7.3.1-5** DOE has revised the statement in the final EIS as suggested.
Comment D0077-32 (EPA Region 6) *Section 4.2.7: Beyond compliance with NEPA and CWA Section 404, there is also a fundamental need to ensure that the proposed project is not inconsistent with Federal and state efforts to restore coastal Louisiana. The Federal and state interest in stemming the rapid loss of Louisiana's coastal wetlands and barrier islands has lead to a range of ongoing and proposed coastal restoration projects and programs. These include projects developed under the Coastal Wetlands, Planning, Protection and Restoration Act, as well as the proposed Louisiana Coastal Area Ecosystem Restoration Plan, which is currently being considered by Congress for possible authorization within the*	**Response 3.7.3.1-6** DOE considered coastal restoration and hurricane protection projects in the assessment of cumulative impacts to wetlands resources in sections 4.2.2 and 4.2.6 of the EIS. In addition, DOE coordinated with the USACE and many state agencies prior to issuance of the EIS. DOE did not identify a conflict between its proposed actions in Louisiana and the goals or projects developed by these coastal restoration and hurricane protection projects. With regard to Louisiana, development of the proposed site at Chacahoula would have significant impact to Louisiana’s coastal

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Water Resources Development Act. Most recently, the Corps of Engineers and state of Louisiana have embarked on an ambitious effort to produce a plan that would increase hurricane protection in coastal Louisiana through structural measures such as levees and non-structural measures such as coastal restoration and protection. *The aforementioned Federal investments in coastal restoration are motivated in part by the recognition that past and ongoing loss of Louisiana's coastal wetlands and barrier islands puts vital energy infrastructure at increasing risk from storm damage. In this way, coastal restoration efforts can be considered part of an overall strategy to provide secure and reliable energy for the nation's economy. Rigorous efforts to avoid and minimize adverse wetland impacts from the proposed project will help ensure that it is not in conflict with the Federal interest in these coastal restoration efforts, including the shared goal of energy security. Moreover, the project sponsor should also ensure that there is no conflict with any specific coastal restoration projects that may be in the vicinity of the various alternatives under consideration.*	wetlands. DOE would avoid and minimize potential impacts to these wetlands by minimizing the proposed storage site's footprint and co-locating the proposed pipeline along existing utility ROWs to the maximum extent possible. Wetlands impacts and avoidance and minimization steps proposed for the Chacahoula site are discussed in appendices B and O of the EIS. If one of the Chacahoula alternatives is selected, DOE would continue consultation with EPA, USACE, USFWS, and state and local agencies to avoid or minimize impacts to these projects and important wetlands and coastal resources.
Comment D0078-9 (DOI) *Compensatory Mitigation Recommendations:* *After all alternatives are considered and wetland impacts are deemed unavoidable, compensatory mitigation for unavoidable wetlands losses should be considered. Compensatory mitigation plans should be developed in order to significantly reduce impacts to fish and wildlife habitats. Once final sites are chosen, the FWS will provide recommendations to reduce impacts to fish and wildlife habitats.* *Pipeline construction activities through emergent marsh habitats will*	**Response 3.7.3.1-7** DOE looks forward to further coordination during the permit process and to receiving recommendations on the compensation plan for impacts to wetlands and waters of the United States. DOE has stated its intent to conduct pipeline corridor monitoring after construction is complete as stated in section 3.7.2.2.3. DOE would follow all monitoring conditions that are established in the Section 404/401 permitting process and in consultation with natural resource agencies. DOE acknowledges in the EIS that compensatory mitigation ratios for impacts to jurisdictional waters (including wetlands) would consider the functions and value of the impacted wetlands if required by the Section

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be considered temporary if the attached USACE pipeline monitoring conditions are incorporated into final project plans. Any impacts to forested wetland areas are considered permanent and the FWS recommends compensation by the preservation or enhancement of forested wetlands within the same watershed. Compensatory mitigation ratios will be dependent upon the condition and value of habitats proposed to be impacted. *Comment D0115-5 (Audubon Society, Houston)* *We believe that several issues relevant to our mission are outstanding in this DEIS including a mitigation plan that compensates for the loss of coastal habitats and forested areas. We urge the DOE to work with the FWS to ensure that adequate mitigation is provided.*	404/401 permitting process (as stated in section 3.7.2.1.3).
Comment D0078-13 (DOI) *According to the Draft EIS, once the DOE selects an alternative, a wetland delineation of the selected sites would be conducted and approved by the appropriate USACE District. The DOE would then submit an application to initiate the Section 404 of the Clean Water Act permitting process, and the proposed project would be evaluated to avoid and minimize impacts to jurisdictional wetlands.* *Compensatory mitigation will also be required to fully offset remaining unavoidable project-related wetland habitat losses. Such mitigation should be designed in consultation with the USACE, the FWS, and other interested natural resource agencies, and should be implemented prior to, or concurrently with, project implementation. To minimize impacts to emergent and forested 'wetlands', the FWS recommends that the horizontal directional drilling method be used at all major stream and/or river crossings (including adjacent floodplains), as well as at*	**Response 3.7.3.1-8** DOE proposes in the EIS to use horizontal directional drilling at all major stream and river crossings, wetlands crossings greater than 100 feet (30 meters), and across beaches where practicable as described in section 3.7.2.1.2 and section 2.3.9. DOE will work with USACE, USFWS, and other appropriate resource agencies to develop a wetlands compensatory mitigation plan during Section 404/401 permitting for the selected alternative.

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coastline interfaces (i.e., beachfronts), and that the construction ROWS through such areas be minimized as much as practicable for safe working conditions. Should a Louisiana site be chosen as the preferred alternative, the FWS looks forward to working with the DOE and the USACE to develop measures to avoid, minimize, and mitigate wetland impacts as much as possible.	**[See response 3.7.3.1-8 above]**
Comment D0080-1 (Louisiana Department of Environmental Quality) *According to the DEIS, for all filling and permanent conversion of wetlands the Department of Energy would complete a wetland delineation, secure a jurisdictional determination, and secure Clean Water Act Section 404/401 permits from the U.S. Army Corps of Engineers (USACE). LDWF requests that a USACE jurisdictional wetland determination be conducted at each alternative SPR site in order to verify/quantify the wetland impacts associated with each site.* *LDWF is concerned about the direct impact of the proposed SPR expansion on wetlands and inshore and offshore fishery resources of Louisiana. If need can be established, actions must be taken to avoid and/or minimize adverse impacts to fish and wildlife resources. Those actions and other measures designed to fully compensate for unavoidable wetland impacts must be addressed in a mitigation plan and approved by USACE, LDWF, and other interested natural resource agencies.* *To minimize impacts to wetlands, LDWF recommends that horizontal directional drilling be used at all perennial stream crossings (to include adjacent riparian wetlands) and at coastline interfaces. Also, construction right-of-ways through wetlands need to be minimized as much as practicable.*	**Response 3.7.3.1-9** DOE acknowledges that it has not completed wetlands delineations and jurisdictional determinations for each alternative for the NEPA process, but would complete delineations after selecting an alternative, if an alternative other than the no-action alternative is selected. As explained in section 3.7.2.1.1 and section 3.7.2.1.3 of the EIS, DOE used a consistent approach to identify effects on both jurisdictional wetlands and nonjurisdictional wetlands. DOE used National Wetland Inventory data and spot checks in the field to identify wetlands for this EIS and described the impacts to all mapped wetlands regardless of whether they are jurisdictional. Field-based delineations for all alternatives for the NEPA process are not practicable considering the distances covered by the alternatives and the complexity of securing right of access. DOE acknowledges the concern the Louisiana Department of Environmental Quality has about effects on wetlands and inshore and offshore fisheries of Louisiana, and DOE commits to avoiding adverse impacts and protecting these resources to the extent practicable. DOE looks forward to working with the LA Department of Wildlife and Fisheries to develop a compensation plan for impacts to wetlands, waters of the United States, and EFH. As stated in appendix B, section B.7.4 of the EIS, DOE intends to use

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[See comment D0080-1 text above]	directional drilling under larger stream and wetlands crossings and sensitive coastline interfaces where practical and feasible. DOE also identifies measures to avoid and minimize wetlands impacts along the proposed ROWs by using existing corridors as much as possible, restoring the pre-existing contours, reestablishing the native plant community, and monitoring the postconstruction conditions. DOE will continue with these strategies as the design and permitting proceed for the selected alternative.
Comment D0081-11 (NPS, Gulf Islands National Seashore) *The DEIS states in numerous places that analysis of impacts to certain biological resources would not be covered in the DEIS because additional assessments are required under Sections 401 and 404 of the Clean Water Act and several Executive Orders. A statement from DOE that it plans to obtain the necessary permits is not adequate to stipulate that sufficient analysis has been conducted. In order to evaluate this proposal fully, detailed information pertaining to these resources must be made available. Until these additional assessments are completed, a full evaluation of the DEIS is not possible.*	**Response 3.7.3.1-10** The EIS assessed and disclosed the potential effects on biological resources. DOE acknowledges that the EIS stated that additional analysis of the avoidance and minimization of impacts to resources would occur during the Section 404/401 permitting process for the selected alternative because site-specific and design information would be available at that stage that is not currently available. The EIS provided a comprehensive analysis of the effects on biological resources based on conceptual plans. For example, the EIS analyzed a conservative footprint or limits of construction for the site storage area, ROW, RWI, and tank farms. As engineering design proceeds for the selected alternative, DOE will develop more detailed information such as proposed fill dimensions, elevations of roadways and well pads, site-specific feasibility analysis of directional drilling, and culvert size and type. This more detailed information would allow further analysis of avoidance and minimization measures. This multistage process of analyzing avoidance and minimization is typical of most projects that transition from the proposal stage to permitting and implementation because the more detailed design information needed for these analyses is available only at later project stages. See response 3.7.2.1-3.

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Comment D0106-1 (USFWS) *The DEIS provides, in general, a good discussion of impacts to fish and wildlife resources in Mississippi. However, there are several inadequacies and omissions that should be addressed in the document. These inadequacies and omissions deal with disagreements regarding the severity of the impacts. The document only mentions mitigation for jurisdictional wetlands. The National Environmental Policy Act (NEPA), E.O. 11990, our mitigation policy, and the Fish and Wildlife Coordination Act require that non jurisdictional wetlands of high value to our trust resources be also adequately mitigated.*	**Response 3.7.3.1-11** Consistent with Executive Order 11990, the Administration's "No-Net-Loss" and the President's "Net Gain" goals for the Nation's wetlands, DOE has included measures to avoid and minimize effects on nonjurisdictional and jurisdictional wetlands. Section B.7 of the EIS discusses in more detail the avoidance, minimization, and mitigation measures that would be used to reduce, avoid, and compensate for the impacts to wetlands. Appendix O of the EIS describes a conceptual compensation plan for impacts to wetlands. DOE will continue with the avoidance and minimization strategy as the design and permitting proceed for the selected alternative. DOE looks forward to input from the resource agencies as the detailed compensation plan is developed.
Comment D0106-8 (USFWS) *Page 2-72, Table 2.8-3: Impacts to Wetlands. This table provides an estimation of wetland acres filled and permanently converted by construction of the storage and expansion sites and ancillary facilities. It also estimates the acres of wetlands within the temporary and permanent easement for the project rights-of-ways (ROWs). The table should also give estimated acres for wetlands filled and permanently converted in the temporary and permanent ROWs. This information would be necessary to adequately assess impacts of the proposed alternatives.*	**Response 3.7.3.1-12** Table 2.8-3 summarizes wetlands affected by each alternative. As described in section 2.3.9, no wetlands would be filled within a pipeline ROW. All wetlands within the permanent easement would be converted to as emergent or open water wetlands. Permanent conversion includes clearing forested and scrub-shrub wetlands, which would be permanently converted to emergent wetlands. Emergent wetlands would be allowed to re-establish, but periodic clearing and maintenance would be performed to prevent trees and shrubs from growing. Wetlands within the temporary construction easement would be restored or converted to emergent or open water wetlands in accordance with Section 404/401 permit requirements. Temporary conversion includes clearing forested and scrub-shrub wetlands, which would be converted to emergent wetlands. Emergent wetlands would be allowed to re-establish and DOE would restore original contours, replace the

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[See comment D0106-8 text above]	original hydric topsoil back in the disturbed area (where practical) and seed with native species. Re-establishment of scrub-shrub or forested wetlands may take 5 - 25 years depending on the type of wetland affected. DOE discusses pipeline construction techniques within wetlands in section 3.7.2.1.2. Section 3.7 of the EIS discusses the amount of forested wetlands in the proposed ROWs. A full discussion of effects on wetlands for each proposed site is presented in appendix B of the EIS, which also provides details about effects on different types of wetlands including the amount of permanent and temporary conversion within the ROW. See tables B.6.1-2, B.6.1-3, B.6.2-2., B.6.2-3, B.6.3-1, B.6.4-3, B.6.5-2, B.6.6-1, and B.6.7-1.
Comment D0106-16 (USFWS) *Page 3-191, paragraph 3, lines 3 through 5. It is stated that unavoidable wetland impacts would be compensated by creating, restoring, and/or preserving wetlands, paying an in-lieu of fee, or buying credits from an approved mitigation bank. We request DOE consider as a mitigation option acquiring in holdings or lands adjacent to Wildlife Management Areas (WMA) and National Wildlife Refuges (NWR). In holdings and adjacent lands are usually areas owned by private landowners. Certain criteria would need to apply including acquisition on a willing seller basis, operation and maintenance costs should be included in the cost, and habitat of in holding should be similar to the wetland habitat lost.*	**Response 3.7.3.1-13** DOE would consider compensating for wetlands impacts at sites adjacent to existing special status areas such as National Wildlife Refuges and Wildlife Management Areas or existing wetlands and coastal restoration projects. DOE welcomes specific recommendations about opportunities and sites that are available for wetlands compensation that fit into broader natural resource preservation and restoration plans.
Comment D0106-23 (USFWS) *Page 3-253, Plants, Wetlands, and Wildlife, Paragraph 2. The Department of Energy discusses at length that, in order to obtain a construction permit and water quality certificate in accordance with the*	**Response 3.7.3.1-14** As noted in the EIS, mitigation plans for wetlands losses will be reviewed by USACE, USFWS, NOAA Fisheries, EPA, and the appropriate state agencies (see section 3.7.2.1.3), and DOE will

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Clean Water Act, they will work with the Corps of Engineers (COE) and Mississippi Department of Environmental Quality (MDEQ) to develop a mitigation plan for the loss of jurisdictional wetlands. The Fish and Wildlife Coordination Act requires that federal agencies consult with the Service when their proposed activities in any waterbodies would result in the loss of fish and wildlife habitat including wetlands. Therefore, the DEIS should state that the mitigation plan for wetland losses will be developed in consultation with the COE, MDEQ, and the FWS.	incorporate their recommendations where feasible.
Comment D0005-1 (Louisiana Department of Environmental Quality) *The Office of Environmental Services recommends that you investigate the following requirements that may influence your proposed project :* *1. If your project results in a discharge to waters of the state, submittal of a Louisiana Pollutant Discharge Elimination System (LPDES) application may be necessary.* *2. If the project results in a discharge of wastewater to an existing wastewater treatment system, that wastewater treatment system may need to modify their LPDES permit before accepting the additional wastewater.* *3. LDEQ has storm water general permits for construction areas equal to or greater than one acre. It is recommended that you contact Aaron Cox at (225) 219- 3092 to determine if your proposed improvements require one of these permits.* *4. All precautions should be observed to control nonpoint source pollution from construction activities.*	**Response 3.7.3.1-15** DOE has consulted with the USACE. Federal requirements for permits from the USACE are addressed in table L-1 of appendix L under Biological Resources (Federal) and in section 3.7 and appendix B of the EIS. The EIS also identified that a Section 401 Water Quality Certification would be required from the appropriate state agency (section 3.7.2.1.1). In the case of a Louisiana site, that agency would be the Louisiana Department of Environmental Quality.

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Comment D0013-6 (Gulf Restoration Network) *Development of the Chacahoula site would require the clearing of 239 acres of cypress-tupelo swamp, and removal of trees from an additional 90 acres. The DEIS notes that the site falls within a large continuous patch of cypress-tupelo wetlands in the area and also indicates that there is an abundance of this habitat in the region (DEIS, p 3-220). The DEIS ignores environmental realities as reflected by the conclusions of a Science Working Group (SWG) empanelled by Governor Blanco (LA).* *It is true that cypress-tupelo swamps were once abundant in coastal Louisiana. These forests were extensively clear-cut early in the last century and extensive parts of Louisiana's Maurepas Basin and other parts of the Deltaic plain where such clear-cutting occurred have witnessed no significant regeneration of cypress trees. In fact, some scientists doubt that cypress swamps can regenerate in the face of rising water levels and the continuing deterioration of wetlands being experienced in coastal Louisiana. Successful sprouting of seeds can take place only during prolonged drought conditions when deep swamps have exposed unsaturated soils, conditions which are not likely today in coastal Louisiana.* *The Governors' SWG scientists have identified three "condition classes" for the coastal wetland forests:* *Class I: Sites with Potential for Natural Regeneration;* *Class II: Sites with the Potential for Artificial Regeneration Only (through use of aggressive reforestation techniques); and* *Class III: Sites with No Potential for either Natural or Artificial*	**Response 3.7.3.2-1** In section 3.7.4.1.1, section 3.7.4.1.2, and appendix B of the EIS, DOE recognizes the importance of forested wetlands habitat at the proposed Chacahoula site and along ROWs. Where wetlands impacts cannot be avoided, DOE would conduct the required wetlands delineations, secure jurisdictional determinations, and then complete and submit the appropriate permit application to USACE, the appropriate state agency responsible for the Section 401 process and appropriate state and Federal resource agencies. Unavoidable wetlands impacts would be compensated for by creating, restoring, or preserving wetlands, paying an in-lieu-of fee, or buying credits from an approved mitigation bank. In the final EIS, DOE has expanded on the conceptual compensation plan by adding appendix O, which describes possible mitigation for Chacahoula and the other candidate sites. DOE recognizes the uniqueness and importance of the cypress swamp at the Chacahoula site and the complexity of compensating for effects on cypress swamp impacts. The draft EIS stated that a functional assessment (and similar classification or categorization such as that developed by the Governor's Science Working Group) would be completed during the Section 404/401 permit process to determine appropriate mitigation for the selected alternative. If one of the Chacahoula alternatives is selected in the ROD, DOE would work with appropriate state and Federal agencies to develop a mitigation plan that compensates for the functions and values of the wetlands that are affected.

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Regeneration *Within the final EIS the DOE must determine the class of Cypress/Tupelo wetlands located on the Chacahoula site. If, as suspected, the Chacahoula site consists of Class III cypress/tupelo swamps. The wetland impacts associated with development of this site will not be mitigable in-kind or in region. If it is found that the forests on the site are a Class II wetlands, the DOE must include within any mitigation plan, an acknowledgement that mitigation will be in-kind requiring aggressive reforestation, to ensure replacement of this dwindling natural resource.*	**[See response 3.7.3.2-1 above]**
Comment D0074-1 (U.S. Army Corp of Engineers) *Based on our June 29th, 2006, meeting, I offer the following points for consideration in the FEIS:* *1. Clarify why the proposed new facility at Clovelly is not technically practicable. There is existing infrastructure, proximity to LOOP and appears compatible with petroleum support function and development trends in the Port Fourchon area. This alternative appears to be one of less environmentally damaging options.*	**Response 3.7.3.2-2** See response to 2.2-1 for a discussion of why a new SPR facility at Clovelly is infeasible and therefore not reasonable.
Comment D0077-28 (EPA Region 6) *The DEIS identifies the Clovelly site as least environmentally damaging to wetlands. Section 404 of the Clean Water Act requires the least damaging practicable alternative be selected. It appears from the information provided by DOE that the proposed Clovelly site plus the expansion of the 3 existing facilities (Bayou Choctaw, Big Hill and West Hackberry) should be selected as the preferred alternative.*	**Response 3.7.3.2-3** DOE has determined that the Clovelly and Clovelly-Bruinsburg alternatives are infeasible and therefore not reasonable. See response 2.2-1 for a description of why DOE reached this conclusion.

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<tr><th>COMMENT</th><th>RESPONSE</th></tr>
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<tr><td>Comment D0078-3 (DOI)
Habitat losses: Permanent impacts caused by the construction of the Stratton Ridge Storage Site and associated infrastructure are approximately 258 acres of rare and ecologically important bottomland hardwood forested wetlands. In addition, 35 acres of deciduous forests, 23 acres of palustrine-emergent wetlands, 12 acres of scrub-shrub, and 45 acres of old field and roads will be impacted. The permanent pipeline Right-of-way (ROW) impacts are estimated to include 373 acres of bottomland hardwood forest, 40 acres of grassland and scrub-shrub, 11 acres of water and emergent wetlands, 124 acres of sand flats and beach habitat, and 140 acres of disturbed or managed land.

The bottomland hardwood forests adjacent to the Brazos, Colorado, and San Bernard Rivers of the upper Texas coast are known regionally as the Columbia Bottomlands. The Columbia Bottomlands extend from the Texas coast, approximately 150 km inland, and include parts of seven counties. It is estimated that the Columbia Bottomlands comprised over 283,000 hectares (ha) at the beginning of the last century. Today, the forest covers about 71,632 ha, and the remaining stands are highly fragmented and continuously lost or degraded through residential and commercial development, overgrazing, timbering, and infestation of invasive plants. Recent studies utilizing Geographic Information Systems suggested a loss of approximately 17 percent between 1979 and 1995.

Bottomland forests adjacent to the Gulf of Mexico provide stopover and staging habitat for Nearctic-Neotropical migrant landbirds. Millions of Nearctic-Neotropical migrant landbirds move through the coastal forests of the Gulf of Mexico during annual migration. The Columbia</td><td>Response 3.7.3.2-4
The EIS states in appendix B that DOE would undertake mitigation measures for effects on wetlands (including bottomland forests) and waters of the United States. The EIS identifies the effects on wetlands from the permanent maintained easement and the temporary construction easement (from forested/scrub shrub wetlands to emergent wetlands, then a return to forested scrub shrub wetlands within 5-25 years) within the ROW (see response 3.7.3.1-12). The EIS states in appendix B that compensation would be required for permanent conversion of forested wetlands within the ROW and for temporary effects on forested wetlands within the construction easement where required by the Section 404/401 permit. DOE stated that the mitigation ratio would be determined based on the wetlands functions and values that were affected by the selected alternative. DOE welcomes input on the wetlands compensation plan, and intends to develop a detailed plan for the selected alternative. DOE will continue to consult with the USFWS to mitigate impacts to fish and wildlife resources, including managed lands.

See response 3.7.2.2-1.</td></tr>
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Bottomlands provides the only expanse of forest adjacent to the Gulf of Mexico in Texas. An estimated 29 million Nearctic-Neotropical migrant landbirds represented by 65-70 species migrate through the Columbia Bottomlands annually. Forest stands in the Columbia Bottomlands provide structural complexity and resources known to be important for sustaining an abundance of forest-dwelling birds. *Mitigation is being offered for the loss of forested wetlands, due to construction of the storage site, at a ratio of 7: 1. This may be adequate and acceptable depending on field evaluations. However, no mitigation is being considered for the loss of the 373 acres of forest proposed to be cleared for the pipeline routes. Insufficient information has been provided describing the quality of the 140 acres of managed land or the 120 acres of sand flat and beach habitat. Therefore, field evaluations and continued coordination is recommended in order for the FWS to determine if these impacts will have an adverse effect on fish and wildlife and their habitats. The FWS believes that additional mitigation will be needed to compensate for the loss of 373 acres of bottomland hardwood forest, impacts to sandflats and beach habitats, and possibly the managed land in the pipeline routes. We look forward to working with DOE in developing a stronger mitigation plan to be included in the Final EIS.* *Comment D0115-2 (Audubon Society, Houston)* *We are particularly concerned with the potential impacts to bird and wildlife habitat and the lack of adequate compensation for the losses that may occur at each Texas site location. Impacts to the Columbia Bottomlands are highly undesirable because of the Neartic- Neotropical birds that migrate through these properties. We agree with the concerns of the FWS that adequate mitigation may not have been offered to*	**[See response 3.7.3.2-4 above]**

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compensate for these losses.	**[See response 3.7.3.2-4 above]**
Comment D0079-5 (Dow Chemical Company) *The Draft EIS notes that developing the Stratton Ridge, TX site would require the most filled wetlands acres at 227, with the next largest potential expansion site only requiring150 acres of filled wetlands. Again, this is something that can be managed, but Dow urges DOE not to under-estimate the advantage to the environment of making a choice that does not maximize the amount of wetlands that would need to be filled.* *The Draft EIS notes that developing the Stratton Ridge, TX site would involve filling and converting some 258 acres of relatively rare and ecologically important bottom hardwood forest. While, as the Draft EIS notes, some of this has been invaded by exotic plants and animals, this is still "relatively rare and ecologically important." Again Dow urges DOE not to under-estimate the advantages of not having government action fill and complete the conversion of this "relative rare and ecologically important" bottom hardwood forest.*	**Response 3.7.3.2-5** See response 3.7.3.2-4.
Comment D0101-2 (David Kohler, Dominion Natural Gas Storage) *And that's the reason why we wanted to come here and have our comments heard, because in the Draft EIS there's a comment in there that really was misdirected, and I want to read it to you. It's on Page S, Paragraph 2 of the Draft Order, and it says, "The Chacahoula alternative, including the Chacahoula storage site and two of the three SPR expansion sites, Bayou Choctaw and West Hackberry, would affect the most acres of wetland of any alternative in the combination with other projects in the same ecosystem. The Clovelly alternative would have the smallest effect the combination with the other projects. Louisiana has lost substantial amounts of wetlands associated with*	**Response 3.7.3.2-6** The analysis presented in the EIS (section 3.7.9) indicates that expansion of the West Hackberry site may affect approximately 5 acres (2 hectares) of palustrine scrub-shrub wetlands. These wetlands are contained within the proposed security buffer and new access road. The proposed security buffer and access road are away from the existing storage caverns and outside of the commenter's property. DOE appreciates the efforts by Dominion on this issue. If DOE selects the Chacahoula alternative with the expansion of West Hackberry, DOE would complete a wetlands delineation and secure a jurisdictional

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agricultural activities, land development, natural land subsidence, erosive forces over the many decades." *Well, our facility happens to sit juxtaposed to the SPR facility. We share a fence line with them. It's 18 feet above sea level, and when Hurricane Rita came through we didn't even have any water in the wells, so we found it kind of difficult to think that there may be a wetland issue, so we actually invited the Corps of Engineers to come out with us. We actually met them today down at the facility just to have a walk-through, because they're the ones that made the comment.* *And I think the reason why the comment was probably made was misconstrued, because we do own some other property that does go out into Black Lake, and I think they misconstrued that the development would go into Black Lake. The three caverns sit up 18 feet above sea level.* *We had them come out, and they said if the DOE pursues the plan that they have outlined in their depiction, said that there would be no need for a wetlands permit and there's no issue. So we wanted to make sure that was made very clear.*	determination from USACE. Also, as described in section 2.2.3, the Chacahoula alternatives consist of constructing the 160-MMB Chacahoula storage site and either expanding Bayou Choctaw, Big Hill, and West Hackberry existing storage sites for a total of 275 MMB, or expanding the Big Hill and Bayou Choctaw facilities for a total 276 MMB of storage. Most of the effects on wetlands in the Chacahoula alternative, including the expansion of West Hackberry, are associated with the proposed new storage site at Chacahoula and the associated infrastructure as described in section 3.7.4.1.
Comment D0106-32 (USFWS) *If the (Bruinsburg) plan is selected as the preferred alternative, the Service recommends the following measures be considered for inclusion in the plan: […]* *5) placing the proposed Jackson tank farm in upland areas to avoid wetland losses. Finally, the DOE should fulfill their obligations under*	**Response 3.7.3.2-7** The Clovelly-Bruinsburg alternatives have been determined to be infeasible and therefore not reasonable (see response 2.2-1), and for this reason is not considered further in the final EIS. Thus, the Jackson tank farm is not part of any reasonable alternative.

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NEPA and the Fish and Wildlife Coordination Act regarding mitigation of fish and wildlife habitat including jurisdictional wetlands as well as non jurisdictional wetlands.	**[See response 3.7.3.2-7 above]**
Comment D0106-11 (USFWS) *Page 2-83, Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative.* *The table discusses that only jurisdictional wetlands will be mitigated because of the importance of wetlands. The Service has determined that non jurisdictional wetlands of shorter hydro periods including forested and emergent wetlands are also of regional importance and recommends that the loss of these areas be mitigated. Our recommendation is in accordance with E.O. ll990, which requires no net loss of wetlands. Our recommendation is also in accordance with NEPA, our mitigation policy, and the Fish and Wildlife Coordination Act.*	**Response 3.7.3.2-8** See responses 3.7.3.1-9 and 3.7.3.1-11.
Comment D0102-1 (Sybil Guidry, individual) *I'm a resident of Terrebonne Parish. I'd like to voice my concerns regarding the destruction of wetlands in Chacahoula, the Department of Energy and disappointingly on the recommendation of the State of Louisiana.*	**Response 3.7.3.2-9** Comment noted.
Comment D0113-1 (Sierra Club, Houston Regional Group) *1) The HSC is appalled that the DOE has no wetlands delineation to document the potential damage. The wetlands delineation for the Stratton Ridge site is needed to create an adequate mitigation plan. This DEJS should be withdrawn or supplemented with a new public comment period when the DOE conducts a wetlands delineation and the Corps of Engineers verifies its accuracy. The public and decision-*	**Response 3.7.3.2-10** DOE acknowledges that it has not completed wetlands delineations and jurisdictional determinations for each alternative, but would complete delineations after selecting an alternative, if any alternative other than the no-action alternative is selected. DOE used National Wetland Inventory data and spot checks in the field to identify wetlands for this EIS and wetlands assessment, and described the effects on all mapped

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makers need the wetlands delineation in the DEIS to review, comment on, and understand the full environmental impacts of the SPRE. *2) The HSC requests that a 3O:l compensation ratio (in acres) be assigned to any Columbia Bottomlands that are destroyed or damaged by the proposed SPRE. This means that the reported 258 acre loss of Columbia Bottomlands would be mitigated with compensation that results in land acquisition, protection, and management of 2,580 acres of Columbia Bottomlands forested wetlands. The HSC recommends that an amount of money that will buy 2,580 acres of Columbia Bottomlands forested wetlands be earmarked and given to the U.S. Fish & Wildlife Service for the acquisition of this compensation land.* *An EIS is not complete unless it contains "a reasonably complete discussion of possible mitigation measures." Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 352. 109 S.Ct. 1835, 104 L.Ed.2d 351 (1989). (" ..omission of a reasonably complete discussion of possible mitigation measures would undermine the "action-forcing" function of NEPA. Without such a discussion, neither the agency nor other interested groups and individuals can properly evaluate the severity of the adverse effects.") That requirement is implicit in NEPA's demand that an EIS must discuss " 'any adverse environmental effects which cannot be avoided should the proposal be implemented.' " /d. at 351-52, 109 S.Ct. 1835 (quoting NEPA, 42 U.S.C. § 4332(C)(ii)); see also 40 C.F.R. § 1502.16(h) (stating that an EIS must contain "[m]eans to mitigate adverse environmental impacts").* *A "mitigated FONSI" is upheld when the mitigation measures significantly compensate for a proposed action's adverse environmental*	wetlands regardless of whether they are jurisdictional. Field-based delineations for all alternatives for the NEPA process are not practicable considering the distances covered by the alternatives, and the complexity of securing right of access. When DOE was planning field studies, the selected type of field studies were based on a congressionally mandated project schedule. DOE would coordinate with state and Federal resource and permitting agencies when it develops the detailed wetlands compensation plan after an alternative has been selected. DOE would consider an in-lieu-of fee for wetlands impacts if those agencies and DOE determine it is appropriate compensation. See also response 3.7.3.1-7.

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impacts. Friends of Endangered Species, Inc. v. Jantzen. 760 F.2d 976, 987 (9th Cir. 1985); Greenpeace Action, 14 F.3d at 1332-33. See also City of Auburn, 154 F.3d at 1033 (agency may condition its decision not to prepare a full EIS on adoption of mitigation measures). However, although mitigation measures need not completely compensate for adverse environmental impacts, Friends of the Payatte v. Horseshoe Bend Hydroelectric Co., 988 F.2d 989, 993 (9th Cir.1993), the agency must analyze mitigation measures in detail and explain how effective the measures would be. Northwest Indian Cemetery Protective Ass'n v. Peterson, 795 F.2d 688, 697 (9th Cir.1986), rev'd on other grounds, Lyng v. Northwest Indian Cemetery Protective Ass'n, 485 U.S. 439, 108 S.Ct 131 9, 99 L.Ed.2d 534 (1988). "A mere listing of mitigation measures is insufficient to qualify as the reasoned discussion required by NEPA." Id. Instead, mitigation measures should be supported by analytical data, Idaho Spotting Congress v. Thomas, 137 F.3d 1146, 11 51 (9th Cir.1998), even if that data is not based on the best scientific methodology available. Greenpeace Action. 14 F.3d at 1333. The general invocation of a term like "Best Management Practices" does not satisfy the NEPA requirement that the analysis discuss measures to mitigate the proposed action's adverse environmental impacts. Northwest Indian Cemetery Protective Ass'n v. Peterson. 565 F.Supp. 586(D.C.Cal., 1983) *In other words, the applicable regulations require that a DEIS discuss means to mitigate adverse environmental impacts of the proposed action. Those mitigation measures must be analyzed in detail and must explain, in detail, how effective they will be in mitigating any adverse environmental impacts. Without analytical data to support the proposed mitigation measures they amount to nothing more than a "mere listing" of good management practices. A mere listing of mitigation measures is*	**[See response 3.7.3.2-10 above]**

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insufficient to qualify as the reasoned discussion required by NEPA. Simply pointing out, for instance, that BMPs will be followed is not an adequate discussion of means to mitigate adverse environmental impacts *The DEIS does not analyze any mitigation measures in detail or explain how effective these measures would be. This could hardly qualify as a detailed analysis.* *The DEIS does not adequately analyze mitigation measures in detail and lacks an explanation of how these measures would be effective for this particular project. The mitigation measures are not supported by any site-specific analytical data. Therefore the DEIS violates NEPA. Without this analysis and a showing that the mitigation measures will be effective at averting significant environmental effects the DEIS is deficient.*	**[See response 3.7.3.2-10 above]**
Comment D0116-1 (Texas Parks and Wildlife Department) *All wetland impacts at the Stratton Ridge site should be mitigated within the Austin's Woods (Columbia Bottomlands) region of Southeastern Texas. The Austin's Woods, the southern most extensive forest in Texas, is recognized as being a nationally important stopover and resting area for spring and fall neo-tropical migrant song birds. It is estimated that approximately 29,000,000 migrant land birds of 65-70 species migrate through these bottomlands. Impacts to these forested should be minimized to the greatest extent practicable. All forested wetland impacts should be compensated at a 7:1 wetland preservation ratio. Opportunities exist for forested wetland preservation through the San Bernard National Wildlife Refuge. All forested wetlands cleared and maintained for permanent pipeline right-of-way are permanent*	**Response 3.7.3.2-11** In section 3.7.6 of the EIS, DOE acknowledges that the Stratton Ridge alternatives could have effects on Brazoria National Wildlife Refuge. Appendix O of the EIS provides some information on possible compensation sites. Following DOE's selection of an alternative in the ROD, DOE will first delineate the wetlands that would be affected at any new and expansion sites, and then it will consult with all relevant resource agencies including Texas Parks and Wildlife Department, USFWS, and the NOAA Fisheries. In these consultations, DOE will take into account the Austin's Woods/Columbia Bottomlands regions of southeastern Texas as a compensation area. DOE will apply appropriate best management practices to reduce effects caused by pre- and post-pipeline construction phrases, and it also will consult with

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wetland losses and should be compensated as above. *The major potential impact regarding the Big Hill site expansion arises from the need to replace the 24 mile long crude oil distribution pipeline between the Big Hill site and refineries in Nederland, Texas. Permanent wetland impacts from pipeline installation has been well documented (Polasek, 1997). Although the proposed pipeline will follow existing ROWS, there will likely be additional wetland impacts from installation. TPWD recommends proposed ROW and work corridors be minimized for all pipeline installation through wetlands and other sensitive habitat.* *All pipeline installation (for both the Stratton Ridge site and the Big Hill Site) corridor should be monitored utilizing the monitoring criteria developed by TPWD, US Fish and Wildlife Service and National Marine Fisheries Service (attached). The wetlands in the vicinity of the Big Hill site are especially vulnerable to permanent impacts from pipeline installation due to the high organic content and compressibility of the soils. Extreme care should be taken to minimize impacts to these wetlands.*	resource agencies on monitoring protocols and conditions. DOE appreciates the Texas Parks and Wildlife Department recommendations concerning the wetland compensation strategy and ratio and a possible location for a wetland compensation site for the impacts to wetlands that would be caused by the Stratton Ridge site alternatives. DOE looks forward to continued coordination with Texas Parks and Wildlife Department and other resource agencies on the wetland compensation plan during the Section 404/401 permitting for the selected alternative. DOE also would coordinate with the permitting and resource agencies to determine appropriate compensation for the effects on wetlands resulting from the ROWs for the selected alternative. Section 3.7.10 and appendix B of the EIS describe the effects on wetlands, special status species and special status areas that would occur from the ROWs for the proposed Big Hill expansion. DOE described the proposed measures that would be used to avoid and minimize effects on wetlands and other sensitive habitat. After selecting an alternative in the ROD, DOE will continue to coordinate with TPWD and other resource agencies to further avoid and minimize impacts to biological resources. For example, see response 3.7.3.1-2. In addition, DOE has committed to monitoring the pipeline corridors after construction is completed using protocols that are established by the Section 404/401 permitting process (section 3.7.2.1.2). If the Stratton Ridge site or Big Hill expansion are part of the alternative selected in the ROD, DOE will continue to consult with the TPWD and other permitting and resource agencies to develop and implement the postconstruction monitoring program.

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[See comment D0116-1 text above]	See responses 3.6.2.2-4, 3.7.2.1-3, and 3.7.3.2-12.

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Comment D0078-2 (DOI) *Because the DOE is in the process of evaluating potential sites for the expansion of the SPR, a complete analysis of potential impacts to federally threatened and endangered species has not yet been conducted. However, the DOE has issued a document of findings of "no effect" or "may affect" for each species that may occur at each proposed site. Once an alternative is selected, additional investigations will be conducted and Endangered Species Act (ESA) consultations with the FWS will be completed. According to the Draft EIS, the DOE will initiate formal consultation with the FWS should a finding of "may affect" be determined for the selected sites. We look forward to working with the DOE in developing mitigative measures to ensure no adverse affects to federally listed species occur. However, the FWS would be willing to enter into formal consultation should the DOE make that request.*	**Response 3.7.4.1-1** As noted in section 3.7.1.2 of the EIS, after DOE has issued a ROD and selected an alternative for development, DOE will perform site- and species-specific habitat screenings and surveys for all the species that received a finding of "may affect" for the selected alternative. If any part of the selected alternative could adversely affect a listed species, DOE would complete a formal consultation with USFWS or NOAA Fisheries and prepare a Biological Assessment as mandated under Section 7 of the ESA (section 3.7.1.2). DOE looks forward to continued coordination with the USFWS and NOAA Fisheries to ensure no adverse effects occur to federally listed species.
Comment D0106-9 (USFWS) *Page 2-74, Richton, bullets 3 through 5. These bullets provide a summary of impacts by the Richton alternative to the federally endangered yellow-blotched map turtle and Gulf sturgeon and the pearl darter (candidate species). The impact summary should mention that operation of the raw water intake on the Leaf River would adversely*	**Response 3.7.4.1-2** DOE amended these bullets in section 2.8.6 of the final EIS to include degradation of water quality. DOE acknowledges that withdrawal of water from the Leaf River may result in adverse impacts on water resources (see 3.6.5.1.2) and aquatic

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affect these species through degradation of water quality during low flow periods.	resources, such as endangered species (see 3.7.5.1.2). To reduce DOE's dependence on the Leaf River, DOE has added to the Richton alternatives a RWI structure on Singing River Island in Pascagoula, which would allow DOE to withdraw water from the Gulf of Mexico to reduce withdrawal from the Leaf River during low-flow conditions. If DOE selects one of the Richton alternatives, DOE would develop a Water Conservation Plan for water withdrawal during cavern creation, drawdown, and maintenance. During cavern creation, drawdown, or maintenance, withdrawal from the Leaf River would be used during normal and high-flow conditions. Under low-flow conditions in the Leaf River, the withdrawal would be supplemented by a secondary source, the Pascagoula RWI, which would withdraw water from the Gulf of Mexico. The Pascagoula RWI would be designed to handle about 0.5 MMBD of the total required volume, which is about 1.2 MMBD. During construction or maintenance, when flows in the Leaf River reach the Minimum Instream Flow that is designated by the regulatory agencies to protect special status species, withdrawal from the Leaf River would be reduced or terminated until the Minimum Instream Flow in the Leaf River is reached. During this period, DOE would withdraw water from the Gulf of Mexico. If necessary, DOE would consider possible supplemental sources during Section 7 Consultation with the regulatory agencies, including possible groundwater sources, withdrawals from other surface water bodies, and a possible onsite off-stream reservoir. If low-flow conditions exist in the Leaf River during emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico, and, as necessary to reach the water withdrawal

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[See comment D0106-9 text above]	rate of 1.2 MMBD, from the Leaf River. Operation of the Pascagoula RWI may affect the Gulf sturgeon, which is a federally threatened species, because of impingement and entrainment of sturgeon and its prey (see section 3.7.5.2.3). To further mitigate the impacts of the RWI on the Leaf River, DOE has modified the conceptual design for the RWI on the Leaf River to reduce the potential for impingement and entrainment of aquatic organisms. The revised conceptual plan would use cylindrical screens located in the water column and oriented parallel to the river flow (see section 2.4.3 and figure 2.4.3-3). To minimize the likelihood of entrainment and impingement, this design takes advantage of the sweeping velocity of the river, whereby the velocity of the water flows parallel and adjacent to the RWI screen surface (Gowan et al. 1999). DOE would use a relatively low intake velocity of 0.5 feet per second and relatively small screen size of 0.5 inches to further reduce impingement and entrainment. DOE would refine the conceptual plan for the RWI and water withdrawal during the Section 7 Consultation with the USFWS, NOAA Fisheries, and the Mississippi Natural Heritage Program and coordination with the USACE and MDEQ for the Section 404/401 permit and the water withdrawal permit.
Comment D0078-10 (DOI) *The DOE has determined that the proposed development of the Clovelly site in Lafourche Parish and the expansions of the Bayou Choctaw site in Iberville Parish and the West Hackberry site in Cameron and Calcasieu Parishes would have "no effect" on federally listed species. Those determinations were based on the fact that no new construction would be conducted outside existing facility boundaries. Additionally, no federally listed species are documented within the immediate vicinity*	**Response 3.7.4.1-3** DOE has determined that both the Clovelly and the Clovelly-Bruinsburg alternatives are infeasible and therefore not reasonable. These alternatives have been eliminated from the final EIS as potential alternatives. See response 2.2-1.

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of the proposed sites according to the database maintained by the Louisiana Department of Wildlife and Fisheries. Based on the above information, the FWS concurs with the determination that the proposed activities associated with those alternatives would have no adverse effects on threatened or endangered species. However, should the project not be initiated within 1 year or the scope or location of the proposed activities change, follow-up consultation should be initiated with the FWS as soon as possible.	**[See response 3.7.4.1-3 above]**

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Comment D0007-4 (Elizabeth Waldorf, individual) *Endangered species are protected by federal law. Sturgeon survive in the Pascagoula. Dramatically reducing its flow would put this remnant population of ancient fish at greater risk.*	**Response 3.7.4.2-1** In section 3.7.5.2.3 of the EIS, DOE concludes that withdrawal of water from the Leaf River may have an adverse effect on the Gulf sturgeon. See response 3.7.4.1-2.
Comment D0009-2 (June Havens, individual) *Also the devastating impact on endangered species is unacceptable. The loss of the Leaf River flow into the Pascagoula River could be detrimental to the only unfettered river bed in the area. And with the current drought situation any loss of water is crucial.* *Why would it even be considered since it would violate the Endangered Species Act?*	**Response 3.7.4.2-2** The EIS acknowledges that withdrawal of water from the Leaf River may have an adverse effect on endangered species and aquatic resources that depend on the Leaf River or Pascagoula drainage system (see section 3.7.5.2.3). See response 3.7.4.1-2.

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Comment D0011-3 (Nan Johnson, individual) *The U.S. Fish and Wildlife Service Mississippi field office has stated there are concerns over potential negative impacts to 17 threatened or endangered species and their habitats. Black bears, sturgeon, bald eagles and sea turtles, among others, could all be "adversely impacted by the proposed construction or operation of the oil storage facility."*	**Response 3.7.4.2-3** The Mississippi Field Office of USFWS provided a list during scoping of all federally protected species known to exist in the counties affected by the proposed action. DOE used this list to assess whether the proposed action may affect endangered or threatened species. DOE found that the proposed Richton site may have an adverse effect or may affect the Gulf sturgeon, pearl darter, yellow-blotched map turtle, black pine snake, and gopher tortoise (see section 3.7.5.2.3). If one of the Richton alternatives is selected in the ROD, DOE would complete a biological assessment if any part of the proposed action may adversely affect a listed species. DOE would initiate formal Section 7 Consultation with USFWS, complete a biological assessment, and implement any conditions of the biological opinion. See response 3.7.4.2-1.
Comment D0013-7 (Gulf Restoration Network) *The Richton, MS site:* *Selection of this site also poses a significant risk of environmental degradation and irreparable damage to endangered species. Predominantly these impacts are associated with water withdrawal associated with salt dome excavation. As currently planned, water will be withdrawn from the Leaf River (DEIS at p. 2-44). The DEIS authors admit that "the flow rate of the Leaf River is highly variable and there would be significant potential for withdrawing a significant fraction of the total river flow during drought periods" (DEIS at p. 2-70). In fact, during low flow, withdrawal from the Leaf River could constitute as much as 11% or more of total flow in the river. Such a withdrawal rate during low flow conditions, as aptly noted by the DEIS, could*	**Response 3.7.4.2-4** As stated in section 2.8.6 and section 3.7.5.2.3 in the EIS, withdrawal of water from the Leaf River for the Richton site may result in adverse effects to aquatic species and several endangered, threatened, or candidate species. See response 3.7.4.1-2. The EIS also acknowledges that site excavation and pipeline construction may affect the black pine snake and gopher tortoise (see section 2.8.6 and section 3.7.5.1.1). If one of the Richton alternatives is selected in the ROD, DOE would initiate formal Section 7 Consultation with the USFWS and NOAA Fisheries as required by the ESA for potential adverse effects to listed species. DOE would prepare a biological assessment and implement

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significantly impact downstream aquatic communities as the decrease in flow would lower water depth, reduce stream channel width, and change currents. The severity of the effect on species would depend on the length and frequency of low-flow rate in the Leaf River during the four to five years of cavern solution mining (DEIS at pp.3-253, 3-254). Water withdrawal could also potentially affect water quality as it would reduce capacity of river to assimilate waste from non-point and permitted dischargers (DEIS at p. 3-254). In addition, several pipeline Right of Ways (ROWs) will cross the lower Pascagoula drainage, potentially affecting habitat for resident endangered species. *The area of the Leaf River that will be the site of this activity is designated habitat for several species listed as threatened or endangered under the Endangered Species Act or that are candidates for listing. For example, the pearl darter (a federal candidate species) has been documented throughout the Leaf River to the lower Pascagoula drainage. The black pine snake (another federal candidate species) and the gopher tortoise (a federally listed species) are found within close proximity of both the proposed storage site and all ROWs. In fact, the segment containing the RWI is designated as critical habitat for the federally threatened gulf sturgeon (DEIS, p. 3-247). Both the USFWS and Mississippi Natural Heritage Program have expressed serious concern about the effect that selection of the Richton site will have on water flow and the Gulf sturgeon, due to the importance of the Leaf River near Hattiesburg to spawning and juvenile sturgeon (DEIS at p 3-255).*	any conditions of the biological opinion, as described in section 3.7.1.2. DOE would consult with the USFWS and Mississippi Natural Heritage Program for potential adverse effects to the pearl darter, a candidate species. **]**
Comment D0073-8 (NOAA Fisheries) *Also, Mississippi Sound is designated as critical habitat for the Gulf sturgeon under provisions of the Endangered Species Act.*	**Response 3.7.4.2-5** DOE acknowledges that the draft EIS did not identify that the proposed Richton brine discharge pipeline crosses through designated critical habitat for the Gulf sturgeon. The proposed discharge location is

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[See comment D0073-8 text above]	located deep enough in the Gulf that the increased salinity would not affect the designated critical habitat. To reduce DOE's dependence on the Leaf River, which can have variable flow and is critical habitat for the Gulf sturgeon, DOE modified the Richton alternatives from that presented in the draft EIS to include an additional surface water source from the Gulf of Mexico as a supplemental source during low-flow conditions in the Leaf River. Operation of the Pascagoula RWI may affect the Gulf sturgeon, which is a federally threatened species, because of impingement and entrainment of sturgeon and its prey (see section 3.7.5.2.3). If one of the Richton alternatives is selected by DOE in the ROD, DOE would initiate formal Section 7 Consultation with NOAA Fisheries and the USFWS and follow the required ESA steps to avoid adverse impacts to the Gulf sturgeon. DOE has revised the language in the final EIS to include the Mississippi Sound as designated critical habitat for the Gulf sturgeon. See response 3.7.4.2-4.
Comment D0074-5 (U.S. Army Corp of Engineers) *In addition, EFH and ESA issues will likely require consultation.*	**Response 3.7.4.2-6** As noted in the EIS, DOE will consult with USFWS, NOAA Fisheries, and other appropriate agencies regarding EFH and ESA issues (section 3.7.1.2). DOE looks forward to continued coordination on these issues.
Comment D0079-6 (DOW Chemical Company) *The Draft EIS notes that developing the Stratton Ridge, TX site would create the potential of adversely affecting the "foraging, roosting and nesting habitat for bald eagles." While the Draft EIS study didn't find any bald eagles in the corridor, the Draft EIS notes that bald eagles are both an endangered species and our national bird. Incidentally, there is*	**Response 3.7.4.2-7** As described in section 3.7.6.2.1 and appendix H, DOE identified a known bald eagle nest northwest of the proposed Stratton Ridge storage site through informal consultation with USFWS. If one of the Stratton Ridge alternatives is selected by DOE in the ROD,

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a bald eagle that nests on the north side of CR-226 on the Stratton Ridge salt dome. Dow urges DOE to correct the mistake in the Draft EIS and, in DOE's recalculation of the relative merits of each potential expansion site, not to under-estimate the impact of this expansion of the SPR adversely affecting this endangered species and national bird which is actually nesting near the Stratton Ridge site.	DOE would survey the site, ROWs, and RWI for bald eagle nests, including the area mentioned by Dow Chemical. If a nest is identified, DOE will consult with USFWS and Texas Parks and Wildlife Department, and it will follow the procedures required by the ESA.
Comment D0080-2 (Louisiana Department of Wildlife and Fisheries) *Our records indicate the proposed project may potentially impact 9 bald eagle (Haliaeetus leucocephalus) nesting sites. This species is listed as threatened under the Endangered Species Act. No major activities should occur during the nesting period (October 1- May 15) within one mile of the nest tree. To protect the core nesting area, there should be no activity within a 1,500-foot radius of the nest tree at any time. All bald eagle nests (active, inactive or seemingly abandoned) should be protected. Within the core nesting area, no large tree should be removed.* *The proposed project may impact two ground-nesting birds of concern in Louisiana. The Louisiana Waterthrush (Seims motacilla) and Worm-eating Warbler (Helmitheros vermivorus) are known to nest in East and West Felician Parishes of Louisiana. Breeding habitat for these birds include wet forested areas along streams and creeks flowing through hilly terrain. We recommend a qualified biologist conduct a survey along the proposed right way if activity takes place during the breeding season. Results of the survey should be sent to the above address care of LNHP. The breeding season for these two species is generally mid-April through July.*	**Response 3.7.4.2-8** DOE evaluated the potential impacts of the proposed Chacahoula site on federally listed species and found that the proposed alternative may affect the bald eagle and brown pelican (see section 2.8.6). If one of the Chacahoula alternatives is selected, DOE would initiate formal Section 7 Consultation with the USFWS, prepare a biological assessment, and implement any conditions of the biological opinion as described in section 3.7.4.2.1. DOE also evaluates whether the proposed action would affect species regulated by state endangered species laws in appendix I. DOE found no additional species under State protection that may be affected beyond the federally listed species in Louisiana. The Louisiana waterthrush, worm-eating warbler, long-tailed weasel, southern shield wood-fern, and rooted spike-rush are not protected under State laws and were not evaluated for the EIS. If one of the Chacahoula alternatives is selected in the ROD, DOE will coordinate with the LA DWF during the design and permitting process to avoid and minimize effects on sensitive species.

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The proposed project may potentially impact the long-tailed weasel (Mustela frenata). This species is found in a wide variety of habitats, usually near water. Favored habitats include brushland and open woodlands, field edges, riparian grasslands, swamps, and marshes. Dens are in abandoned burrows of other mammals, rock crevice, brushpiles, stump hollows, or spaces among tree roots; one individual may use multiple dens. Research indicates that long-tailed weasels may be sensitive to agriculturally induced fragmentation of habitat and the importance of maintaining landscape connectivity for species conservation. *The proposed project may impact Southern Shield Wood-fern (Dryopteris ludoviciana) and Rooted Spike-rush (Eleocharis radicans). Both of these plants are considered extremely imperiled in Louisiana due to extreme rarity. A forested seep with large populations of these plants is located in the direct path of the proposed pipeline right of way extending north from Baton Rouge.*	**[See response 3.7.4.2-8 above]**
Comment D0080-3 (Louisiana Department of Wildlife and Fisheries) *Our database indicates the presence of many waterbird nesting colonies within the proposed project area or within one mile of the proposed project. Please keep in mind that rookeries can move from year to year and no current information is available on the status of these rookeries. We recommend that a qualified biologist inspect the proposed worksite for the presence of nesting colonies during the nesting season. We recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests and should avoid disturbing them during the breeding season. No activity is permitted within 400 meters (700 meters for Brown Pelicans) around rookeries during the breeding season, which is generally March*	**Response 3.7.4.2-9** If DOE selects an alternative other than the no-action alternative in the ROD, DOE would consult further with USFWS on nesting colonies and rookeries prior to construction. DOE would have a qualified biologist inspect proposed sites for the presence of nesting colonies during the nesting season. DOE would minimize the disturbance to rookeries during the breeding season for brown pelicans and during the nesting season for other bird colonies as practicable. As stated in section 3.7.1.2 of the EIS, DOE would initiate formal Section 7 Consultation with the USFWS if the selected alternative may adversely affect a listed species such as the brown pelican. DOE would work closely with the LA Department of Wildlife and Fisheries and USFWS to avoid adverse effects on the brown pelican, and DOE would follow all requirements

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15-July 15. Contact the US Fish and Wildlife Service at (337) 291-3100 to discuss impacts on rookeries. To minimize disturbance to colonial nesting birds, the following restrictions on activity should be observed: - *For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, roseate spoonbills, anhingas, and/or cormorants), all activity occurring within 300 meters of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, depending on species present).* - *For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 400 meters of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, depending on species present).*	of the ESA.
Comment D0081-6 and 7 (NPS, Gulf Islands National Seashore) *Specific GUIS resources that are put at risk by the proposed pipeline and brine disposal include:* […] *Federally threatened/endangered sea turtle species could be adversely affected if seagrass beds, a primary feeding habitat, are directly disturbed or indirectly subjected to sedimentation and turbidity. Both the green sea turtle (Chelonia mydas) and the loggerhead turtle (Caretta caretta) are known to feed in and around grassbeds.* *Adverse impacts to nesting birds on the islands, which include endangered species, could be substantial if pipeline construction and subsequent inspections took place during periods of nest site selection, incubation, or chick rearing. Any visual or noise intrusion which causes*	**Response 3.7.4.2-10** DOE evaluated the effects of the proposed action on the loggerhead turtle in section G.4.2.7.7 of appendix G of the EIS. In the final EIS, DOE added an evaluation of impacts to the green sea turtle to appendix G, as well as the leatherback and Atlantic hawksbill turtle, which is also known to occur in the Gulf and was erroneously left out of the draft EIS. DOE acknowledges that portions of the loggerhead sea turtle's feeding habitat would be temporarily disturbed during brine discharge pipeline construction if one of the Richton alternatives is selected in the ROD. The EIS concludes that the proposed Richton brine discharge pipeline would not likely result in an adverse effect to the loggerhead sea turtle. Habitat disturbance would be limited to the width of the ROW. In addition, DOE would attempt to avoid and minimize impacts to SAV and any effects to SAV would be mitigated. DOE determined that the same pipeline is not likely to adversely affect the green sea

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parent birds to flush provide the possibility of nest abandonment, eggnest overheating, or nest predation. Construction and inspection activities should be limited to non-nesting times of the year. *Gulf sturgeon (Acipenser oxyrinchus desotoi), a federally threatened species, have been documented as utilizing the shallow passes between the Mississippi islands for large portions of the year. Pipeline construction and inspection activities would need to be limited to times of the year that sturgeon are upriver and not utilizing the island passes.*	turtle, leatherback, and Atlantic hawksbill sea turtle. If one of the Richton alternatives is selected in the ROD, DOE would consult further with USFWS to determine whether formal Section 7 Consultation is required, as stated in section 3.7.1 of the EIS. In the EIS, DOE proposes to place the brine disposal pipeline for the Richton site between Horn Island and Petit Bois Island (see figure 2.4.3-3). The proposed alignment is 1,600 feet (490 meters) away from Horn Island, the closest island. DOE does not expect construction activities at this distance would cause an adverse effect on the nesting birds. If one of the Richton alternatives is selected, DOE would continue coordination with USFWS and NPS to avoid or minimize impacts to resources on or managed within GUIS. DOE has revised the discussion of the Richton site in the final EIS to address the effects of offshore pipeline construction and brine diffusion to GUIS in sections 3.7.5.1.6 and 3.7.5.2.6 and appendices E and G. DOE would schedule construction activities for the pipeline during the period when many Gulf sturgeon have migrated into freshwater rivers. DOE determined that development of the proposed Richton site may have an adverse effect on the Gulf sturgeon from withdrawal of water from the Leaf River (see section 3.7.5.1.3). To reduce DOE's dependence on the Leaf River, which can have variable flow and is critical habitat for the Gulf sturgeon, DOE modified the Richton alternatives from those presented in the draft EIS to include an additional surface water source from the Gulf of Mexico as a supplemental source during low-flow conditions in the Leaf River. Operation of the Pascagoula RWI may affect the Gulf sturgeon, which is a federally threatened species, because of impingement and entrainment of sturgeon and its prey (see section 3.7.5.2.3). DOE has

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[See comment D0081-6 and 7 text above]	revised the final EIS to indicate that offshore pipeline construction activities would be scheduled during times of the year that sturgeon are upriver to avoid an adverse effect to this species.
Comment D0081-2 (NPS, Gulf Islands National Seashore) *Since a portion of the proposed disposal pipeline route passes through waters managed by GUIS, if a right-of-way could be issued for the pipeline, NPS permitting and consent would be necessary. This consent would include evaluation of the location, construction, and operation of the pipeline. The regulatory and permitting authorities of the NPS should be included in the DEIS and that the potential issuance of a right-of-way permit for the pipeline must consider the full environmental effects.*	**Response 3.7.4.2-11** Permit requirements for obtaining ROW through the GUIS have been added in appendix L, table L-1. In section 3.7.5.2.6, DOE has expanded the information about the potential environmental impacts and approvals required for the proposed brine discharge pipeline crossing through the GUIS for the Richton site.
Comment D0106-4 (USFWS) *Bayou Pierre is the only stream supporting the federally threatened Bayou darter, and also supports the state-endangered crystal darter.*	**Response 3.7.4.2-12** The draft EIS acknowledged the presence of the Bayou darter and crystal darter in Bayou Pierre in section 3.7.3.1.1, appendix I, and appendix G. As discussed at an interagency meeting on June 22, 2006, there are concerns that development of the Bruinsburg site may increase erosion in Bayou Pierre and further degrade habitat quality. DOE would consider measures to help prevent this erosion (see response 3.6.2.2-3). If one of the Bruinsburg alternatives is selected in the ROD, DOE would work with the permitting and resource agencies to avoid adverse effects. Pipelines in the Clovelly-Bruinsburg alternative would have crossed

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[See comment D0106-4 text above]	Bayou Pierre. As explained in response 2.2-1 and in EIS section 2.6, this alternative is infeasible and therefore not reasonable, and it is not considered in the final EIS.
Comment D0106-5 (USFWS) *Page S-29, Richton. This section summarizes impacts of the Richton alternative to the endangered yellow-blotched map turtle and Gulf sturgeon and the pearl darter, a candidate species. The document should also state that the raw water intake would also adversely affect these species through impairment of water quality.*	**Response 3.7.4.2-13** As noted in the EIS, the Richton RWI in the Leaf River may adversely affect the yellow-blotched map turtle, Gulf sturgeon, and the pearl darter through impairment of water quality (section 3.7.5.2.3). The effects from construction and operation of the RWI in the Leaf River are also discussed in this section for the yellow-blotched map turtle, Gulf sturgeon, and the pearl darter. See response 3.7.4.1-2.
Comment D0106-22 (USFWS) *Page 3-247, paragraph 5, lines 3 through 5. The document states that the only area where the pearl darter spawning has been documented in recent decades is in the Leaf River near Hattiesburg, which is located upstream from the proposed raw water intake (RWI). The statement seems to imply that the pearl darter does not occur below the proposed location of the RWI. It would also contradict a statement made earlier on page 3-245 that "the pearl darter has been documented throughout the Leaf River…" The Service information also indicates that the pearl darter occur throughout the Leaf River into the Pascagoula River.*	**Response 3.7.4.2-14** DOE did not intend for the statement in section 3.7.5.1.2 of the draft EIS to imply that pearl darters are located in only one section of the Leaf River—even though spawning has been documented only near Hattiesburg. In other sections of the EIS, DOE notes that the pearl darter has been documented throughout the Leaf River to the lower Pascagoula drainage (section 3.7.5.2.3). To clarify this potential misunderstanding, DOE has added the following sentence in section 3.7.5.1.2 to the final EIS: “The pearl darter has been documented throughout the Leaf River to the lower Pascagoula drainage.”

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Comment D0106-24 (USFWS) *Page 3-254, paragraph 5, lines 7 through 8. The document mentions that impinged yellow-blotched map turtles would be returned downstream of the intake by traveling screens. The DEIS omits any discussion regarding the condition of the turtles returned to the stream. We believe that a potentially significant percentage of the turtles could die from this traumatic incident.*	**Response 3.7.4.2-15** In sections 2.8.6, section 3.7, and appendix G of the draft EIS, DOE indicated that construction and operation activities may affect the yellow-blotched map turtle. DOE has amended these sections of the final EIS to indicate that withdrawal of water from the Leaf River may have an adverse effect on that species. In addition, DOE has added a statement to acknowledge that impingement of the yellow-blotched map turtle may cause bodily harm leading to death. If one of the Richton alternatives is selected, DOE would enter formal Section 7 Consultation with USFWS, prepare a biological assessment, and follow the recommendations of the biological opinion.
Comment D0106-25 (USFWS) *Page 3-255, last paragraph, lines 3 through 6. The document states that due to the small size of the pearl darter, impingement on the screens or entrainment through the screens would occur and would cause bodily harm that may lead to death of some individual fish. This paragraph appears to indicate that the fish entrained through the screens and impinged would not suffer high mortality. The Service disagrees with this conclusion. All of the entrained fish would be killed, and impingement of the fish would result in almost 100 percent mortality. This inadequacy should be remedied in the DEIS.*	**Response 3.7.4.2-16** DOE acknowledges this error in section 3.7.5.2.3. Appendix G of the draft EIS stated, "Due to their small size, impingement on the screens or entrainment through the screens would occur and would cause bodily harm that may lead to death of some individual fish." DOE concurs that entrainment of pearl darters would cause 100 percent mortality. High mortality arising from entrainment was discussed in section 3.7.2.2.2 in the draft EIS. DOE agrees that impingement or entrainment of the pearl darter by the RWI on the Leaf River would result in high mortality and concluded that operation of the RWI on the Leaf River may have an adverse affect on the species. DOE has amended this statement in the final EIS to read "Due to its small size, impingement on the screens or entrainment through the screens would occur and would cause bodily harm that would lead to death of individual fish." In the final EIS, DOE modified the conceptual design from that presented in the draft EIS for the RWI on Mississippi River for the Bruinsburg site and the RWI on the Leaf River for the Richton site, the only two RWIs on naturally flowing rivers. The modified RWIs are

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[See comment D0106-25 text above]	designed to reduce potential effects on aquatic resources by proposing a series of cylindrical screens located in the stream channel that would be oriented parallel to the river flow (see sections 2.4.1 and 2.4.3 and figure 2.4.3-3). This conceptual plan is typically recommended for river intakes because it uses the river flow to create a sweeping velocity across the screen surface to minimize the likelihood of impingement of organisms (Gowan et al. 1999). The screens would be fitted with air back flow systems to reduce clogging and reduce the likelihood of impingement of organisms. In addition, the intake system would be constructed within a cofferdam to minimize the potential for water quality impacts during construction.
Comment D0106-26 (USFWS) *Page 3-256, paragraph 1. This paragraph discussed Section 7 consultation regarding the Gulf sturgeon. Section 7 consultation would also be required for the threatened yellow-blotched map turtle. This omission should be addressed in the EIS.*	**Response 3.7.4.2-17** As described in response 3.7.4.2-15, DOE indicates in section 2.8.6 and appendix G that construction and operation activities at the RWI for the Richton site may affect the yellow-blotched map turtle. DOE has made a correction to this statement acknowledging that Section 7 Consultation will be initiated if one of the Richton alternatives is selected in the ROD.
Comment D0106-27 (USFWS) *Page 3-256, paragraph 1 and 2. These paragraphs provide the conclusions regarding the impacts of the Richton RWI on endangered and threatened species. It is our understanding that the impacts would occur when the Leaf River is at average annual low-flow discharge of 720 cubic feet per second or near the 7Q10 discharge (503 cfs). During the June 22 interagency meeting, DOE mentioned that removal of water from the Leaf River would continue when river flows reached the 503 cfs discharge. Pumping of water from the Leaf River when flow is below 503 cfs would have severe impacts on listed and non threatened and endangered aquatic species. Impacts resulting from pumping water when flow is below 503 cfs should be discussed in the*	**Response 3.7.4.2-18** DOE acknowledges that withdrawal of water from the Leaf River may result in adverse impacts on water resources (see 3.6.5.1.2) and aquatic resources, such as endangered species (see 3.7.5.1.2). DOE acknowledges that withdrawal of water from the Leaf River may result in adverse impacts on water resources (see 3.6.5.1.2) and aquatic resources, such as endangered species (see 3.7.5.1.2). To reduce DOE's dependence on the Leaf River, DOE has added to the Richton alternatives a RWI structure on Singing River Island in Pascagoula, which would allow DOE to withdraw water from the Gulf of Mexico to reduce withdrawal from the Leaf River during low-flow conditions.

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EIS.	If DOE selects one of the Richton alternatives, DOE would develop a Water Conservation Plan for water withdrawal during cavern creation, drawdown, and maintenance. During cavern creation, drawdown, or maintenance, withdrawal from the Leaf River would be used during normal and high-flow conditions. Under low-flow conditions in the Leaf River, the withdrawal would be supplemented by a secondary source, the Pascagoula RWI, which would withdraw water from the Gulf of Mexico. The Pascagoula RWI would be designed to handle about 0.5 MMBD of the total required volume, which is about 1.2 MMBD. During construction or maintenance, when flows in the Leaf River reach the Minimum Instream Flow that is designated by the regulatory agencies to protect special status species, withdrawal from the Leaf River would be reduced or terminated until the Minimum Instream Flow in the Leaf River is reached. During this period, DOE would withdraw water from the Gulf of Mexico. If necessary, DOE would consider possible supplemental sources during Section 7 Consultation with the regulatory agencies, including possible groundwater sources, withdrawals from other surface water bodies, and a possible onsite off-stream reservoir. If low-flow conditions exist in the Leaf River during emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico, and, as necessary to reach water withdrawal rate of 1.2 MMBD, from the Leaf River. Section 3.7.5.2.3 of the EIS discusses the effects of withdrawal at a level higher than the 7Q10. This section discusses the Minimum Instream Flow to protect aquatic resources, and it follows the

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[See comment D0106-27 text above]	Mississippi Natural Heritage Program recommendation to use 30 percent of the mean daily discharge as a Minimum Instream Flow. This flow of about 1,131 cubic feet per second (32 cubic meters per second) may be established as the Minimum Instream Flow (allowed by permit) because this section of the river is designated as critical habitat for the Gulf sturgeon. DOE determined that operation of the RWI in the Leaf River may have an adverse effect on aquatic resources in the Leaf River, including several endangered, threatened, or candidate species. Operation of the Pascagoula RWI may affect the Gulf sturgeon, which is a federally threatened species, because of impingement and entrainment of sturgeon and its prey (see section 3.7.5.2.3). To further mitigate the impacts of the RWI on the Leaf River, DOE has modified the conceptual design for the RWI on the Leaf River to reduce the potential for impingement and entrainment of aquatic organisms. The revised conceptual plan would use cylindrical screens located in the water column and oriented parallel to the river flow (see section 2.4.3 and figure 2.4.3-3). To minimize the likelihood of entrainment and impingement, this design takes advantage of the sweeping velocity of the river, whereby the velocity of the water flows parallel and adjacent to the RWI screen surface (Gowan et al. 1999). DOE would use a relatively low intake velocity of 0.5 feet per second and relatively small screen size of 0.5 inches to further reduce impingement and entrainment. DOE would refine the conceptual plan for the RWI and water withdrawal during the Section 7 Consultation with the USFWS, NOAA Fisheries, and the Mississippi Natural Heritage Program and coordination with the USACE and MDEQ for the Section 404/401 permit and the water withdrawal permit.

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[See comment D0106-27 text above]	If one of the Richton alternatives is selected, DOE would initiate formal consultation with the USFWS and NOAA Fisheries under Section 7 of the ESA and initiate permit coordination with the MDEQ and USACE for the Section 404/401 permit and Permit to Withdraw for Beneficial Uses from the Public Waters of Mississippi. These regulatory programs would establish the Minimum Instream Flow and any limitations or conditions on withdrawals during low-flow periods. See responses 3.6.2.2-1 and 3.6.4.2-1.
Comment D0106-17 (USFWS) *In addition, Bayou Pierre has a serious headcutting problem, which causes bank sloughing and sedimentation. The headcutting problem is having adverse impacts on the endangered Bayou darter. As the Bruinsburg alternative may potentially exaggerate the head cutting problem, we recommend measures to address the head cutting problem be considered as an option for stream mitigation.*	**Response 3.7.4.2-19** DOE appreciates this suggestion for stream mitigation. If one of the Bruinsburg alternatives is selected in the ROD, DOE would work with the USFWS and other state and Federal agencies to develop a compensation plan for effects on streams and wetlands. If deemed appropriate compensation by the permitting agencies, DOE would consider measures to help prevent erosion in Bayou Pierre.
Comment D0106-21 (USFWS) *Page 3-245, Special Status Species, paragraph 2, last two lines. The paragraph states that candidate species such as the pearl darter are not regulated under the Endangered Species Act unless they are listed as threatened or endangered by the U.S. Fish and Wildlife Service or National Oceanographic and Atmospheric Administration before the proposed action is undertaken. The document should also mention that although the pearl darter has not been officially listed, federal agencies generally give it and other candidate species the same consideration as listed species. Furthermore, the American Fisheries Society considers the fish as threatened, and the State of Mississippi lists the pearl darter as a species of special concern and a state endangered species. Therefore, the Service requests the Department of Energy to treat the*	**Response 3.7.4.2-20** As described in section 3.7.1.2, after DOE issues a ROD to select an alternative, DOE will consider the impact of the proposed action on candidate species. If one of the Richton alternatives is selected, DOE would treat the pearl darter as a listed species and initiate formal Section 7 Consultation.

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pearl darter as a listed species.	**[See response 3.7.4.2-20 above]**

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Comment D0078-12 (DOI) *The proposed Chacahoula and Bayou Choctaw project sites are also located within areas where colonial nesting waterbirds may be present. Colonies may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries. That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Should a Louisiana site be chosen as the preferred alternative, we recommend that a qualified biologist inspect the proposed work areas for the presence of undocumented nesting colonies during the nesting season. To minimize disturbance to colonial nesting birds (i.e., herons, egrets, night-herons, ibis, roseate spoonbills, anhingas, and/or cormorants), all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, depending on species present). In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and they should avoid affecting them during the breeding season.*	**Response 3.7.5.1-1** See response 3.7.4.2-9 for discussion of these issues.**]**

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Comment D0013-8 (Gulf Restoration Network) *The Brazoria NWR was established to provide habitat for migratory waterfowl and other birds (DEIS at pp. 3-262-263). ROW crossings of the NWR would reduce the areas value as habitat and thus undermine the purposes of the NWR.*	**Response 3.7.5.2-1** DOE addresses the effects of pipeline ROWs and the impacts of ROWs on the Brazoria National Wildlife Refuge in the EIS. See section 3.7.2.1.2, section 3.7.2.2.3, and section 3.7.6.2.3. In the EIS, DOE recognizes the important habitat that Brazoria National Wildlife Refuge provides for migratory birds, waterfowl, and other wildlife. DOE would avoid or minimize pipeline construction during spring and fall migration. DOE would bury the power lines to the RWI to further minimize long-term effects on vegetation and wildlife. DOE would use the existing Bryan Mound ROW as much as possible for pipeline and staging areas to minimize the footprint of the crude oil pipeline through the refuge. DOE would coordinate with USFWS for the easement through the wildlife refuge and reseed ROWs with native herbaceous, shrub, and tree species to promote regeneration of habitat in the temporary construction easement as stated in section 3.7.6.2.2. DOE would restore the permanent easement to preconstruction contours. Disturbed areas would be restored with herbaceous species. If one of the Stratton Ridge alternatives is selected in the ROD, DOE would coordinate with the USFWS to avoid and minimize effects on migratory birds and other birds, and secure the appropriate approval for crossing the National Wildlife Refuge.
Comment D0078-5 (DOI) *The proposed SPR facility and pipeline route may be located within the vicinity of documented bird rookeries and colonial nesting bird sites. Of particular concern is Drum Bay bird rookery located in Brazoria County and Little Pelican Island located in Galveston County. There are several others within Brazoria, Galveston, and Jefferson Counties. These rookery sites can be identified on the FWS's Texas Coastal Program website at http://texascoastalprogram.fws.gov/ TCWC.htm. Development operations, which include drilling, dredging, seismic*	**Response 3.7.5.2-2** DOE used point location data from the USFWS Texas Colonial Waterbird database to examine the proximity of rookeries to the proposed Stratton Ridge storage site and associated infrastructure as well as the Big Hill expansion site and associated pipelines. The closest known rookeries to any proposed project infrastructure, as described in section 3.7.6.1.4, are more than 1,000 feet (30 meters) away. See response 3.7.4.2-9.

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exploration, construction activity, or watercraft landing occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, depending on species present). We recommend that DOE develop a monitoring plan that identifies these rookeries and documents that they will not be disturbed by construction activities.	**[See response 3.7.5.2-2 above]**
Comment D0078-7 (DOI) *National Wildlife Refuge (NWR) System: Since the raw water intake pipeline, brine disposal line, and oil distribution line are each greater than 24 inches in diameter, they would all require Congressional approval per 50 CFR 29.21-9(m) for an application for a ROW on the Brazoria NWR. The oil distribution line may be deemed a common-carrier per 50 CFR 29.21-9(j 1).* *Refuge compatibility issues must be addressed for all three lines regardless of size. If the oil distribution line can be located within the existing, heavily disturbed 23 inch and greater pipeline corridor (commonly referred to as the Dow Corridor), compatibility issues and concerns can be better addressed. The raw water intake and brine disposal lines, however, occur in a nationally recognized declining habitat type - Gulf cordgrass and adjacent wetlands. The area in question (Freshwater Lake area) also has minimal to no disturbance; therefore, construction of two new lines and the resulting wide ROW (150 feet in wetlands and 100 feet in uplands) would be of concern to the refuge during the compatibility determination. Compatibility stipulations may include boring of the two lines underground to minimize habitat loss or other means to replace refuge habitat lost. Additionally, compatibility with the refuges within the National Wildlife Refuge Systems must be identified and addressed.*	**Response 3.7.5.2-3** If one of the proposed Stratton Ridge alternatives is selected in the ROD, DOE would work with Brazoria National Wildlife Refuge to address ROW concerns. DOE would secure all required approvals and assist with compatibility determinations for crossing the National Wildlife Refuge. See response 3.7.5.2-1. See also response 3.3-7.

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Comment D0115-4 (Audubon Society, Houston) *Additionally, compatibility with the refuges within the National Wildlife Refuge system must be identified and addressed.*	**[See response 3.7.5.2-3 above]**
Comment D0081-9 (NPS, Gulf Islands National Seashore) *Localized impacts from the brine disposal could be significant with a disproportionate impact on benthic communities. According to the DEIS, studies have shown significant reductions in benthic biomass almost 7,000 feet from the brine diffusers. Depending on currents and tidal movement, the brine plume could easily be transported into GUIS waters and to GLTIS seagrass resources with resultant adverse impacts. A significant loss of benthic organisms represents a significant loss of prey food for the Gulf fisheries.*	**Response 3.7.5.2-4** The effects of brine disposal on benthic organisms are addressed in appendix E, section E.5.3 of the EIS. As stated in appendix E, if DOE selects one of the Richton alternatives in the ROD, DOE would attempt to avoid areas of seagrass during the detailed design and permitting stages. The final EIS has been updated to describe direct and indirect effects on seagrass in section 3.7.5.2.6 and appendix E, section E.5.2. In addition, if construction of the brine disposal pipeline through seagrass is unavoidable, DOE would undertake mitigation measures. The seagrass beds would be regulated as EFH and special aquatic sites and wetlands under Section 404/401 of the Clean Water Act; therefore, unavoidable impacts would be compensated through DOE's plan to create, restore, preserve, or pay in-lieu-of fees as described in appendices B and O. DOE would continue to consult with NOAA Fisheries, USACE, USFWS, NPS at GUIS, and relevant state resource agencies to avoid and minimize effects on fisheries, aquatic resources, and EFH, including those resources in GUIS managed waters. See response 3.3-8 and 3.7.2.1-1.
Comment D0003-1 (Mary Ellen Witworth, individual) *I am opposed to destroying 258 acres of relatively rare and ecologically important bottomland hardwood forest at the Stratton Ridge site. The Brazoria National Wildlife Refuge is meant to be an*	**Response 3.7.5.2-5** See response 3.7.5.2-1.

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area that is protected for generations to come. The DOE needs to look at other sites for their pipeline that does not destroy what cannot be restored. The lowest cost is not sufficient reason to use public land over other alternatives.	**[See response 3.7.5.2-5 above]**

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Comment D0084-9 (Frank Leach, Jackson County Board of Supervisors) *And with the shrimp and the aquaculture production that we are working so hard to improve so that we don't have to rely upon foreign seafood and the import of additional products, it would seem as though to me we would want to be much more protective of our Gulf than what we are presently talking about doing and that's merely dumping some additional brine or whatever is going to come out of that salt dome down this pipeline into the Gulf of Mexico.*	**Response 3.7.6.1-1** DOE assessed potential impacts on managed and non-managed fisheries based on information provided by and in consultation with USFWS, NOAA Fisheries, and various state agencies. In section 3.7.2.1.5 of the EIS, DOE examined the effect of brine on managed fisheries and concluded that there would not be a significant adverse effect on managed fisheries. Past analyses examining effects of the brine contaminants on fish showed that salinity levels may be slightly elevated around the diffusers, but fish populations do not suffer adverse effects because the salt concentrations are low and fish are mobile and can avoid such areas (Hann et al. 1984; see appendix E). In addition, the brine discharge is a short-term effect that persists during solution mining (4 or 5 years or less), cavern drawdown (6 months or less), and maintenance (a few weeks or less). For the Richton alternatives, cavern creation and the associated brine discharge could last up to approximately 9 years if the flow in the Leaf River persists below the Minimum Instream Flow for 9 consecutive years and DOE draws water exclusively from the Gulf of Mexico to

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[See comment D0084-9 text above]	create the Richton caverns. It is highly unlikely, however, that flows would remain below the Minimum Instream Flow in the Leaf River for 9 consecutive years. More likely, only a portion of the water for cavern creation would come from the Gulf of Mexico. The length of cavern creation and the associated brine discharges could be longer for two reasons: (1) the rate of withdrawal from the available water sources may be smaller than the planned rate of withdrawal from the Leaf River, and (2) each barrel of saltwater from the Gulf of Mexico has less capacity than each barrel of freshwater from the Leaf River to dissolve salt and therefore a larger volume of saltwater would be needed to create the 160 MMB of storage capacity at Richton. If the total rate of water withdrawal for solution mining is reduced, the rate of brine discharged into the Gulf of Mexico would be lower and the size of the brine plume would also be slightly smaller. During brine refill events, after emergency drawdown or maintenance, brine discharge may be slightly longer if water is withdrawn from the Gulf of Mexico, as compared to water from the Leaf River. Appendix E examines the direct and indirect effects from the construction of brine disposal pipelines, the periodic maintenance of pipeline ROWs, and brine discharge and diffusion on EFHs for the fish species and their major food sources. The brine discharges would comply with the effluent limits of the NPDES permit, which were established to protect water quality standards for aquatic resources as well as human health. See response 3.7.2.1-1.

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Comment D0014-3 (Tony Bland, individual) *My second main concern is the effect of dumping large quantities of brine directly into the Mississippi Sound and the impact it would have on fish and other seafood.*	**Response 3.7.6.2-1** See response 3.7.6.1-1.
Comment D0073-2 (NOAA Fisheries) *3.7.2 Impacts Common to Multiple Sites* *3.7.2.1 Construction Impacts* *3.7.2.1.5 Essential Fish Habitat* *The NMFS has concerns with siting the Richton brine discharge pipe in the Gulf of Mexico approximately one mile south of Pascagoula Ship Channel. The DOE predicts that the increase in salinity will be as high as 4.7 parts per thousand and will extend into Horn Island Pass/Pascagoula Ship Channel which connect to Mississippi Sound. Salinities within the pass, ship channel, and sound vary greatly, with the highest salinities generally occurring in June. The DEIS states that demersal species such as white and brown shrimp are tolerant of a wide range of salinities; however, we are unaware of any information regarding how a higher than ambient salinity gradient in a restricted pass/channel may affect larval and postlarval recruitment from the Gulf of Mexico into an estuary. Since this action could result in a switch in dominance from white shrimp to brown shrimp (page E-28) and is to last for up to five years, more detailed evaluations should be provided, and alternative sites located further south of Horn Island Pass and the Pascagoula Ship Channel should be addressed.*	**Response 3.7.6.2-2** DOE has concluded that the brine discharge from the Richton site would have a minor effect on larval and postlarval recruitment and changes in shrimp dominance. The salinities levels are expected to be within natural salinity variability of the Gulf, except during occasional periods of low circulation and high ambient salinity. Moreover, as shown in appendixes C and E, the highest increase in salinity of 4.3 parts per thousand would occur over a relatively small area of the Gulf and Pascagoula ship channel, about 15 miles (24 kilometers) from the coast and 7 miles (11 kilometers) from the Mississippi Sound, and where the designated EFH is located. Brine discharge would be temporary; it would occur during cavern solution mining, which would last approximately 4 or 5 years, drawdown, and periodic maintenance, which lasts a few months or weeks for each drawdown or maintenance activity. The discharge would be relatively localized and within NPDES permit limits and the effects on managed species such as brown and white shrimp would not be significant. See response 3.7.6.2-1 for a discussion of why brine disposal may persist slightly longer and the brine plume may be slightly smaller for the Richton alternatives. If one of the Richton alternatives is selected in the ROD, DOE would coordinate with NOAA Fisheries to avoid and minimize effects on managed species. During the permitting process for the discharge location, DOE will consider shifting the location of the discharge, if practical and feasible. See response 3.7.2.1-1.

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Comment D0073-3 (NOAA Fisheries) *3.7.4 Chacahoula Storage Site* *3.7.4.1 Affected Environment* *3.7.4.1.2 Chacahoula Rights-of-Way* *Page 3-219, paragraph 1. Essential Fish Habitat. The DEIS incorrectly indicates the project would not be located in an area designated as EFH. The raw water intake (RWI) pipeline between the Gulf Intracoastal Waterway (GIWW) and upland developed areas south of Louisiana Highway 90 would be located in tidally influenced areas that have been designated as EFH for postlarval, juvenile and sub-adult life stages of white shrimp, brown shrimp, and red drum. The brine disposal pipeline would share the ROW with the RWI pipeline between the GIWW and Louisiana Highway 90. From the GIWW, the brine disposal pipeline would extend 33.4 miles through wetlands and shallow water bottoms prior to reaching the beach and extending offshore. Intermediate, brackish, and saline marsh habitats would be impacted by brine disposal pipeline installation activities. Primary categories of EFH potentially impacted by the RWI and onshore components of the brine disposal pipeline include estuarine wetlands, estuarine water bottoms, submerged aquatic vegetation, and estuarine water column. The document should be revised to correctly identify the federally managed species and life stages having EFH designated in the Chacahoula ROWs and listing the general categories of EFH potentially impacted by construction activities.* **Comment D0073-4** *3.7.4.1.2 Raw Water Intake and Access Road* *Page 3-219, paragraph 6. Essential Fish Habitat. The DEIS indicates*	**Response 3.7.6.2-3** DOE acknowledges its error in not identifying the onshore component of EFH in the draft EIS. DOE has identified and described the impacts to onshore EFH from each site in the final EIS (chapter 2, chapter 3, section 3.7, and appendix E). The onshore EFH generally comprises tidally influenced streams, estuaries, and wetlands, which are considered EFH for brown shrimp, white shrimp, and red drum.

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the project would not be located in EFH. As indicated above, that information is incorrect. The document should be revised as recommended in the preceding paragraph. **Comment D0073-5** *3.7.4.2 Impacts* *3.7.4.2.2 Chacahoula Pipeline Rights-of-Way* *Page 3-224, paragraph 1. Essential Fish Habitat. This section states that "No EFH is located in or near the boundaries of the proposed Chacahoula ROWs." As noted above, this is incorrect. NMFS recommends the document be revised to quantify the acres of various categories of EFH that would be impacted by the construction of the RWI ROW and discuss mitigation necessary to compensate for adverse impacts to EFH.* *3.7.4.2.3 Raw Water Intake* *Page 3-225, paragraph 4. Essential Fish Habitat. See previous comment.*	**[See response 3.7.6.2-3 above]**
Comment D0073-6 (NOAA Fisheries) *3.7.5 Clovelly Storage Site* *3.7.5.1.1 Clovelly Storage Site* *Page 3-227, paragraph 6. Essential Fish Habitat.* *The DEIS states, "No EFH is located in or near the proposed Clovelly storage site." The DEIS characterizes wetlands at the Clovelly storage site as being a tidally-influenced estuarine community and lists plant species which are typical of brackish marsh habitats. Wetlands identified at the project site are categorized as EFH for postlarval, juvenile, and sub-adult life stages of white shrimp, brown shrimp, and*	**Response 3.7.6.2-4** Based on after additional studies completed by DOE, the Clovelly and Clovelly- Bruinsburg alternatives that involve cavern development at Clovelly are no longer considered reasonable. They are discussed in Section 2.6, Alternatives Eliminated from Detailed Study, in the final EIS and response 2.2-1.

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red drum. Primary categories of EFH in the Clovelly storage site are estuarine emergent wetlands, estuarine mud bottoms, and estuarine water column. The DEIS should be revised to correctly identify EFH at the Clovelly storage site. *3.7.5.1.2 Raw Water Intake* *Page 3-228, paragraph 3.* *The DEIS states, "No EFH is located in or near the proposed Clovelly storage site." The DEIS states the RWI would be located a few hundred meters southwest of the storage caverns in an area categorized as emergent wetland habitat. Wetlands at the project site are EFH for postlarval, juvenile, and sub-adult life stages of white shrimp, brown shrimp, and red drum. The DEIS should be revised to correctly identify EFH at the Clovelly RWI site.* *3.7.5.2 Impacts* *3.7.5.2.1 Clovelly Storage Site* *Page 3-230, paragraph 2. See previous comment.* *The document should be revised to quantify impacts to various categories of EFH that would occur from the use of the site and to discuss mitigative actions that could be implemented to minimize and compensate for adverse impacts to EFH.* *3.7.5.2.2 Raw Water Intake* *Page 3-231, paragraph 3. Essential Fish Habitat. See previous comment.*	**[See response 3.7.6.2-4 above]**

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The document should be revised to quantify impacts to various categories of EFH that would occur from the use of the site and to discuss mitigative actions that could be implemented to minimize and compensate for adverse impacts to EFH.	**[See response 3.7.6.2-4 above]**
Comment D0073-7 (NOAA Fisheries) *Section 3.7.7.2.4 Terminal in Pascagoula* *Page 3-256.* *The DEIS lacks information to allow an adequate assessment of the impacts to the 35 acres of estuarine wetlands at the Pascagoula terminal on Singing River Island. DOE chose to just indicate that, if this alternative is selected, the DOE would refine the conceptual site plan and secure permits from the Corps of Engineers by providing compensation for the unavoidable wetland impacts. The estuarine wetlands on Singing River Island have been designated as EFH for various federal managed fishery species.*	**Response 3.7.6.2-5** DOE acknowledges the oversight and has added to the final EIS a description of the estuarine wetlands at the Pascagoula terminal as EFH. If one of the Richton alternatives is selected by DOE in the ROD, DOE would continue to coordinate with NOAA Fisheries to identify measures to avoid and minimize the potential fill of estuarine wetlands when constructing the Pascagoula terminal and RWI structure. DOE would work closely with USACE, USFWS, and NOAA Fisheries to develop an appropriate mitigation plan to compensate for the unavoidable loss of wetlands and EFH for the selected alternative. **]**
Comment D0073-10 (NOAA Fisheries) *3.7.11 West Hackberry Expansion Site* *Page 3-288, paragraph 2. Essential Fish Habitat.* *There are extensive wetlands and open water areas surrounding the West Hackberry site and the DEIS reports that expansion activities would affect five acres of "emergent wetlands and water." Tidally influenced wetlands at the expansion site are EFH for postlarval, juvenile, and subadult life stages of white shrimp, brown shrimp, and red drum. Estuarine emergent wetlands, estuarine mud bottoms, and estuarine water column are the primary categories of EFH potentially*	**Response 3.7.6.2-6** See response 3.7.6.2-3.

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affected by expansion activities. NMFS recommends the document be revised to identify and discuss EFH at the West Hackberry expansion site. *3.7.11.2 Impacts* *Page 3-289, paragraph 6. Essential Fish Habitat.* *The DEIS states "There is no EFH within or near the proposed West Hackberry Expansion Site." This is incorrect, and the document should be revised to quantify impacts to various categories of EFH that would occur from the use of the site and to discuss mitigative actions that could be implemented to minimize and compensate for adverse impacts to EFH.*	**[See response 3.7.6.2-6 above]**
Comment D0074-5 (U.S. Army Corp of Engineers) *In addition, EFH and ESA issues will likely require consultation.*	**Response 3.7.6.2-7** As noted in the EIS, DOE will consult with USFWS, NOAA Fisheries and other appropriate agencies regarding EFH and ESA issues (section 3.7.1.2).
Comment D0081-4 (DOI) *Submerged Aquatic Vegetation/Seagrass* *The potential impacts of pipeline construction on seagrass communities have not been fully addressed. In order to assess both short-and long-term impacts, additional analysis is necessary. Up-to-date information on seagrass distribution is necessary. Recent reports show that approximately two-thirds of the seagrass beds in Mississippi Sound have disappeared since the 1970s with the remaining majority existing within GUIS. Seagrass resources are known to exist both east and west of the proposed pipeline route.*	**Response 3.7.6.2-8** As described in appendix E, DOE will try to avoid any direct impacts to SAV if one of the Richton alternatives is selected in the ROD. DOE has revised this section of the final EIS to state that DOE will mitigate any direct impacts to SAV that are unavoidable. DOE obtained data from a 1997 survey that describes the local distribution of seagrass in GUIS. This was the most recent data set available. A GIS analysis was conducted to compare the proposed brine disposal ROW with known seagrass beds. The results are described in appendix E of the final EIS. If one of the Richton

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Historic trends, distribution, and composition of seagrass communities in the Mississippi Sound should be examined to determine the significance of impacts on these remaining seagrasses. The seagrass beds near the north shore of Petit Bois Island reportedly contain the last occurrence in the Mississippi Sound of turtle grass (Thalassia testudinum), formally the second most abundant seagrass, and Manatee grass (Syringodium filiforme), once the third most abundant. *The seagrass meadows within park waters are vital nursery areas for the Gulf of Mexico. Seventy percent of recreational fisheries in the Gulf are estuarine-dependent; for commercial fisheries, this percentage is even greater. Seagrass communities are one of the most biologically diverse communities in the southeastern United States and are currently in severe decline. Certain seagrass communities have declined to approximately 20 percent of their historical coverage. Damage to the seagrass communities, therefore, could result in significant biological and economic impacts. Any impact to the seagrass communities is unacceptable.* *The proposed pipeline route should be sited to avoid all seagrass. Any seagrass located within the proposed route would be directly destroyed through pipeline burial. In addition, entire seagrass communities can be adversely affected when fragmented by pipeline burial. Scars through grassbeds can take up to 10 years to recover if at all. If erosional pathways are created by dredging or vessel use, the entire grassbed could be scoured away.*	alternatives is selected in the ROD, DOE would delineate all seagrass beds within the ROW corridor. In addition, DOE would secure appropriate permits and approvals and design and secure approval for a compensation plan to mitigate the impacts to any SAV. In the final EIS, DOE has updated the discussion of direct and indirect effects from brine disposal on SAV in section 3.7.5 and appendix E. See response 3.7.2.1-1 and 3.7.6.2-8.

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The DEIS states that impacts from construction of the pipeline would include the loss of benthic communities, increased sedimentation in the surrounding area, and increased turbidity in the water column. Previous assessments have shown that suspended sediments can be transported distances greater than 1 mile and partially bury seagrasses. The current status of seagrass communities along the proposed route and within 1 mile of the route should be determined due to their potential to be affected by downstream turbidity and sedimentation.	**[See response 3.7.6.2-8 above]**
Comment D0081-5 (NPS, Gulf Islands National Seashore) *Surface and bottom water current data should be included to define seasonal velocities and direction as well as an analysis of seasonal variations in the potential extent of turbidity plumes and sedimentation. This will assist in assessing the potential impacts as a result of the turbidity plume created by pipeline burial. It will also help determine the potential of creating a new tidal pass which could serve as a source of excess suspended matter for a protracted time.* *To evaluate properly the extent of downstream turbidity and sedimentation, the effectiveness of proposed turbidity control devices needs to be determined. This information is critical in assessing the expected environmental impacts. In addition, a turbidity monitoring program should be conducted during and for a period of time following construction. The program design and time period should be determined by subject-matter experts.*	**Response 3.7.6.2-9** As presented in the EIS, DOE acknowledges in section 3.7.2.1.2 that pipeline construction would create temporary increases in turbidity and sedimentation as a result of offshore pipeline construction. DOE would use appropriate best management practices in accordance with the Section 404 USACE permit, the Section 401 Water Quality Certificate requirements, and the erosion and sediment control plan. DOE would install silt curtains for construction in sensitive areas such as EFH including seagrass beds (section E.5) and conduct monitoring during construction to identify and resolve turbidity and sedimentation problems. See response 3.7.3.1-1.
Comment D0081-10 (NPS, Gulf Islands National Seashore) *Although the DEIS states this impact will be negligible given the overall area of the Gulf, that may not be the case. The brine plume will most likely affect the shallow water areas of the Gulf and not be carried into deeper waters. It is the shallow water areas that are most productive*	**Response 3.7.6.2-10** DOE obtained data from a 1997 survey that describes the local distribution of seagrass in GUIS. This was the most recent data set available. A GIS analysis was conducted to compare the proposed brine disposal ROW with known seagrass beds. The results are

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and serve as the vital nursery areas. Assessing the level of impact to these important and productive nursery areas by using the entire area of the Gulf, much of which is extremely under-productive, is misleading. Given the location of the brine disposal site, localized impacts to GUIS benthic and seagrass resources could be significant.	described in appendix E of the final EIS. DOE has also updated the discussion of direct and indirect impacts from brine disposal on SAV in section 3.7.5 and appendix E. See responses 3.7.6.2-8 and 3.7.5.2-4.

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Comment D0079-26 (Dow Chemical Company) *The EIS needs to fully evaluate the socioeconomic impact of locating the new SPR facility in currently hurricane devastated states (Louisiana and Mississippi).* **Comment D0079-27 (Dow Chemical Company)** *The EIS needs to fully evaluate the potential benefit from locating the new SPR facility in the recently devastated hurricane states of Louisiana and Mississippi by locating it in a state that has many new low income populations.* **Comment D0079-34 (Dow Chemical Company)** *Dow cites Testimony for a discussion of the well known devastation caused by the recent hurricanes to the states of Louisiana and Mississippi. Everything else being equal, there would be a greater societal value for the funding and jobs associated with the new SPR facility to be located in Louisiana or Mississippi than Texas. This aspect of the Socioeconomics needs to be carefully and fully evaluated*	**Response 3.8-1** DOE acknowledges that the 2005 hurricanes dramatically affected the regions of influence for proposed SPR facilities assessed in this EIS, and that jobs in affected areas would be a substantial and positive economic benefit. The EIS considers the effects of the 2005 hurricanes on the regions of influence when analyzing the potential impacts of SPR expansion. SPR employment and income effects are recognized as positive economic benefits, and economic development is a goal of all regions of influence evaluated in this EIS.

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by the EIS.	**[See response 3.8-1 above]**
Comment D0021-7 (Brazoria County Commissioner) *I also understand that Bryan Mound was removed from consideration because it did not have adequate capacity for expansion and that the plans for Stratton Ridge would include facilities to off load foreign crude in Texas City and bring the oil in through pipeline. So it seems this would not even benefit Port Freeport.*	**Response 3.8-2** DOE acknowledges that the beneficial effects of the various potential facilities, pipelines, and other infrastructure would vary by community. The location of a terminal in any of the identified potential locations would not necessarily provide a major economic benefit to nearby communities. DOE also acknowledges that the terminal associated with the Stratton Ridge site would go into Texas City, and therefore, would not provide substantial economic benefit to Port Freeport.
Comment D0017-1 (Charlie Singletary, individual) *I oppose the DOE selecting the Stratton Ridge Site in Texas. I feel this will eliminate jobs in Brazoria County. I'm not opposed to having more oil for reserve, just not in Brazoria County.* **Comment D0021-5 (Brazoria County Commissioner)** *At a time when the chemical industry is struggling with high energy and feedstock costs and high construction costs this waste of Stratton Ridge salt and concern of government taking of critical property could further affect the decisions of industry in this area to locate new plants here and perhaps even negatively affect business decisions for investments to support current operations.* **Comment D0021-6 (Brazoria County Commissioner)** *The 40 or so jobs created for managing the SPR site could jeopardize literally thousands of direct chemical industry jobs and thousands of indirect jobs.* **Comment D0021-3 (Brazoria County Commissioner)** *The SPR uses underground salt formations as the basis for their oil storage operations. For their purposes they remove the salt and*	**Response 3.8-3** DOE agrees that use of the Stratton Ridge site for SPR purposes may result in adverse socioeconomic effects if Dow Chemical Company cannot access and use the Stratton Ridge salt resource as it currently envisions, or if SPR operations precluded use of the site for natural gas storage. Text of the EIS has been clarified to further disclose potential socioeconomic issues and effects to existing segments of the economy from SPR development at Stratton Ridge. See also the land use discussion in section 3.6 of the EIS and response 3.3-1 for further context on this topic. For more information on the economic value of the salt lost through SPR cavern development, see response 5-1 and section 5.3.

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discharge it into the ocean. Placing the SPR at Stratton Ridge would waste salt that the chemical industry could use to make useful products in the future. The DoE time line to remove the salt from the salt dome and other operational considerations would not allow this salt to be used to maker products and thus would be wasted. As I understand it the other sites under consideration do not have co-located salt based production facilities, so the salt wasted into the ocean isn't salt that can be made into useful products, as can the salt at Stratton Ridge. **Comment D0021-1 (Brazoria County Commissioner)** *The Brazosport area and all of Brazoria County has a great stake in this decision, thousands of jobs are enabled because of the salt the chemical industry mines at Stratton Ridge. Industry uses this salt to produce products that used locally by other businesses as well as shipping these products all over Texas, the U.S. and the world.* **Comment D0050-1 (D.L. Vaughn, individual)** *I am not opposed to more oil reserves. I am opposed to having them in Brazoria County, Texas as I feel that using the underground storage facility at Stratton Ridge will be detrimental to our local economy. I am afraid that it will cause local jobs to be lost over the long term.* **Comment D0054-1 (Jeanette Bumpers, individual)** *As a concerned citizen of Brazoria County, I am asking you not to choose Stratton Ridge as the location of the petroleum reserve. This will completely ruin the lives of so many people and the future economy of this area. Please choose one of the locations that is more receptive to this project. This decision would be very devastating to the 6,000 employees of Dow Chemical and their families. This would effect every business in Brazoria County and leave this area extremely depressed.*	**[See response 3.8-3 above]**

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<tr><th>COMMENT</th><th>RESPONSE</th></tr>
<tr><td colspan="2">3.8 Socioeconomics</td></tr>
<tr><td>Comment D0076-1 (Bill Logan, individual)
We in the Brazoria County, TX, area are concerned that the plan to take over Dow's Stratton Ridge facilities would do a great deal of harm to our economy. According to an editorial in The Facts, the people near the proposed Mississippi sites are generally in favor of having storage facilities there.

Comment D0079-12 (Dow Chemical Company)
Simply put: Texas Operations competes with chemical and plastic producers from around the world. We already have a competitive disadvantage due to high energy and feedstock prices on the Gulf Coast. The Dow Texas Operations site could lose its global competitiveness completely if the SPR expansion site is located at Stratton Ridge.

But not only potential new investment would be in jeopardy. These same factors would also negatively affect business decisions for investments to support current operations.

The future of Dow Texas Operations is dependent upon the willingness of Dow 1) to continue to make investments in new products, 2) to continue to make the products we make today and 3) to improve the site's energy efficiency and sustainability. Without such investments, manufacturing facilities like ours may cease to be viable and ultimately be shutdown.

We understand that 100 or so jobs might be created for managing the SPR site. However, placing our Freeport site in further economic jeopardy would literally put thousands of high-wage manufacturing jobs, as well as thousands of additional jobs in our community, at risk.</td><td>[See response 3.8-3 above]</td></tr>
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Comment D0079-13 (Dow Chemical Company) *The Board of The Economic Development Alliance for Brazoria County unanimously passed the attached resolution opposing expansion of the Strategic Petroleum Reserve at Stratton Ridge in our meeting of June 12, 2006 for the following reasons:* *1. The SPR uses underground salt formations as the basis for their oil storage operations. For their purposes they remove the salt and discharge it into the ocean. Placing the SPR at Stratton Ridge would waste salt that the chemical industry could use to make useful products in the future. The DoE time line to remove the salt from the salt dome and other operational considerations would not allow this salt to be used to make products and thus would be wasted. As I understand it, the other sites under consideration do not have co-located salt based production facilities, so the salt wasted into the ocean isn't salt that can be made into useful products, as can the salt at Stratton Ridge.* *2. There is also concern over the government taking of Stratton Ridge property and perhaps even closure of Stratton Ridge Road. We have experienced this sort of thing in the past, and it runs contrary to everything America stands for.* *3. At a time when the chemical industry is struggling with high energy and feedstock fuel costs and high construction costs, this waste of Stratton Ridge salt and concern over the government commandeering private property could dissuade industry from locating new jobs in the area and it may even negatively affect business decisions to make any further investments in support of current operations.* *4. The 40 or so jobs created for managing the SPR site could jeopardize literally thousands of direct chemical industry jobs and four to eight times that many of indirect jobs with contractors and suppliers.* *5. We also understand that Bryan Mound was removed from*	**[See response 3.8-3 above]**

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consideration because it did not have adequate capacity for expansion and that the plans for Stratton Ridge would include facilities to off-load foreign crude in Texas City and bring the oil in through pipeline. So it seems this would not even benefit Port Freeport. **Comment D0079-19 (Dow Chemical Company)** *Dow officials have said thousands of jobs could be lost if the Strategic Petroleum Reserve chooses the Stratton Ridge site. Even more than that, Dow Chemical is intrinsically connected with other industry in the area and with community service and charitable giving.* **Comment D0079-20 (Dow Chemical Company)** *We urge the department also to consider non-environmental impact in the form of possible economic peril to the site chosen, and we urge area residents to make themselves heard on the matter before the comment period ends on July 10.* **Comment D0079-21 (Dow Chemical Company)** *The EIS needs to fully evaluate the potential diversion of over one and a quarter billion barrels of brine, containing valuable chlorine, form the US economy and wasting this diverted brine into the Gulf of Mexico.* **Comment D0079-36 (Dow Chemical Company)** *RESOLUTION NO. R-06-516* *RESOLUTION OF THE CITY OF LAKE JACKSON, TEXAS, INOPPOSITION TO A STRATEGIC PETROLEUM RESERVE ATSTRATTON RIDGE*	**[See response 3.8-3 above]**

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WHEREAS, it is understood that the Energy Policy Act of 2005 directs the Secretary of Energy to fill the Strategic Petroleum Reserve to its one billion barrel capacity, and this will require the Department of Energy to expand the Strategic Petroleum Reserve, such plans to include adding one new storage site, and *WHEREAS, Stratton Ridge, Texas is one of the new sites being considered from the group of sites previously assessed in the Draft Environmental Impact Statement, and Stratton Ridge is located within Brazoria County, Texas, and* *WHEREAS, the proposal to locate a Strategic Petroleum Reserve storage operation at Stratton Ridge, Texas would have an adverse affect on the area's chemical manufacturing industry which constitutes the very foundation of the economy of South Brazoria County with over five thousand direct jobs and as many as four to eight times that number of indirect jobs among contractors and suppliers; and* *WHEREAS, the City of Lake Jackson and other cities in Southern Brazoria County would be harmfully affected by expansion of the Strategic Petroleum Reserve at Stratton Ridge, Texas, since much of the annual revenue for the cities flows from the Chemical Manufacturing Industries; and* *WHEREAS, the expansion of the Strategic Petroleum Reserve at Stratton Ridge would create virtually no significant economic benefit that could conceivably compensate for the potential harm it would do the local economy; and* *WHEREAS, the Department of Energy has other options to meet its mandated expansion of the Strategic Petroleum Reserve capacity;*	**[See response 3.8-3 above]**

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NOW, THEREFORE, BE IT RESOLVED, that the Council of the City of Lake Jackson, Texas hereby opposes said location of a Strategic Petroleum Reserve at Stratton Ridge, Texas. *APPROVED AND ADOPTED by the Council of the City of Lake Jackson, Texas, this 3rd day of July, 2006.City of Lake Jackson, Texas City Secretary.*	**[See response 3.8-3 above]**
Comment D0092-2 (David Stedman, Economic Development Alliance) *Whereas, the proposal to locate a Strategic Petroleum Reserve storage operation at Stratton Ridge, Texas, would have an adverse effect on the area's chemical manufacturing industry which constitutes the very foundation of the economy of South Brazoria County with over 5,000 direct jobs and as many as four to eight times that number of indirect jobs among contractors and suppliers; Whereas the expansion of the Strategic Petroleum Reserve at Stratton Ridge would create virtually no significant economic benefit that could conceivably compensate for the potential harm it would do to the local economy;*	
Comment D0095-1 (Donald Payne, Brazoria County Commissioner) *Whereas, Stratton Ridge, Texas, is in Brazoria County, Texas; and Whereas, the proposed location of a Strategic Petroleum Reserve storage operation is Stratton Ridge, Texas -- would have an adverse effect on the area's chemical manufacturing industry and related jobs and thus the area's new economic base would be adversely affected; Whereas, the Department of Energy has other options to meet its mandated expansion of the Strategic Petroleum Reserve capacity.*	

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Comment D0095-3 (David Payne, Brazoria County Commissioner) *And on a personal note, before I was elected in 2001, I worked for Dow for 22 years, and ten of those years were in a chlorine plant. And I know the need of the brine for the -- for the chlorine operations. And I'm actually surprised when Bob stood up here and said it would only affect 50 percent of the people out there. I figured it would be more than that because at all of the other plants -- or a lot of the other plants tie in to chlorine.* **Comment D0104-2 (Cindy Suggs, individual)** *I'm not sure how strategic it is when the entire economic viability of the region would be at risk. I formerly worked for Dow, and realize that as Dow goes, so goes our communities. If Dow cannot get the raw materials it needs for its key processes, it will be forced to build overseas - much of which they are already doing.* *That in turn costs thousands of jobs, including Dow employees, vendors, contractors, medical professionals, local stores, etc. The Brazosport area would cease to exist.* *I understand there are other sites being looked at. It makes sense to me to look at those (such as Damon) that are not directly tied to the entire economic livelihood of tens of thousands of people.* **Comment D0109-1 (Bernice Bilich, individual)** *Please ask Energy Secretary Bodman to choose a site other than Stratton Ridge to store 160 million barrels of oil. This procedure would have an extremely negative impact on Dow Chemical Company.*	**[See response 3.8-3 above]**

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<tr><th>COMMENT</th><th>RESPONSE</th></tr>
<tr><td colspan="2">3.8 Socioeconomics</td></tr>
<tr><td>Dow Chemical is important to Brazoria County. Besides the jobs it supplies, the company is very involved in the total community, as are its employees.

Comment D0110-1 (Brazosport Area Chamber of Commerce)
The Brazosport area and all of Brazoria County has a great stake in this decision. Thousands of jobs are enabled because of the salt the chemical industry mines at Stratton Ridge. Industry uses this salt to produce products that are used locally by other businesses as well as shipping these products all over Texas, the U.S. and the world.

On behalf of the Board of Directors of the Brazosport Area Chamber of Commerce, of Brazoria County, we do not support the use of Stratton Ridge for the expansion of the SPR for the following reasons:

5) The SPR uses underground salt formations as the basis for their oil storage operations. For their purposes they remove the salt and discharge it into the ocean. Placing the SPR at Stratton Ridge would waste salt that the chemical industry could use to make useful products in the future. The DoE time line to remove the salt from the salt dome and other operational considerations would not allow this salt to be used to make products and thus would be wasted. As we understand it the other sites under consideration do not have co-located salt based production facilities, so the salt wasted into the ocean isn't salt that can be made into useful products, as can the salt at Stratton Ridge.

6) There is also concern over government taking of Stratton Ridge property and perhaps even closure of Stratton Ridge Road. We have local experience on the use of eminent domain by the Government.

7) At a time when 'the chemical industry is struggling with high energy and feedstock costs and high construction costs, this waste of Stratton Ridge salt and concern of government taking of critical property could</td><td>[See response 3.8-3 above]</td></tr>
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3.8 Socioeconomics	
further affect the decision of industry in this area to locate new plants here and perhaps even negatively affect business decisions for investments to support current operations. *8) The 40 or so jobs created for managing the SPR site could jeopardize literally thousands of direct chemical industry jobs and thousands of indirect jobs.* *We also understand that Bryan Mound was removed from consideration because it did not have adequate capacity for expansion and that the plans for Stratton Ridge would include facilities to off load foreign crude in Texas City and bring the oil in through pipeline. So it seems this would not even benefit Port Freeport.*	**[See response 3.8-3 above]**
Comment D0077-15 (EPA Region 6) *Pages 3-293 to 3-299, Section 3.8.2, Affected Environments: The FEIS should disclose if the construction and operational employment figures, if any, for the Anchorage, Liberty and Texas City tank farms are internalized with the data for the Bruinsburg, Richton and Stratton Ridge proposed sites, respectively.* **Comment D0077-16 (EPA Region 6)** *Pages 3-299 to 3-303: Section 3.8.3, Impacts: Are the construction and operational employment figures, if any, for the Anchorage, Liberty and Texas City tank farms internalized with the data for the Bruinsburg, Richton and Stratton Ridge proposed sites, respectively?*	**Response 3.8-4** Tables 3.8.3-1 and 3.8.3-2 present peak construction employment and immigration for each alternative. Those peaks are based on current site plans. By focusing on the peak employment, maximum potential effects can be identified. Beyond the site construction and pipeline construction activities that occur in the peak construction employment years, additional employment would be associated with offsite facilities before and following peak employment. The EIS text has been modified to discuss the projected offsite facility employment needs before and following peak construction years. Before the peak construction years, DOE would construct the RWI systems, which would require an estimated average of 50 construction employees. For the Bruinsburg, Richton, or Stratton Ridge alternatives, after the peak construction years, DOE would build terminal facilities which would require an average of about 50 construction employees per terminal. Thus, tables 3.8.3-1 and 3.8.3-2 and associated conclusions remain

COMMENT	RESPONSE
3.8 Socioeconomics	
[See comment D0077-16 text above]	accurate.

COMMENT	RESPONSE
3.9 Cultural Resources	
Comment D0001-1 (NPS, Natchez Trace Parkway) *The Natchez Trace Parkway was authorized by Congress May 18, 1938. The Parkway is an elongated park of 51,150 acres covering a distance of 444 miles in Mississippi, Alabama, and Tennessee between Natchez, Mississippi, and Nashville, Tennessee. The purpose, as set forth by Congress, of the Parkway is to provide and maintain a scenic and recreational motor road commemorating the historic Old Natchez Trace and to provide access to significant natural and cultural resources. The Natchez Trace Parkway is characterized by numerous prehistoric Indian mounds and Chickasaw village sites, a military road associated with General Jackson's famous victory over the British at New Orleans, and its historic sites associated with the westward expansion of the British Colonies and the United States from 1763 - 1898.* *As one of the four nationally recognized rural parkways, the Natchez Trace Parkway, in its entirety, is eligible for the National Register of Historic Places as a designed cultural landscape and as a tribute to Landscape Architectural design and road way engineering partnerships at their best.* *The Parkway is presently not authorized to grant an easement or right-of-way (ROW) for either pipeline crossing through Parkway land in accordance with Director's Order 53. The proposed pipelines would require a Congressional authorization being as there is no current deed reservation for the use of US Government land for this purpose in either location.*	**Response 3.9-1** As indicated in section 3.9.1.1 of the EIS, pipeline routes were not addressed in detail in the initial record search for historic properties. As explained in that section, DOE is entering into programmatic agreements with the SHPO of each state where proposed new and expansion sites are under consideration. Appendix K contains copies of these agreements. Under the terms of those programmatic agreements, DOE would identify historic properties in areas, including pipeline routes and other associated facilities, potentially affected by development under the selected alternative, apply the criteria of effect, and resolve adverse effects. While DOE would attempt to locate power line and pipeline routes in existing utility ROWs to avoid new impacts, resolution of adverse effects could include pipeline or power line reroutes, if necessary. The information provided by the commenter will be useful to the archeologists and historians in the identification and evaluation effort, if one of the Bruinsburg alternatives is selected.

COMMENT	RESPONSE
3.9 Cultural Resources	
Assuming that authorization is granted, a right-of-way cannot be approved at this level and would require approval by the Southeast Regional Director. Right-of-ways are not given freely and are scrutinized very closely by the National Park Service (NPS). Moreover, the NPS has a Congressional mandate to manage NPS lands in a manner that will not result in derogation of the values and purposes for which the park was established. It would be difficult, and perhaps impossible, to explain the relationship between the proposed development and the purpose and values for which the Parkway was established. **Comment D0001-2 (NPS, Natchez Trace Parkway)** *Based on your description of the proposed pipeline alignments, it would appear that the crossing near Milepost 73 is being routed directly through the historic Dillon Plantation, which is eligible for the National Register of Historic Places. The Dillon Plantation is rich in Civil War history associated with the Battle of Raymond, siege of Vicksburg, and the Battle of Jackson. The entire property has been determined to be eligible for listing in the National Register of Historic Places due to its association with those important Civil War battles which had a significant impact on the outcome of the Civil War. The 470-acre property is owned in fee by the National Park Service and is within the authorized boundary of the Natchez Trace Parkway.* *The Natchez Trace Parkway was created by Congress to commemorate the Historic Old Trace. Approximately 500 feet of Old Trace, listed on the National Register of Historic Places, is interpreted within the present boundary of the Parkway near Dean's Stand. Another 8,000 feet of Historic Old Natchez Trace/Port Gibson-Raymond Road is located on the Dillon Plantation. The Old Natchez Trace was used as a military corridor for transportation of troops and supplies during the*	**[See response 3.9-1 above]**

COMMENT	RESPONSE
3.9 Cultural Resources	
Civil War and the Historic Old Natchez Trace/Port Gibson-Raymond Road is an integral link to interpreting the historical military strategies of the of the Battle of Raymond, the Battle of Jackson, and the eventual siege of Vicksburg by General US Grant. General U.S. Grant and General W.T. Sherman's headquarters during three area battles is located on the property. *The crossing near Natchez appears that it could adversely impact Emerald Mound or Mount Locust and it would likely adversely impact segments of the historic Old Trace that runs throughout this section, all listed on the National Register of Historic Places.* *Emerald Mound, located near milepost 10.3 on the Natchez Trace Parkway, is a very impressive prehistoric Natchez Indian ceremonial mound. The mound covers nearly eight acres and is the third largest Indian mound of any type and the second largest ceremonial mound in the United States. The mound was constructed and used during the Mississippian period, approximately A.D. 1300-1600. Two secondary mounds are located on either end of the mound top. Archaeological evidence indicates that six tertiary mounds were built between the secondary mounds. All of the secondary and tertiary mounds probably supported wooden ceremonial structures. Emerald Mound is on the List of Classified Structures (LCS) and has been designated a National Historic Landmark.* *Mount Locust (1780-1820) is one of the oldest dwellings in the state of Mississippi, the only extant stand/inn along the Old Natchez Trace, and the only historic Park building open for visitation where interpretation of Old Trace and its significances are interpreted. Mount Locust functioned as both an inn and a plantation. It is also the only existing inn, among more than fifty, that operated along the Old Natchez Trace. Under Section 110 of the National Historic Preservation Act, the*	**[See response 3.9-1 above]**

COMMENT	RESPONSE
3.9 Cultural Resources	
Natchez Trace Parkway is mandated to identify, evaluate and protect historic properties eligible for listing on the National Register of Historic Places. **Comment D0114 – 3 (NPS, Natchez Trace Parkway)** *Please be aware that the entire areas under consideration for your construction activities could be archeologically sensitive and could require extensive mitigation as well.* **Comment D0114 – 5 (NPS, Natchez Trace Parkway)** *As one of the four nationally recognized rural parkways, the Natchez Trace Parkway, in its entirety, is eligible for the National Register of Historic Places as a designed cultural landscape and as a tribute to Landscape Architectural design and road way engineering partnerships at their best.* **Comment D0114 – 6 (NPS, Natchez Trace Parkway)** *As we stated in our June 02, 2006 correspondence, based on your description of the proposed pipeline alignments, it would appear that the crossing near Milepost 73 is being routed directly through the historic Dillon Plantation, which is eligible for the National Register of Historic Places. Approximately 500 feet of Old Trace, listed on the National Register of Historic Places, is interpreted within the present boundary of the Parkway at Dean's Stand near Milepost 73.* *The crossing near Natchez, Mississippi appears that it could adversely impact Emerald Mound or Mount Locust and it would likely adversely impact segments of the historic Old Trace that runs throughout this section, all listed on the National Register of Historic Places.*	**[See response 3.9-1 above]**

COMMENT	RESPONSE
3.9 Cultural Resources	
Comment D0077-17 (EPA Region 6) *Page 3-305, Section 3.9.1.1, Identification of Historic Properties: Was the Louisiana State Historic Preservation Office aware that the crude oil pipeline could run from Bruinsburg to the Anchorage tank farm? There are a number of national and state recognized historic sites in the general area of the proposed route of the pipeline (East Feliciana, West Feliciana and East Baton Rouge parishes).*	**Response 3.9-2** DOE is not familiar with the details regarding the record search conducted by the Louisiana SHPO. Nevertheless, if one of the Bruinsburg alternatives is selected, DOE would identify historic properties located along the crude oil pipeline route, apply the criteria of effect, and resolve adverse effects to properties in Louisiana in consultation with the Louisiana SHPO under the terms of a programmatic agreement as described in response 3.9-1.

COMMENT	RESPONSE
3.10 Noise	
Comment D0077-18 (EPA Region 6) *Page 3-324, Section 3.10.2.2, Operation and Maintenance Impacts: Were the noise impacts associated with the pumping station west of Columbia, MS, along the Richton to Liberty crude oil pipeline analyzed and included in the Richton data?*	**Response 3.10-1** DOE acknowledges that the draft EIS did not discuss the noise impacts associated with the operation and maintenance of the intermediate pumping station on the Richton-to-Liberty Station crude oil pipeline. DOE has analyzed this issue and found that any noise impact from operating the pumping station would be negligible. While the pumping station would be located about 300 feet (91 meters) from the closest apparent residence, the pump would be located in a pump house with noise shielding. No other residences appear to be located within 600 feet (180 meters) of where the pump would be located, and the pump would be operated only when oil is being transferred through the pipeline.

COMMENT	RESPONSE
3.11 Environmental Justice	
Comment D0079-7 (Dow Chemical Company) *The Draft EIS notes that there are "Native Hawaiian or Other Pacific Islander populations" in the Stratton Ridge, TX area. Dow is unaware*	**Response 3.11-1** Table 3.11-1 presents the potential environmental justice populations for each proposed new or expansion site based on U.S. Census Bureau data. These data are presented in more detail in appendix J. The EIS

COMMENT	RESPONSE
3.11 Environmental Justice	
of any such local populations.	identifies the presence of a potential environmental justice population for the minority census category "Native Hawaiian or Other Pacific Islander" for only the Richton, MS, storage site, not the Stratton Ridge, TX, site.
Comment D0079-35 (Dow Chemical Company) *Dow cites Testimony for a discussion of the well known devastation caused by the recently devastated hurricanes states of Louisiana and Mississippi. There are many newly low-income people created in Louisiana and Mississippi. While Environmental Justice has historically focused solely on the adverse effect of the proposed project, Dow suggests that DoE takes a larger view of Environmental Justice and weighs the good locating a project in a devastated area can cause relative to locating the project in another location. If the beneficial aspects of locating the new SPR facility in Mississippi or Louisiana outweigh the harm, Dow suggests that the Environmental Justice aspect of the EIS be weighed in favor of locating the new SPR facility in Mississippi or Louisiana. This project may well be one that has a positive overall impact from the location, from an Environmental Justice perspective.*	**Response 3.11-2** Implementation of the alternatives (other than the no action alternative) generally would provide a positive economic benefit to populations in any of the potential site locations, including Louisiana and Mississippi. DOE evaluated socioeconomic benefits in section 3.8 of the EIS. DOE expects the positive socioeconomic benefits to extend to the entire community, regardless of race, income, or national origin. Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, does not require analysis of positive impacts, only "disproportionately high and adverse human health or environmental effects"; therefore, the benefits to potential environmental justice populations are not analyzed in this context.

COMMENT	RESPONSE
4. Cumulative Impacts	
4.1 Methodology	
Comment D0077-19 (EPA Region 6) *Page 4-2, Section 4.2, Methodology: There are other Gulf Coast area natural gas pipeline and storage projects regulated by FERC that are not-directly associated with LNG terminals that should be considered in Table 4.2-1 and the potential cumulative impacts analysis.*	**Response 4.1-1** Table 4.2-1 in the draft EIS incorrectly indicated that DOE had only reviewed LNG terminal projects regulated by FERC. DOE's review of FERC projects actually included LNG terminals (development projects), pipelines, and facility alterations. In the EIS, table 4.2-1 has been corrected to indicate the full range of FERC projects reviewed by DOE.

COMMENT	RESPONSE
4. Cumulative Impacts	
4.2 General Cumulative Impacts	
Comment D0073-11 (NOAA Fisheries) *4.0 Cumulative Impacts* *Pages 4-1 through 22. No information is provided in this section related to the cumulative impacts to NMFS trust resources that would be caused by implementation of each of the three alternatives considered to expand SPR storage capacity by 273 MMB. While Section 3.0 of the DEIS quantifies impacts to various categories of habitat that would result at each expansion site, the three alternatives being considered include expansion activities at various combinations of sites. To allow for a side-by-side comparison of the cumulative impacts to various categories of wetlands and EFH that would result from each alternative, this section should be revised to include a summary quantification of impacts to EFH and dependent fishery resources.*	**Response 4.2-1** Chapter 4 Cumulative Impacts provides information on the cumulative impacts on NOAA Fisheries trust resources (EFH) by proposed new or expansion sites. To clarify the cumulative impacts by alternative, DOE has updated section 4.2, table 4.2.7-1, which provides a side-by-side comparison of the alternatives.
Comment D0113-2 (Sierra Club, Houston Regional Group) *The HSC is concerned that cumulative impacts have not been adequately covered in the SPRE DEIS. There is insufficient documentation in the DEIS of cumulative impacts, including direct, indirect, secondary, and connected impacts of past, present, and foreseeable future actions. Yet the NEPA and the CEQ require that analysis, assessment, and evaluation of cumulative impacts be conducted. Please see Chapters 1502.76, 1508.7, and 1508.8 of the CEQ regulations which are binding on all federal agencies to implement. The DOE does not include in its cumulative impacts analysis all past actions.* *At minimum, an adequate cumulative effects analysis must:* *1) Identify the past, present, and reasonably foreseeable actions of*	**Response 4.2-2** DOE completed the cumulative impact analysis in accordance with CEQ implementing regulations (40 CFR Parts 1500 to 1508) and guidance (CEQ 2005). The draft EIS describes past actions, and DOE identifies the present and reasonably foreseeable future actions as described in section 4.2. Based on the current information about the past, present, and reasonably foreseeable future projects, DOE provided quantitative information on the cumulative impacts or stated that such information was not available. In the cumulative impact analysis, DOE stated which site expansion or new site development would result in cumulative impacts and defined the specific resources that would be affected. DOE described the

COMMENT	RESPONSE
4. Cumulative Impacts	
4.2 General Cumulative Impacts	
DOE and other parties affecting each particular aspect of the affected environment *2) Must provide quantitative information regarding past changes in habitat quality and quantity, water quality, resource values, and other aspects of the affected environment that are likely to be altered by DOE actions* *3) Must estimate incremental changes in these conditions that will result from DOE actions in combination with actions of other parties, including synergistic Effects* *4) Must identify any critical thresholds of environmental concern that may be exceeded by DOE actions in combination with actions of other parties* *5) Must identify specific mitigation measures that will be implemented to reduce or eliminate such effects* *Please also see the CEQ's January 1997 document, "Considering Cumulative Effects Under the National Environmental Policy Act." It is clear that the DOE has an affirmative duty, a statutory duty, and a regulatory duty to carry out cumulative impacts assessment.*	conceptual mitigation plan that would be used to mitigate for adverse impacts to wetlands and threatened and endangered species. DOE also provided mitigation measures that would be used to mitigate for impacts to water resources, fish and wildlife resources, migratory birds, special status areas, invasive species, and EFH. In addition, DOE stated that after the selection of an alternative, additional mitigation measures for cumulative impacts would be developed through the regulatory permit or consultation process. The cumulative impacts analysis includes the potential synergistic effects of DOE actions in combination with past, present, and reasonably foreseeable projects. Regarding specific mitigation measures, see response 3.7.2.1-3.
Comment D0113-3 (Sierra Club, Houston Regional Group) *Examples of where the DOE is deficient in determining cumulative impacts include but are not limited to:* *1) The DOE does not examine the cumulative impacts due to the U.S. Amy Corps of Engineers not implementing Section 404 as required by the Clean Water Act.* *2) The DOE does not examine the cumulative impacts due to the Intercoastal Waterway (for instance the continued loss of wetlands due*	**Response 4.2-3** It would be unreasonable to assume in the EIS that another agency would fail to meet its obligations under the law without any evidence of that behavior. The action proposed by DOE would not increase the width of the ICW or result in a long-term increase in boat traffic; therefore, DOE did not analyze such cumulative impacts on the ICW.

COMMENT	RESPONSE
4. Cumulative Impacts	
4.2 General Cumulative Impacts	
to the widening of the Intercoastal Waterway via boat wakes). *3) The DOE does not examine the cumulative impacts due to implementation or lack of implementation of Federal Emergency Management Administration's floodplain and storm surge regulations and development in the 100 year floodplain and the hurricane storm surge areas.* *4) The DOE does not list all Federal Highway Administration, Texas Department of Transportation, Brazoria County, and Brazoria County cities actions (projects) and discuss in detail the cumulative impacts they have on Columbia Bottomlands forested wetlands and other sensitive environmental receptors.*	As stated in section 4.2, DOE reviewed actions and permit activities undertaken by or under the jurisdiction of USACE, FERC, State Transportation Improvement Programs, city and county governments, and projects carried out with Coastal Wetlands Planning, Protection and Restoration Act funding. State Transportation Improvement Programs and city and county governments include the relevant transportation projects that could have a potential cumulative impact with DOE's proposed action.
Comment D0077-2 (EPA Region 6) *Page 1-3, Section 1.4.2.1, Summary of Scoping: The response to the scoping comment regarding cumulative impacts that the Stratton Ridge LNG project is not going forward is incorrect. Freeport LNG is actively pursuing the development of a 7.5 bcf underground gas storage facility in the salt dome. Please correct this in the FEIS.* **Comment D0079-1 (Dow Chemical Company)** *In Section 3.2, the DoE says that the concern related to the cumulative and secondary impacts of the SPR expansion presented for increased risk for terrorism or accidents due to the Stratton Ridge facility being close to a proposed bulk liquid natural gas facility are eliminated as there is no longer such a proposal. Dow, as a resident in the local area, having contracted to receive a significant part of the LNG from that facility and an investor in the Freeport LNG facility is already under construction. Ground was broken along time ago and significant construction is on-going. Dow urges DoE to correct this significant mistake in the Draft EIS, relative to the Stratton Ridge potential site and after making this correction, not to under-estimate the impact of*	**Response 4.2-4** DOE has corrected the EIS to describe the current status of Freeport LNG's proposed natural gas storage project and analyze the potential impacts related to the project in sections 3.3.6.2.1 and 4.6.1. Response 4.2-5 presents additional details on the Freeport LNG project.

COMMENT	RESPONSE
4. Cumulative Impacts	
4.2 General Cumulative Impacts	
this initially significant concern when recalculating the relative merits of each potential expansion site.	**[See response 4.2-4 above]**
Comment D0093-1 (Bill Henry, Freeport LNG) *One of the comments I wanted to make is that in your environmental impact statement study it was unclear to me, as I went through it, that you were really considering the fact that there was an LNG plant being built here. Let me assure you that it is. We were -- we had filed for and received our federal regulatory permits back in June of 2004. In August of 2005 we started construction. In January, 2005, we are 18 months into construction. First deliveries through the first phase of our plant will begin at the end of '07 and continue from thereon.* *We have also filed for an expansion of this facility. It's specified in those dockets there. That expansion is to go from 1.5 Bcf of daily capacity to 4 Bcf of daily capacity at the terminal. That was filed in May of 2005. The environmental assessment on that has just been published, and it is on the FERC agenda for July. So, we anticipate getting all the permits for that by the end of this year and -- and then possibly starting construction at the first part of 2007.* *We also have as part of this project a send-out pipeline -- a 42-inch send-out pipeline which goes from Quintana Island to Stratton Ridge. It actually crosses the 40-inch DOE line going to Texas City. That's a high-pressure pipeline. 1250 pounds, MAOP of 1440. So, I want to make sure that if you're going to build another pipeline you be real careful where you put it.* **Comment D0093-2 (Bill Henry, Freeport LNG)** *The second thing that's in our expansion is salt cavern storage wells. We have in our plans to build up to two natural gas salt cavern storage*	**Response 4.2-5** Section 4.6.1 states that Freeport LNG has a natural gas storage facility currently under construction in close proximity to SPR's proposed Stratton Ridge storage facility. Section 4.6.2 of the cumulative impacts chapter has been revised to refer to Freeport LNG's under construction storage project. In addition, all proposed pipeline routes would be surveyed and all existing utilities would be located before initiating construction. Appropriate construction methods would be used for pipeline construction around and near existing infrastructure.

COMMENT	RESPONSE
4. Cumulative Impacts	
4.2 General Cumulative Impacts	
wells as part of our Freeport LNG facility. We have permitted those with the Texas Railroad Commission. They're considered nonjurisdictional by FERC. So, they were permitted by the Texas Railroad Commission. That docket is shown in the -- the material I have given you. So, that -- that's going to happen. It is on the other side about approximately where you pointed. I will send you by E-mail the X and Y coordinates of those particular -- those wells so that you'll be able to consider those in your consideration.	**[See response 4.2-5 above]**
Comment D0093-3 (Bill Henry, Freeport LNG) *Our position is that -- is that we want to make sure that you've considered our operations in any development just like we would be concerned about Dow or anybody else's development therein concerning our operations. One other thing, which I don't know if it was recognized in your environmental impact statement, but because of our first phase and second phase, we would have up to 400 LNG ships a year coming into this port. So, we're going to add fairly considerably to the marine traffic coming in here. We have worked with the Coast Guard. We have received our waterway suitability studies for that number of ships. So, I suggest those are things that you may want to consider as you consider your project with additional ships and crude carriers that would come into the Freeport port.*	**Response 4.2-6** The development and operation of the proposed Stratton Ridge site would not affect shipping in and out of Freeport. The development and operation of the proposed RWI structure would not affect shipments on the ICW and the construction and operation of the offshore brine diffusion system would not affect travel through any shipping lanes.
Comment D0083-9 (Becky Gillette, Sierra Club) *The other -- this other last point that I will make is I don't think that you've adequately considered the cumulative impact. And I had an idea if TV was here tonight, I was going to walk from the back and just go like this (indicating) and say, I surrender. We have four major public hearings this week in this county of major environmental impacts. We have two LNG boards that you want to put right next to the island that you are talking about putting this marine Shell terminal. These two LNG ports are going to have to require a great amount of security around them. I don't know how you are going to get all of these tankers*	**Response 4.2-7** Section 4.5 has been updated to include the DuPont Chemical plant and the proposed new marine Shell terminal. DOE has contacted Chevron, and the company has not announced its intention to expand the refinery. Section 4.5 has been revised to refer to these proposed facilities and evaluate the cumulative impact.

COMMENT	RESPONSE
4. Cumulative Impacts	
4.2 General Cumulative Impacts	
in and out. Two LNG ports, right next door, Chevron Pascagoula Refinery is planning on expanding, doubling the size of their refinery so they would go from being the seventh largest refinery in the country to the third largest refinery in the country. *I just went to a hearing tonight at 6:00 about DuPont Chemical expanding their operations there and bringing in a dangerous chemical that I don't think we need. So I don't think that you've adequately addressed the cumulative impact.*	**[See response 4.2-7 above]**
Comment D0079-29 (Dow Chemical Company) *Second, the adverse impact the potentially increased subsidence, discussed in the Geological and Soil Resources section of these comments, will have on the existing commercial pipeline corridors and their included pipelines caused by locating the new SPR facility on the well developed Stratton Ridge salt dome needs to be evaluated in the Land Use section of the EIS. In making this comparison in the Land Use section of the EIS, DOE needs to have the base case the lesser subsidence caused by the continuation of the existing rate of development of the Stratton Ridge salt dome. If the leached salt continues to be consumed by the nearby chemical facility, the rate of development can be easily calculated.*	**Response 4.2-8** Oil storage caverns are created in salt domes by leaching the salt using solution mining. The salt, which is potentially economically valuable, would be disposed of as brine either through discharge to the Gulf of Mexico or through underground injection. Because the salt would be solution mined and disposed of in a manner that destroys its original economic value, this salt resource would be irreversibly and irretrievably committed to the project and could not be recovered for economic uses. Economic reuse of the salt (e.g., as a raw material in a chemical production process) would be infeasible for several reasons. The brine generated by the solution mining for cavern creation may be too dilute for economic use in chemical processing. Also, a large amount of brine would be generated from cavern development in a relatively short period of time, and the brine would not be generated at a constant rate of flow. Dow Chemical indicated in its comments on the EIS (Comment D0079-11) that the amount of salt in the Stratton Ridge site would be enough to operate its chlorine production plant for 7 years; according to the proposed construction schedule for cavern development DOE would generate this amount of salt brine in less than 5 years at the Stratton Ridge site. Therefore, even if the brine was

COMMENT	RESPONSE
4. Cumulative Impacts	
4.2 General Cumulative Impacts	
[See comment D0079-29 text above]	generated at an economically feasible concentration, it would be difficult for a chemical production process to accommodate the brine because of the high and variable flow rate at which the brine would be generated.

COMMENT	RESPONSE
4. Cumulative Impacts	
4.3 Cumulative Biological Impacts	
4.3.2 Chacahoula	
Comment D0074-4 (USACE-NOLA) *4. All indications suggest that the Chacahoula site is a strong contender for selection. Therefore, the social, economic and environmental impacts should be specifically documented. Every opportunity to minimize impacts incurred by each aspect of the project should be incorporated into the design. As discussed previously, the swamp is a high quality persistently flooded, forested wetland system comprised of muck and mineral muck soils. It provides critical biological support, flood control, water storage, tropical storm buffer, water quality enhancement, recreation. Based on the scope of the project and regional land use trends and demographic patterns in the Morgan City, Houma and Thibodaux area, the cumulative impacts will require thorough analysis. An adequate mitigation project that functionally integrates in to the natural system, is within the watershed (HUC 08090302 - West Central Coastal Louisiana), and that fully compensates all impacted physical, chemical and biological functions, should be in the formulation process.*	**Response 4.3-1** The EIS assesses the social, economic, and environmental impacts associated with Chacahoula alternative. Chapter 2 identifies the mitigation measures that are incorporated into each alternative, while specific mitigation measures are described by resource in chapter 3. DOE has developed a conceptual plan for wetlands impacts for the Chacahoula alternative. A detailed wetlands mitigation plan will be developed after selection of an alternative in the ROD. The cumulative impacts associated with the Chacahoula alternative are presented in section 4.4 of the EIS.

COMMENT	RESPONSE
4. Cumulative Impacts	
4.3 Cumulative Biological Impacts	
4.3.5 Richton	
Comment D0106-6 (USFWS) *Page S-32, CUMULATIVE IMPACTS, paragraph 1. The paragraph concludes by stating that DOE does not expect the cumulative effects to threatened and endangered species to be significant. Operation of the proposed raw water intake on the Leaf River in combination with other major water users on the river could have significant cumulative effects especially during low flow conditions. For example, although the water removed from the Leaf River by the paper mill at New Augusta and the power plant upstream is eventually returned to the River, these facilities frequently hold this water for some time. Unpermitted water removal for other purposes such as irrigation and livestock watering is also greater during low flow conditions. These activities in combination with the operation of the raw water intake could result in significant cumulative, adverse effects.*	**Response 4.3-2** DOE has revised the EIS to state that "DOE does not expect the cumulative effects to threatened and endangered species to be significant for any alternative, except for the Richton alternative, which may have a cumulative adverse effect on the Gulf sturgeon, pearl darter, and yellow-blotched map turtle." This is consistent with DOE's conclusion from other sections of the EIS.

COMMENT	RESPONSE
4. Cumulative Impacts	
4.3 Cumulative Biological Impacts	
4.3.6 Stratton Ridge	
Comment D0077-20 (EPA Region 6) *Page 4- 16, Section 4.8.1 Stratton Ridge Storage Site: The description incorrectly characterizes the Freeport LNG proposal. Freeport LNG intends to create a salt dome cavern storage facility for natural gas post-regasification. It is not an underground storage facility for liquefied natural gas. The cumulative impacts analysis should reflect the Freeport LNG proposed natural gas storage facility as well as the natural gas pipeline from the regasification facility on Quintana Island.*	**Response 4.3-3** See responses 4.2-4 and 4.2-5. The Freeport LNG project has been added to the cumulative impact analysis.

COMMENT	RESPONSE
4. Cumulative Impacts	
4.3 Cumulative Biological Impacts	
4.3.9 West Hackberry	
Comment D0077-21 (EPA Region 6) *Page 4-21, Section 4.1 1.2, West Hackberry Associated Infrastructure: The paragraph incorrectly characterizes the state of LNG terminal and pipeline development in Calcasieu and Cameron parishes. Currently one LNG terminal is operating in Calcasieu Parish and three FERC approved LNG terminals in Cameron Parish are under various stages of development. The operating terminal (Trunkline LNG) has been approved for an expansion. Two of the Cameron Parish terminals have already sought expansion, one of which has been granted by FERC.*	**Response 4.3-4** LNG terminal and pipeline activities in Calcasieu and Cameron Parishes were incompletely referred to in the draft EIS. Section 4.9.2 has been revised to incorporate additional information concerning these facilities and activities.

COMMENT	RESPONSE
4. Cumulative Impacts	
4.4 Cumulative Water Impacts	
4.4.5 Richton	
Comment D0083-4 (Becky Gillette, Sierra Club) *You have as -- as addressed in the EIS, you have all kinds of difficulties, not just with your aquatic resources, but everybody who has a wastewater discharge downriver from that will have less water in which to put their wastewater which causes problems for the municipalities that are discharging that wastewater and also from industrial water users. You may actually have a conflict with Chevron Refinery. There have been times when Chevron Refinery has come very close to not being able to run their refinery because the drought conditions have made the Pascagoula River low. So I would say that that is definitely a conflict of interest there in taking more water out of the Leaf River.***]**	**Response 4.4-1** Section 4.5.3.2 states "DOE determined that the impact of the Leaf River RWI would have a potential adverse effect on the aquatic resources in the Leaf River during drawdown activities. The impact could be mitigated by conditions in the Stream Diversion and Use of Public Waters permit from the Mississippi DEQ and CWA Section 404 permit, which would ensure protection of the Minimum Instream Flow." These permit processes would consider use of Leaf River water by the upstream paper mill and power plant and downstream facilities (including the Chevron refinery), and also would consider unpermitted removal of water for uses such as irrigation and livestock watering, and thus consider cumulative effects of both upstream and downstream water usage. In addition, the EIS acknowledges that there would be a cumulative adverse impact on

COMMENT	RESPONSE
4. Cumulative Impacts	
4.4 Cumulative Water Impacts	
4.4.5 Richton	
[See comment D0083-4 text above]	water resources during drawdown.

COMMENT	RESPONSE
5. Irreversible and Irretrievable Commitment of Resources	
Comment D0079-3 (Dow Chemical Company) *In Chapter 3 (Section 3.3) and Chapter 5, the Draft EIS addresses "Irreversible and Irretrievable Commitment of Resources. While the same amount of salt will be "wasted" regardless of which site is chosen, there is a major and significant difference between Stratton Ridge and the other sites under consideration. As eloquently addressed by Bob Walker and others, Dow has Chlor-Alkali facilities that can constructively use the salt, if mined at a rate and with a quality appropriate to feed our Chlor-Alkali and down stream chemical manufacturing plants. This makes the salt that would be wasted if Stratton Ridge were selected different from the other potential sites. Dow urges DOE not to under estimate this critical difference.* **Comment D0079-21 (Dow Chemical Company)** *The EIS needs to fully evaluate the potential diversion of over one and a quarter billion barrels of brine, containing valuable chlorine, form the US economy and wasting this diverted brine into the Gulf of Mexico.* **Comment D0021-3 (Brazoria County Commissioner)** *The SPR uses underground salt formations as the basis for their oil storage operations. For their purposes they remove the salt and discharge it into the ocean. Placing the SPR at Stratton Ridge, would waste salt that the chemical industry could use to make useful products in the future. The DoE time line to remove the salt from the salt dome*	**Response 5-1** With respect to the potential economic value of the salt that would be lost through cavern development, the Stratton Ridge site differs from the other proposed new and proposed expansion sites. The Dow Chemical Company uses salt from the Stratton Ridge salt dome in chemical manufacturing. The economic value of the salt that would be removed from the dome through SPR development and brine disposal would not be available for use as a raw material in chemical manufacturing. Although the economic value of a given amount of salt is theoretically the same for any of the new and expansion sites, the other sites do not have existing infrastructure in place to use the salt, and such infrastructure would need to be constructed to realize the economic value of the salt; therefore, the potential to realize the economic value of the salt is lower for the other sites than for the Stratton Ridge site. DOE has added this information to the assessment of Irreversible and Irretrievable Commitment of Resources in chapter 5, section 5.3. See also response 3.3-1.

COMMENT	RESPONSE
5. Irreversible and Irretrievable Commitment of Resources	
and other operational considerations would not allow this salt to be used to maker products and thus would be wasted. As I understand it the other sites under consideration do pnot have co-located salt based production facilities, so the salt wasted into the ocean isn't salt that can be made into useful products, as can the salt at Stratton Ridge	**[See response 5-1 above]**

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