

## Chapter 4. Cumulative Impacts

### 4.1 INTRODUCTION

This section of the draft 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 ( <a href="http://www.lacoast.gov">www.lacoast.gov</a> ) (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

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, Clovelly, Bruinsburg
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**

<b>SPR Site and Associated Facilities</b>	<b>Number of Projects Resulting from County/Parish Level Screen</b>	<b>Number of Projects Resulting from Intermediate Stage Screen</b>	<b>Number of USACE Projects on Shortlist</b>
Bruinsburg	8	10	13
Chacahoula	37	7	7
Clovelly	12	6	6
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	338	260+	173

**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, NMFS, NRCS, and USFWS. The Web site for Louisiana Coastal Wetlands Planning, Protection and Restoration Act work ([www.lacoast.gov](http://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, Chacahoula, and Clovelly.

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**

<b>SPR Site and Associated Facilities</b>	<b>Number of Projects Resulting from Basin Level Screen</b>	<b>Number of Projects Resulting from Intermediate Stage Screen</b>	<b>Number of Projects on Shortlist</b>
Chacahoula & Clovelly	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**

<b>State Transportation Improvement Programs</b>	<b>SPR Sites and Associated Infrastructure</b>
Louisiana, 2005–2007	Bruinsburg; Chacahoula; Clovelly; Covelly-Bruinsburg; 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**

<b>SPR Site and Associated Facilities</b>	<b>Number of Projects Resulting from County/Parish Level Screen</b>	<b>Number of Projects Resulting from Intermediate Stage Screen</b>	<b>Number of Projects on Shortlist</b>
Bruinsburg	30	8	8
Chacahoula	6	2	0
Clovelly	2	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	90	25	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-kilometer) spatial region of influence of the proposed new SPR storage sites in Bruinsburg, MS; Chacahoula, LA; Clovelly, 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; 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 Clovelly site and 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 or two new SPR sites plus two or three expansion sites.

### 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 draft 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.

Known Activity	Description
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 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 464 acres (188 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 464 acres (188 hectares) to 687 acres (278 hectares) with two expansion sites and to 692 acres (280 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 jurisdictional wetlands and waters of the United States.

The regulatory permits for filling and impacting jurisdictional wetlands would require mitigation or compensation to ensure there is no net loss of jurisdictional 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 impact and 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 jurisdictional 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 mussel (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 NMFS if the proposed Bruinsburg site may adversely affect these species. DOE would prepare a Biological Assessment and implement the conditions of the Biological Opinion (if required). 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 draft 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 241 acres (98 hectares) of 100-year floodplain and about 21 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 have a cumulative adverse impact to water resources or floodplains.

### **4.4 CHACAHOU LA 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
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 breaches 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 2,258 acres (915 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 no significant effects to EFH would result from construction and operation. 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 jurisdictional wetlands and waters of the United States. Compensation for the jurisdictional wetland impacts would be required 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 2,258 acres (914 hectares) to 2,479 acres (1003 hectares) with two expansion sites and to 2,484 acres (1005 hectares) with three expansion sites.

The regulatory permits for filling jurisdictional wetlands would require compensation or mitigation to ensure there is no net loss of jurisdictional 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. Therefore, DOE has determined that the Chacahoula alternative and other planned or foreseeable projects would not 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 136 acres (55 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 jurisdictional surface water bodies through the Section 404/401 permit process.

### **4.5 CLOVELLY STORAGE SITE AND ASSOCIATED INFRASTRUCTURE**

#### **4.5.1 Clovelly Storage Site**

The Clovelly site consists of brackish marsh and wooded wetlands. Features that influence the site include cheniers (water-deposited and wind-driven deposition associated with high water marks), open beaches, levees, and dredge spoil banks. The area has a long history of oil and gas-related activity. The existing Clovelly Dome Storage Terminal is part of the LOOP project. Oil received at LOOP's offshore facilities flows to the Clovelly terminal through a pipeline from the Fourchon station, the point where LOOP's oil comes onshore. The Clovelly terminal within the LOOP system is used to store crude oil in underground salt domes before it is shipped to the various regional and midwest refineries. The Clovelly terminal currently consists of eight caverns, a pump station, meters to measure the crude oil receipts and deliveries, and a brine storage reservoir. If chosen as an SPR site, the SPR operation would use LOOP's existing oil distribution infrastructure. LOOP operations dominate the area and are an established activity. This makes alternative land uses of the site difficult. There are no known proposed uses of the 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 Clovelly were not developed. SPR development at Clovelly would essentially be an expansion of existing operations at the site.

#### **4.5.2 Clovelly Associated Infrastructure**

No modifications for pipelines are being proposed for the Clovelly site; however, a new RWI would be built to meet the independent needs of DOE.

#### **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 Clovelly alternative. No expected activities or projects were found to occur within close proximity of this alternative.

The Clovelly storage site, associated facilities, and ROW would permanently affect about 10 acres (4 hectares) of wetlands. The affected wetlands have been disturbed by past development of the site and invasion of exotic plants, including tallow trees. The Clovelly site development would have no adverse

effect on EFH and no effect on any federally listed threatened or endangered species or designated critical habitat.

The Clovelly alternative would include either two or three of the SPR expansion sites, increasing the cumulative impacts to wetlands within the region. The cumulative impacts to wetlands associated with the Clovelly alternative and the expansion sites would increase from 10 acres (4 hectares) to 238 acres (96 hectares) with three expansion sites. The Clovelly alternative would have to secure regulatory permits and meet regulatory requirements for impacts to jurisdictional wetlands and waters of the United States.

The regulatory permits for filling and impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional wetlands in the project area 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 avoid adverse cumulative impacts. Therefore, DOE has determined that the Clovelly alternative and other planned or foreseeable projects would not have a cumulative adverse impact to wetland resources.

#### **4.5.3.2 Water**

DOE evaluated the potential cumulative impacts to water resources, which include surface water floodplains and groundwater in the Clovelly watershed. The Clovelly storage site would affect the open waters and navigable channels located in the project area because of dredging and filling activities. These impacts would be mitigated by compliance with the regulatory permit. The Clovelly storage site and associated facilities would affect about 21 acres (9 hectares) of 100-year floodplain and it would be outside the 500-year floodplain. The impacts to floodplains from the storage site are expected to be minimal due to the overall size of the floodplain system, the small amount of aboveground construction and the use of elevated platforms to support most of the infrastructure. Therefore, DOE has determined that the Clovelly alternative and the other planned or reasonably foreseeable projects would not have a cumulative adverse impact to water resources.

### **4.6 CLOVELLY-BRUINSBURG STORAGE SITES AND ASSOCIATED INFRASTRUCTURE**

#### **4.6.1 Reasonably Foreseeable Activities On or Near the Clovelly-Bruinsburg Storage Sites**

The reasonably foreseeable activities on or near the Clovelly-Bruinsburg storage sites are the same activities as the individually proposed Bruinsburg and Clovelly projects described previously.

#### **4.6.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Clovelly-Bruinsburg**

The reasonably foreseeable activities near the associated infrastructure for the Clovelly-Bruinsburg alternative are the same activities as the individually proposed Bruinsburg and Clovelly projects described previously.

#### **4.6.3 Cumulative Impacts Discussion**

##### **4.6.3.1 Biology**

Construction and operation of the Clovelly-Bruinsburg alternative would not adversely affect EFH or any state or federally listed threatened or endangered species or critical habitat.

The projects listed in the table have the potential to affect wetland resources located in the vicinity of the Clovelly-Bruinsburg alternative. The Clovelly-Bruinsburg storage sites and associated facilities and ROW would affect about 530 acres (215 hectares) of wetlands and associated water bodies. The impacts for the 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 Clovelly-Bruinsburg 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 Clovelly-Bruinsburg alternative and the expansion sites would increase from 530 acres (215 hectares) to 753 acres (305 hectares) with two expansion sites and to 758 acres (307 hectares) with three expansion sites. The Clovelly-Bruinsburg alternative and the other projects in the area would have to secure regulatory permits and meet regulatory requirements for any impacts to jurisdictional wetlands and waters of the United States.

The regulatory permits for filling and impacting jurisdictional wetlands would require an adequate compensation ratio to ensure there is no net loss of jurisdictional wetlands within the project watershed. A combination of wetland and stream restoration 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 adverse cumulative impacts. Therefore, DOE has determined that the Clovelly-Bruinsburg alternative and other planned or foreseeable projects would have a cumulative adverse impact to biological resources. However, the impacts would be mitigated minimizing the permanent adverse impacts.

#### **4.6.3.2 Water**

The Clovelly-Bruinsburg alternative would affect about 136 acres (55 hectares) of 100-year floodplain and about 48 acres (19 hectares) of 500-year floodplain. The 80 MMB Bruinsburg storage site and associated infrastructure would be located in an extensive floodplain system with numerous floodplains associated with the Mississippi River and Bayou Pierre, and their tributaries.

### **4.7 RICHTON STORAGE SITE AND ASSOCIATED INFRASTRUCTURE**

#### **4.7.1 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 impacted 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.

**4.7.2 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.

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.

**4.7.3 Cumulative Impacts Discussion**

**4.7.3.1 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 1,305 acres (529 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) and pearl darter (Federal candidate species) due to the possible impingement and entrainment of these fish by the RWI and modification of the flow and habitat in the Leaf River. No 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 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 1,305 acres (529 hectares) to 1,528 acres (619 hectares) with two expansion sites and to 1,533 acres (621 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 jurisdictional wetlands.

The regulatory permits for filling and impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional 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.

#### **4.7.4 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 Richton RWI would have a potential adverse effect on the minimum in-stream flow in the Leaf River. 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 in-stream flow. The Richton storage site and associated facilities would affect about 63 acres (26 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 would have a cumulative adverse impact on water resources.

### **4.8 STRATTON RIDGE STORAGE SITE AND ASSOCIATED INFRASTRUCTURE**

#### **4.8.1 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, although there is no formal proposal for that development. There is a proposed LNG storage cavern, a part of the Freeport LNG project, in close proximity to the proposed site of the DOE caverns. The LNG storage cavern would be a major development in the area and would create cumulative site development changes with the potential SPR use.

#### **4.8.2 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

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, 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 impacts wetlands and other natural resources. No 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 598 acres (242 hectares) of wetlands and waters of the United States. The impacts associated with the other projects 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. 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. 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 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 598 acres (242 hectares) to 821 acres (332 hectares) with two expansion sites and to 826 acres (334 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 jurisdictional wetlands.

The regulatory permits for filling and impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional 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.

#### **4.8.3.2 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 124 acres (50 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 jurisdictional 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.

### **4.9 BAYOU CHOCTAW EXPANSION SITE AND ASSOCIATED INFRASTRUCTURE**

#### **4.9.1 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.

## **4.9.2 Cumulative Impacts Discussion**

### **4.9.2.1 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 impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional 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 Richton alternative and other planned or foreseeable projects would not be adverse.

### **4.9.2.2 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 waterbody crossings would result from the alternative. Expansion of the Bayou Choctaw storage site and associated facilities would affect about 187 acres (76 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.

## **4.10 BIG HILL EXPANSION SITE AND ASSOCIATED INFRASTRUCTURE**

### **4.10.1 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.

### **4.10.2 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

### 4.10.3 Cumulative Impacts Discussion

#### 4.10.3.1 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 alternative would have no adverse effects on EFH or any state or federally listed rare, threatened or endangered species or 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 jurisdictional wetlands and waters of the United States. The regulatory permits for filling and impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional 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.

#### 4.10.3.2 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 alternative 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 jurisdictional 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.

## **4.11 WEST HACKBERRY EXPANSION SITE AND ASSOCIATED INFRASTRUCTURE**

### **4.11.1 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.

### **4.11.2 West Hackberry Associated Infrastructure**

No expected activities were found to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the West Hackberry site. However the following LNG development activities were identified in the host Parishes of Cameron and Calcasieu: A new LNG terminal, LNG terminal expansion, and new pipelines to be located at Hackberry, Cameron and Calcasieu Parishes; underground gas storage at Starks salt dome, Calcasieu Parish; and two natural gas storage caverns with associated distribution pipelines, Calcasieu Parish.

### **4.11.3 Cumulative Impacts Discussion**

#### **4.11.3.1 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 alternative 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 alternative would have to secure Section 404/401 permits and meet regulatory requirements for impacts to jurisdictional wetlands.

The regulatory permits for filling and impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional 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 Richton alternative and other planned or foreseeable projects would not be adverse.

#### **4.11.3.2 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 Irrecoverable 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 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 is approximately 50 percent of the total area of the crude oil, brine, and raw water pipeline ROWs.

For the proposed Clovelly site, the proposed caverns would be co-located with the existing Clovelly LOOP caverns and would be largely submerged. Affected areas for the proposed Clovelly site include dredged and filled areas. The total area of the Clovelly site is shown in tables 5.1-1 and 5.1-2. 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	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
	30	2	0	0	0	0	7	96	0	2	107
Big Hill	108	206	0	0	0	278	16	0	0	0	500
	96	206	0	0	0	278	16	0	0	0	500
	84	206	0	0	0	278	16	0	0	0	500
	80	206	0	0	0	278	16	0	0	0	500
	72	206	0	0	0	278	16	0	0	0	500
Bruinsburg	160	365	141	1	194	1,742	214	73	7	47	2,784
	80	254	71	0.8	234	813	128	36	7	22	1,566
Chacahoula	160	320	0	1	382	899	553	0	28	15	2,198
Clovelly	120	0	4	1	0	0	0	0	0	0.4	5
	90	0	4	1	0	0	0	0	0	0.4	5
	80	0	4	1	0	0	0	0	0	0.4	5
Richton	160	350	130	1	201	3,060	0	0	56	10	3,808
Stratton Ridge	160	371	39	1	45	911	9	0	125	4	1,505
West Hackberry	0	0	0	0	0	0	0	0	0	0	0
	15	81	0	0	0	0	0	0	0	0	81

**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	1	194	2,020	237	169	7	49	3,470
Bruinsburg w/2 Expansion Sites	571	141	1	194	2,020	237	169	7	49	3,389
Chacahoula w/3 Expansion Sites	607	0	1	382	1,177	576	96	28	17	2,884
Chacahoula w/2 Expansion Sites	526	0	1	382	1,177	576	96	28	17	2,803
Clovelly	289	4	1	0	278	23	96	0	2	693
Clovelly 80 MMB-Bruinsburg 80 MMB w/3 Expansion Sites	335	75	1.8	234	813	135	132	7	24	1,757
Clovelly 80 MMB-Bruinsburg 80 MMB w/2 Expansion Sites	460	75	1.8	234	1,091	151	132	7	24.4	2,176
Clovelly 90 MMB-Bruinsburg 80 MMB w/3 Expansion Sites	541	75	1.8	234	1,091	151	132	7	24	2,257
Clovelly 90 MMB-Bruinsburg 80 MMB w/2 Expansion Sites	460	75	1.8	234	1,091	151	132	7	24	2,176
Richton w/3 Expansion Sites	637	130	1	201	3,338	23	96	56	12	4,494
Richton w/2 Expansion Sites	556	130	1	201	3,338	23	96	56	12	4,413
Stratton Ridge w/3 Expansion Sites	658	39	1	45	1,189	32	96	125	6	2,191
Stratton Ridge w/2 Expansion Sites	577	39	1	45	1,189	32	96	125	6	2,110
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. Such water use is 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 will create storage capacity for one barrel of oil. 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. The 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. 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. For all of the alternatives, the amount of salt lost would be approximately 95 million metric tons (105 million short tons).

**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
Clovelly	120	840	600	1,440
Clovelly 80 MMB and Bruinsburg 80 MMB	160	1,120	800	1,920
Clovelly 90 MMB and Bruinsburg 80 MMB	170	1,190	850	2,040
Richton	160	1,120	800	1,920
Stratton Ridge	160	1,120	800	1,920
Bayou Choctaw	20	140	100	240
Bayou Choctaw	30	140	150	290
Big Hill	108	756	540	1,296
Big Hill	96	672	480	1,152
Big Hill	84	588	420	1,008
Big Hill	80	560	400	960
Big Hill	72	504	360	864
West Hackberry	0	0	0	0
West Hackberry	15	0	75	75

**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
Clovelly	273	1,736	1,365	3,101
Clovelly 80 MMB-Bruinsburg 80 MMB w/3 Expansion Sites	275	1,820	1,375	3,195
Clovelly 80 MMB-Bruinsburg 80 MMB w/2 Expansion Sites	276	1,932	1,380	3,312
Clovelly 90 MMB-Bruinsburg w/3 80 MMB Expansion Sites	277	1,834	1,385	3,219
Clovelly 90 MMB-Bruinsburg w/2 80 MMB Expansion Sites	274	1,918	1,370	3,288
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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