Appendix D
Common and Scientific Names of Species

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Appendix D
Common and Scientific Names of Species

Appendix D identifies the scientific names for all common species described in section 3.7 Biological Resources. All the scientific names for special status species, such as threatened or endangered species, are provided in appendices F, G, and H on the biological screening for Louisiana, Mississippi, and Texas, respectively.

The lists are organized by common name and divided into separate lists for plants and wildlife. The scientific names were verified using the following reference sources:

NatureServe. 2005. *NatureServe Explorer: An online encyclopedia of life [web application]*. 3-Version 4.6. Arlington, Virginia. NatureServe. Accessed March 28, 2006 at http://www.natureserve.org/explorer

Smithsonian National Museum of Natural History: Mammal Species of the World (MSW). Accessed March 28, 2006 at http://nmnhgoph.si.edu/cgi-bin/wdb/msw/names/form

Rodnreel.com. Gulf Fish Database. Accessed March 28, 2006 at http://www.rodnreel.com/gulffish/gulffish.asp?cmd=LIST&mode=CN

Native Trees of Texas. Accessed March 28, 2006 at http://aggie-horticulture.tamu.edu/ornamentals/natives/ indexcommon.htm

Little, E.I. 1980. National Audubon Society Field Guide to North American Trees. Knopf, New York.

Thieret, J.W., W.A. Niering, and N.C. Olmstead. 2001. National Audubon Society Field Guide to North American Wildflowers Eastern Region. Knopf, New York.

Table D-1: Plant Names

Common Name	Scientific Name
Arrowhead	*Sagittaria spp.*
Ash	*Fraxinus spp.*
Bald Cypress	*Taxodium distichum*
Black Willow	*Salix nigra*
Blackberry	*Rubus spp.*
Blackjack Oak	*Quercus marilandica*
Box Elder	*Acer negundo*
Bulrush	*Scirpus spp.*
Chinese Tallowtree	*Sapium sebiferum*
Clearweed	*Pilea pumila*
Deer Pea Vetch	*Vicia ludoviclana Nutt.*
Goldenrod	*Solidago spp.*
Grape	*Vitis spp.*
Greenbriar	*Smilax spp.*
Hackberry	*Celtis occidentalis L.*
Hickory	*Carya spp.*
Holly	*Ilex spp.*
Horsetail	*Equisetum arvense L.*
Kudzu	*Pueraria lobata*
Live Oak	*Quercus virginiana*
Oak	*Quercus spp.*
Palmetto	*Serenoa repens*
Pigweed	*Amaranthus spp.*
Pitcher Plant	*Sarracenia spp.*
Post Oak	*Quercus stellata*
Pumpkin Ash	*Fraxinus profunda*
Rattlebush	*Sesbania spp.*
Red Maple	*Acer rubrum*
Roseau Cane	*Phragmites communis*
Salt Grass	*Distichlis spicata*
Salt Meadow Cordgrass	*Spartina patens*
Sedge	*Carex spp.*
Slash Pine	*Pinus elliotii*
Smartweed	*Polygonum coccineum*
Southern Arrowwood	*Viburnum dentatum*
Spanish Moss	*Tillandsia usneoides*
Spike-rush	*Eleocharis quadrangulata*
Sweet Gum	*Liquidambar styraciflua*
Thistle	*Cardous spp.*
Trumpet Creeper	*Campsis radicans*
Trumpet Vine	*Campsis radicans*
Tupelo	*Nyssa spp.*

Table D-1: Plant Names

Common Name	Scientific Name
Virginia Creeper	*Parthenocissus quinquefolia*
Virginia Glasswort	*Salicornia virginica*
Water Ash	*Fraxinus spp.*
Water Hyacinth	*Eichhornia crassipes*
Water Hyssop	*Bacopa rotundifolia*
Water Oak	*Quercus nigra*
Water Tupelo	*Nyssa aquatica*
Winged Elm	*Ulmus alata*
Wiregrass	*Aristida spp.*
Yaupon	*Ilex vomitoria*

Table D-2: Animal Names

Common Name	***Scientific Name***
Alligator	*Alligator mississippiensis*
American Beaver	*Castor Canadensis*
American Crow	*Corvus brachyrhynchos*
American Woodcock	*Scolopax minor*
Armadillo	Family: Dasypodidae
Bass	Family: Sea Basses (*Serranidae)* and Temperate Basses *(Percichthyidae)*
Black Vulture	*Coragyps atratus*
Blue Crab	*Callinectes sapidus*
Bluegill	*Lepomis macrochirus*
Blue-winged Teal	*Anas discors*
Bobcat	*Felis rufus*
Brown Shrimp	*Penaeus aztecus*
Bullfrog	*Rana catesbeiana*
Common Possum	*Didelphis virginiana*
Coyote	*Canis latrans*
Crayfish	Family: Cambaridae
Atlantic Croaker	*Micropogonias undulatus*
Darter	Family: Percidae
Drum	Family: Sciaenidae
Egret	Family: Ardeidae
Feral Pig	*Sus scrofa*
Flounder	Family: Bothidae
Freshwater Catfish	Family: Ictaluridae
Freshwater Eel	Family: Anguillidae
Garter Snake	*Thamnophis sirtalis*
Gizzard Shad	*Dorosoma cepedianum*
Gray Squirrel	*Sciurus carolinensis*
Great Blue Heron	*Ardea herodias*
Heron	Family: Ardeidae
Ibis	Family: Threskiornithidae
Jack	Family: Carangidae
Killifish	Family: Fundulidae
Mink	*Mustela spp.*
Minnow	Family: Cyprinidae
Mottled Duck	*Anas fulvigula*
Mullet	Family: Mugilidae
Muskrat	*Ondatra zibethicus*
Nine Band Armadillo	*Dasypus novemcinctus*
Nutria	*Myocastor coypus*
Owl	Family: Strigidae
Oyster	Family: Ostreidae

Table D-2: Animal Names

Common Name	***Scientific Name***
Perch	Family: Aphredoderidae
Pocket Gopher	Family: Geomyidae
Pugnose Minnow	*Notropis emiliae*
Quail	Family: Odontophoridae
Rabbit	Family: Leporidae
Raccoon	*Procyon lotor*
Red-Eared Slider	*Trachemys scripta*
Red Drum	*Scianenops ocellata*
Red-Tailed Hawk	*Buteo jamaicensis*
River Otter	*Lutra canadensis*
Saltwater Catfish	Family: Ariidae
Slider Turtle	*Chrysemys scripta*
Snapper	*Lutjanus spp.*
Snapping Turtle	*Chelydra serpentina*
Snow Goose	*Chen caerulescens*
Southern Leopard Frog	*Rana sphenocephala*
Stone Crab	*Menippe merceuaria*
Sucker	Family: Catostomidae
Sunfish	Family: Centrarchidae
Swamp Rabbit	*Sylvilagus aquaticus*
Thrush	Family: Turdidae
Trout	Family: Salmonidae
Warbler	Family: Sylviidae
Water Moccasin	*Ancistrodon piscivorus*
Western Diamondback Rattlesnake	Crotalus atrox
White Shrimp	*Penaeus setiferus*
White Tailed Deer	*Odocoileus virginianus*
Wood Duck	*Aix sponsa*
Woodcock	*Philohela minor*
Woodpecker	Family: Picidae

Appendix E
Essential Fish Habitat Assessment

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Essential Fish Habitat Assessment for the Proposed Expansion of the Strategic Petroleum Reserve

Mississippi, Louisiana, and Texas

Prepared for:
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Appendix E
Essential Fish Habitat Assessment

E.1 INTRODUCTION

This document presents the assessment of the Essential Fish Habitat (EFH) survey conducted by the Department of Energy (DOE) for the proposed expansion of the Strategic Petroleum Reserve (SPR). The assessment fulfills a requirement of the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended through 1996 (Magnuson-Stevens Act).

This EFH assessment was prepared in conjunction with the Draft Environmental Impact Statement prepared for consideration of the proposed expansion of the SPR.

The objectives of this EFH assessment are to describe how the actions proposed by DOE may affect EFHs designated by the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) and Gulf of Mexico Fisheries Management Council (GMFMC) in the area of proposed project sites. According to the GMFMC, EFHs in the Gulf of Mexico include all estuarine and marine waters and substrates from the shoreline to the seaward limit of the Exclusive Economic Zone. The Exclusive Economic Zone is the area under national jurisdiction (up to 200-nautical miles [370 kilometers] wide) declared in line with the provisions of 1982 United Nations Convention of the Law of the Sea, within which the coastal nation has the right to explore and exploit, and the responsibility to conserve and manage, the living and non-living resources.

This assessment describes the proposed action and analyzes the direct and indirect effects on EFHs for the managed fish species and their major food sources. This assessment also presents the conclusions regarding the effects of the proposed action and alternatives and proposed mitigation measures.

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E.2 PROJECT DESCRIPTION

The Strategic Petroleum Reserve (SPR) was created in the 1970s to protect the United States from interruptions in petroleum supplies that could be detrimental to our energy security, National security, and economy. Congress mandated creation of the SPR in the Energy Policy and Conservation Act (EPCA) of 1975, and established as a national goal the storage of up to 1 billion barrels of crude oil and petroleum products. The current storage capacity of the SPR is 727 million barrels (MMB). Section 301(e) of the Energy Policy Act (EPACT), Public Law 109-58, enacted on August 8, 2005, directs the Secretary of Energy to:

> "… acquire petroleum in quantities sufficient to fill the Strategic Petroleum Reserve to the 1,000,000,000 barrel capacity authorized under Section 154(a) of the Energy Policy and Conservation Act …"

and Section 303 directs:

> "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. In such proceeding, the Secretary shall first consider and give preference to the five sites which the Secretary previously assessed 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."

In response to these directives the purpose and need for agency action is to fill the SPR to the full authorized 1,000,000,000-barrel capacity (1,000-MMB) and by selecting sites to expand the current 727 MMB storage capacity.

The SPR, which is operated by DOE, 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). In addition, an administrative facility is located 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 current storage capacity of 727 MMB.

E.2.1 Proposed Action and Alternatives

The proposed action is to expand SPR storage capacity from its existing storage capacity of 727 MMB to 1 billion barrels (1,000 MMB). To obtain the additional 273 MMB of storage capacity, DOE would develop one of the following new sites:

- Bruinsburg, MS (160 MMB);
- Chacahoula, LA ((160 MMB);
- Clovelly, LA (120 MMB);
- Clovelly (80 or 90 MMB) and Bruinsburg (80 MMB);
- Richton, MS (160 MMB); or
- Stratton Ridge, TX (160 MMB)

In addition to developing a new site or a combination of two new sites, DOE would expand capacity at existing DOE SPR sites, namely Big Hill, TX, and possibly at Bayou Choctaw, LA, and/or West

Hackberry, LA. DOE will consider a 72, 80, 84, 96, or 108 million barrel capacity expansion at Big Hill, a 20 or 30 million barrel capacity expansion at Bayou Choctaw, and no expansion or a 15 million barrel capacity expansion at West Hackberry.

These combinations of potential new and expansion sites will allow DOE to assess a wide range of alternative configurations to achieve the 1 billion barrel storage capacity, as mandated by the Energy Policy Act of 2005. The assessment of each site will include consideration of ancillary offsite facilities including pipelines to crude oil transportation and distribution complexes.

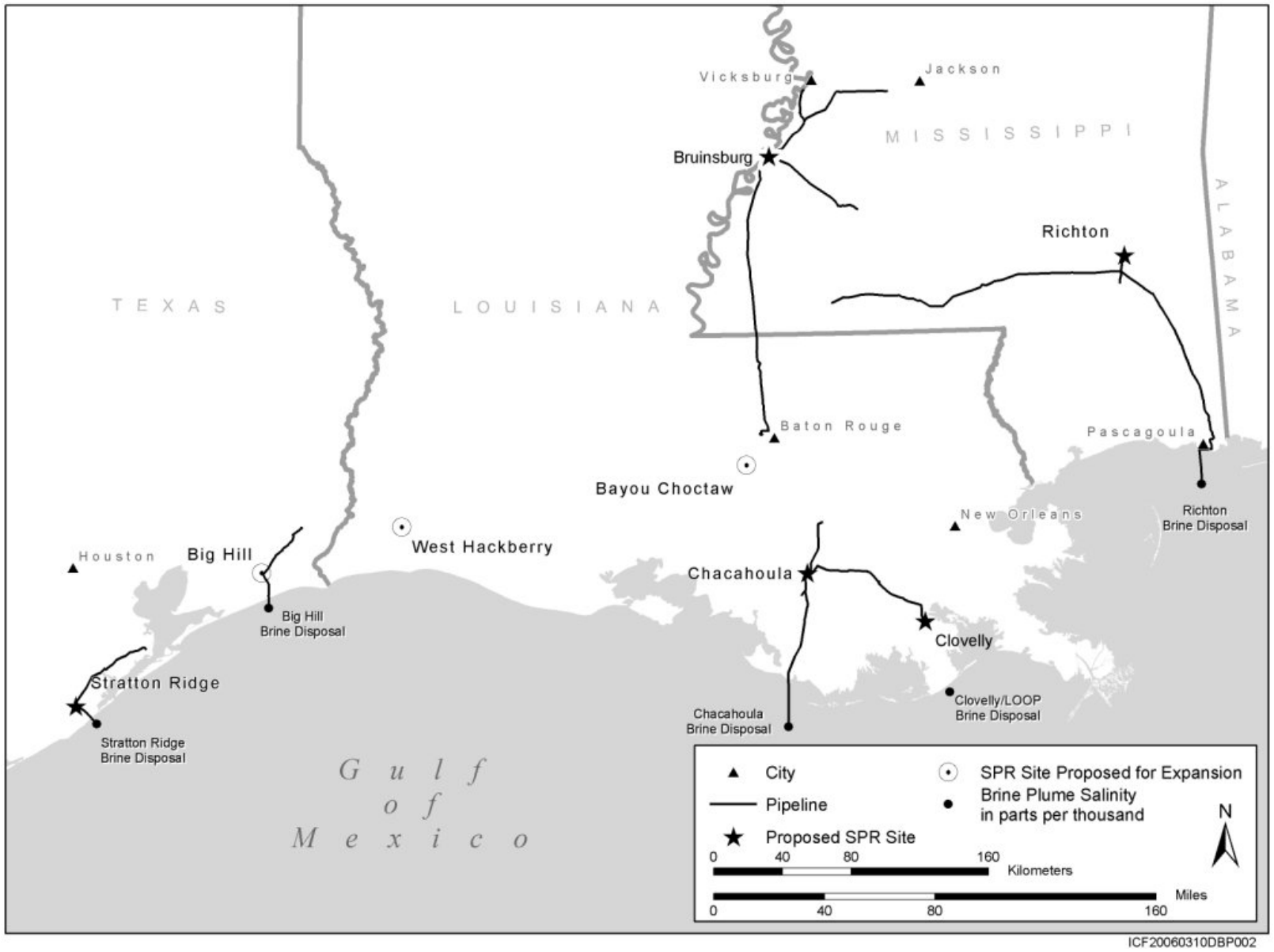
For the proposed new and expansion sites, DOE would create oil storage caverns in underground rock salt formations, except for West Hackberry where DOE would buy existing caverns. Caverns would be constructed through a technique known as solution mining using fresh or salt water. Leaching generates approximately 80 million barrels of concentrated brine wastewater per 10 million barrels in cavern space created. This wastewater would be disposed of either by pipeline to diffusers in the Gulf of Mexico or to an array of underground injection wells.

To supply the water to a new site, a raw water intake structure would be constructed offsite in a surface water body (a canal, the Intracoastal Waterway, the Mississippi River, or the Leaf River). The water and brine systems for leaching caverns would be sized to supply up to 1.2 million barrels per day and the crude oil distribution system would be designed for drawdown up to one million barrels per day. The proposed expansions of existing SPR facilities would, in general, use the existing infrastructure and pipelines of the oil storage site. The location of the existing and proposed offshore pipelines and diffusers are shown in figures E.5-1 through E.5-5.

Brine from three of the sites (Bruinsburg, Bayou Choctaw, and West Hackberry) would be injected into the deep subsurface aquifer via injection wells. At the remaining sites listed below, brine would be discharged into the Gulf of Mexico through diffusers. Brine discharge via pipeline rights-of-way (ROWs) to the Gulf of Mexico would occur at the following proposed sites (see figure E.2-1: Proposed Locations of SPR Brine Diffusers in the Gulf of Mexico).

- Chacahoula, LA (new site, brine pipeline, and diffuser);
- Clovelly, LA (new site with brine discharged through an existing diffuser at the LOOP facility);
- Clovelly-Bruinsburg (new sites with brine from Clovelly discharged through an existing diffuser at the LOOP facility);
- Richton, MS (new site, brine pipeline, and diffuser);
- Stratton Ridge, TX (new site, brine pipeline, and diffuser); and
- Big Hill, TX (expansion of existing SPR brine would discharge through an existing diffuser).

Figure E.2-1: Proposed Locations of SPR Brine Diffusers in the Gulf of Mexico



E.3 ESSENTIAL FISH HABITAT

Essential fish habitat is defined in the Sustainable Fisheries Act (1996) as those "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The identification of the different habitat types in the Gulf of Mexico region has several different types of EFH that are necessary for one commercially important species or another during different stages of their life cycle.

The different types of EFH identified in the proposed project areas would be affected by construction of the brine disposal pipelines. The daily operation of the facility, including periodic maintenance of pipeline ROWs and the discharge of brine and brine diffusion, would have much less potential to affect these habitats. The project does not propose to construct RWI structures in EFH areas.

E.3.1 Estuarine Emergent Wetlands

An estuary is a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water mixes with fresh water. The key feature of an estuary is that it is a mixing place for sea water and a stream or river to supply fresh water. A tide is a necessary component to maintain a dynamic relationship between the two waters. Estuaries occur on submerged coasts where the sea level has risen in relation to the land.

Emergent wetlands are wetlands that are defined by erect, rooted, herbaceous hydrophytic plants. The estuarine environment is defined by the presence of ocean-derived salt with salinity greater than 0.5 percent, and the area is partially or wholly enclosed by land, but it is influenced by oceanic and freshwater sources. Estuarine emergent wetlands are defined in a similar way to estuarine environment, characterized by erect, rooted, herbaceous hydrophytes, but are dominated by halophytic plants such as smooth cord grass (*Spartina alterniflora*).

The estuarine emergent wetlands are a prevalent habitat type along the Gulf Coast. The estuarine emergent wetlands go through periods during low tides when most of the water has receded from the vegetated area, leaving the plants and substrate exposed. These areas are important nurseries for juvenile species of fish and invertebrates. The vegetation provides protection and shelter from larger predators and offers a small habitat for the species to mature (Cowardin, 1979).

E.3.2 Mud, Sand, and Shell Substrates

The different commercially important species found in the Gulf Coast region show preferences to different types of substrates. Species such as shrimp would prefer the muddy substrate because it allows them to forage for food that lives in the substrate. Aside from the commercially important species that can be found in the area, many species of mollusks, polychaetes, oligochaetes, and annelids can be found in or on the muddy or sandy substrate.

The shell substrate is created by oysters that form large reefs, creating an entirely different substrate type. Similar to the sand and mud substrate, many other non-commercially important species can be found in this habitat. Some juvenile fish use these areas for feeding and protection from predators.

E.3.3 Submerged Aquatic Vegetation

Submerged aquatic vegetation, as defined by the Gulf of Mexico Fishery Management Council, is "rooted vascular plants that, except for some flowering structures, live and grow below the water surface." Submerged aquatic vegetation is a sensitive type of EFH, and often accommodates many managed species in the Gulf during some life stage. The offshore brine pipelines associated with Stratton Ridge

and Richton may encounter submerged aquatic vegetation during the construction process. DOE would attempt during the more detailed design stage to avoid these areas during the formal pipeline survey and alignment.

Near Stratton Ridge, there are several different species of submerged aquatic vegetation that occur in the Galveston Bay ecosystem. The different types of submerged aquatic vegetation are shoalgrass (*Halodule wrightii*), wigeongrass (*Ruppia maritima*), and turtle grass (*Thalassia testudinum*). These grasses occur mostly to the northeast in Christmas Bay and Drum Lake, away from the brine pipeline ROW.

The brine pipeline associated with the proposed Richton site would pass near the areas of seagrasses in the Gulf Islands National Shoreline. The species of seagrasses that exist in the proposed project site are shoalgrass (*Halodule wrightii*), wigeongrass (*Ruppia maritima*), and manatee grass (*Syringodium filiforme*). The seagrass beds are sporadically located throughout the system along the barrier islands. Shoalgrass and manatee grass are found on the northern side of the barrier islands in the Gulf Islands National Shoreline where they are protected from the higher wave energy of the open Gulf.

E.3.4 Estuarine and Marine Water Columns

The water column makes up the largest portion of the habitat types in the aquatic environment. The pelagic ecosystem can be home to many species of commercially important fishes. Species such as greater amberjack, tunas, dolphinfish, and cobia are all pelagic species that are found in the Gulf of Mexico. The water column is equally important in the estuarine environment; many of the top tier predators and commercially important species can be found in the pelagic environment. The pelagic environment is home to phytoplankton, the primary producers of the water column, and the start of the food web.

E.3.5 Artificial Reefs

Artificial reefs are manmade structures that create habitat for marine life. These structures can include concrete rubble, sunken ships, and oil rigs (active and decommissioned). Objects used for creation of artificial reefs depend on the water depth. Shallow waters (72-102 feet, 21-31 meters) use concrete rubble, old bridges, and concrete scrap, and beyond 102 feet (31 meters) use decommissioned oil rigs, and even deeper waters that can be home to sunken ships (Texas Parks and Wildlife, 2006). Each of the states along the Gulf has created artificial reef programs that aim to aid operating companies in ecologically sound disposal of decommissioned oil rigs and ships for the conversion to artificial reefs. These artificial reefs provide new, artificial habitat for marine life in areas that may otherwise be devoid of benthic structure. Many fishes can be found associated with the artificial reefs, including snappers, groupers, jacks, sharks, and some reef species.

The larger artificial reefs, for the most part, are located in deeper waters than the proposed brine pipelines or diffusers—beyond 17 fathoms (102 feet, 31 meters). It is not expected that the brine disposal system, would adversely affect the artificial reefs of the Gulf of Mexico. The maximum depth at the terminus of the brine diffusers for any of the sites would be 47 feet (14 meters) for the proposed Richton site. This depth is within the limits of the use of concrete rubble for artificial reefs but not within the depth acceptable for the use of oil rigs and ships.

E.4 MANAGED SPECIES

Many species found in the Gulf of Mexico are highly valued for commercial purposes. Whether taken to market, processed for meal, or used for supplement extraction, these species require management for the prevention of over-harvesting. NOAA Fisheries and the equivalent state agencies are the two main bodies

that work to manage fisheries in the United States. Under the guidance of the Magnuson-Stevens Fisheries Conservation and Management Act and the Sustainable Fisheries Act, NOAA Fisheries and the respective state agencies have created their own guidelines with limits and quotas for the management of the fisheries within their waters.

The species assessed in this document are those most likely to occur within the project areas. Other managed species were considered and determined to be unaffected by the proposed project because of two main factors: (1) they do not occur in shallow waters; or (2) they do not occur in the geographic project area.

E.4.1 Shrimp Fishery

The shrimp fishery is an economically important fishery in the Gulf of Mexico. The shrimp fishery is composed of three different species, which are harvested in commercial quantities throughout the Gulf Coast region. The three main species harvested are the brown, pink, and white shrimp. Each of these species has commercial importance throughout the different proposed project areas.

E.4.1.1 Brown Shrimp

Although they are most abundant in the central and western part of the Gulf of Mexico, brown shrimp (*Farfantepenaeus aztecus*) occur throughout the coastal Gulf region and its associated inshore estuarine environments. Brown shrimp larvae are found offshore, but migrate to inshore estuaries as postlarvae, with the height of migration occurring in late winter and early spring. The silt and mud substrate common to Gulf estuaries provides the juvenile brown shrimp diet, which includes detritus, algae, polychaetes, amphipods, nematodes, ostracods, chironomid larvae, and mysids (Lassuy, 1983). As adults, brown shrimp move from estuaries to areas further offshore, and they can be found at water depths of up to 360 feet (109 meters). Adults will reach maturity within a year of moving offshore. Typically, fluctuations in temperature or salinity levels do not cause direct mortality. Postlarvae and juveniles have been collected in salinity levels up to 70 parts per thousand (GMFMC, 1998a), but that level may reduce vigor and increase vulnerability to predation. In addition, juveniles may leave estuaries early if large freshwater inflows occur and lower the salinity concentration (Larson, et al., 1989).

E.4.1.2 Pink Shrimp

Pink shrimp (*Farfantepanaeus duorarum*) larvae begin life offshore, but juveniles move to estuarine and coastal bay nursery areas with soft sand or mud substrate mixture containing sea grasses. Recruitment of the postlarvae most often occurs in the spring and late fall during flood tides. The juveniles, which remain in nursery areas for 2 to 6 months, forage at night or in turbid conditions during the day. During this time, juvenile pink shrimp prey on a wide variety of organisms including foraminifera, diatoms, dinoflagellates, nematodes, polychaetes, and others (Bielsa, et al., 1983). Potential prey species for juvenile pink shrimp are vulnerable to dredging activities, such as would be required for laying and burying the brine pipelines, but they would recover quickly (Culter and Mahadevan, 1982). After the juveniles reach a certain length, they move offshore, with the principal peak of emigration from nurseries occurring in the fall. Adult pink shrimp are most commonly found at a depth of between 29 and 144 feet (9 and 44 meters), but have been found as deep as 361 feet (110 meters). Spawning for adult pink shrimp most often occurs in the spring, but they can spawn at any time year-round, usually at depths between 12 and 156 feet (4 and 48 meters).

Pink shrimp prefer different salinity levels at various life stages. Post-larval and juvenile shrimp are generally found at lower salinities in their estuarine environments, and they have been collected at salinities as low as between 12 and 5 parts per thousand, respectively. Adult pink shrimp prefer saltier

oceanic water; they have been collected from seawater ranging in salinity from 25 to 45 parts per thousand (Bielsa et al., 1983).

E.4.1.3 White Shrimp

Like pink and brown shrimp, white shrimp (*Litopenaeus setiferus*) are offshore and estuarine dwellers that are pelagic as larvae and become demersal depending on their life stage. Two to three weeks after they hatch offshore, postlarval white shrimp travel to estuaries that serve as nursery areas (Williams, et al., 1990). Juvenile white shrimp seek shallow water with muddy-sand bottoms, and they are invaluable for coastal food chains because they recycle organic matter by feeding on organic matter and detritus in the sediment (Williams, et al., 1990). As juveniles mature, they move to nearshore, demersal habitats that are less than 100 feet (30 meters) deep and generally prefer muddy substrates. Like the brown shrimp, white shrimp prefer higher salinity waters as they mature from the juvenile to adult life stage. Spawning will only occur in waters where salinity is at least 27 parts per thousand, and the depth is between 26 and 101 feet (8 and 31 meters).

E.4.2 Red Drum Fishery

The red drum (*Sciaenops ocellatus*) is one of the most economically important fish in the Gulf of Mexico. Although commercial harvest is not permitted, recreational capture is allowed. The red drum is common throughout the Gulf Coast system, most prevalent in the bays and estuaries, but it can be found along the beachfronts in areas with elevated salinities. The majority of the life cycle is spent in bays and estuaries, and red drum only venture offshore for spawning. The eggs and early larval stage follow the currents and migrate back into the bays and estuaries.

Red drums are found in both marine nearshore habitats and estuarine waters, most commonly over sandy bottoms where they prey on fish, crabs, shrimp, sand dollars, and other invertebrates (Manooch, 1984). Larvae are found in vegetated or unvegetated bottoms in estuaries, tidal flats, and open bays at temperatures ranging from 64 to 87 ^{o}F (18 to 31 ^{o}C), and salinities ranging from 16 to 36 parts per thousand. Optimal conditions are considered to be 77 ^{o}F (25 ^{o}C) and 30 parts per thousand for this species (Buckley, 1984; Holt, et al., 1981; Pattillo, et al., 1997; Peters and McMichaels, 1987). Early juveniles are found in backwaters, tidal flats, primary and secondary bays, and open water mud bottoms at depths up to 9.8 feet (3 meters) and temperatures ranging from 54 to 90 ^{o}F (12 to 32 ^{o}C), and salinities from 0 to 45 parts per thousand (20 to 40 parts per thousand optimal) (Buckley, 1984; Holt, et al., 1981; Pattillo, et al., 1997; Peters and McMichaels, 1987; GMFMC, 1998b).

Juveniles cannot survive in ponds with less than 0.6 to 1.8 parts per million dissolved oxygen. Late juveniles are found in continental shelf and inshore waters at depths slightly greater than those of early juveniles, with temperatures ranging from 71 to 84 ^{o}F (22 to 29 ^{o}C) and salinities ranging from 25 to 45 parts per thousand (Buckley, 1984; Holt, et al., 1981; Pattillo, et al., 1997; Peters and McMichaels, 1987). Adult red drums are found in continental shelf and inshore waters at depths from 131 to 229 feet (40 to 70 meters), temperatures ranging from 35 to 91 ^{o}F (2 to 33 ^{o}C), and typical salinities of 30 to 35 parts per thousand, although the species can tolerate up to 50 parts per thousand (Lyczkowski-Shultz, et al., 1987; Holt, et al., 1981; Pattillo, et al., 1997; Peters and McMichaels, 1987).

E.4.3 Reef Fishery

In 1984, the Gulf of Mexico Reef Fishery Management Plan was one of the first to be developed by the Gulf Fishery Management Council. The goal outlined in the plan was to, “manage the reef fish fishery of the United States waters of the Gulf of Mexico to attain the greatest overall benefit to the nation with particular reference to food production and recreational opportunities on the basis of maximum

sustainable yield as modified by relevant economic, social or ecological factors." A series of amendments to the initial Reef Fishery Management Plan have provided updated policies for 42 species of reef fish that are of commercial or recreational importance in the Gulf of Mexico. Five families of fish—grouper, snapper, tilefish, triggerfish, and jack—account for approximately 95 percent of the reef fish landings in the Gulf. The vast majority of that (about 95 percent by weight) is made up of groupers and snappers (GMFMC, 2004).

The EFHs for reef fish species range from estuarine environments to offshore waters with depths of up to 1,640 feet (500 meters). Many of the species managed under the Reef Fish Management Plan occupy both benthic and pelagic environments depending on life-cycle phase. Larval reef fishes are planktonic, and they occupy the water column feeding on phytoplankton and smaller zooplankton. Some species of reef fish spend their larval phases in estuaries and inland seagrass beds before moving offshore as adults. Mature reef fish are generally demersal, and they are associated with high-relief bottom topographies (e.g., reefs, cliffs and outcroppings) on the continental shelf (GMFMC, 1998c).

Reef fish are also attracted to artificial reefs that may be intentionally constructed to encourage growth of fish stocks, or they may occur incidentally when a structure is constructed for different purposes but doubles as a reef environment. Petroleum operations, particularly in the northwest corner of the Gulf, have led to the construction of several artificial structures that are currently inhabited by Fishery Management Council-regulated species (GMFMC, 1998c).

E.4.3.1 Red Grouper

Red Grouper *(Epinephelus morio)* is the most widely distributed species of grouper and ranges throughout the Gulf of Mexico (Jory and Iversen, 1989). The larval stage for the red grouper lasts from 30 to 40 days, and the species is planktonic in the pelagic zone during that time (Moe, 1969). When the grouper matures to the juvenile phase of the life cycle, it is generally associated with inshore hard-bottom habitat, grassbeds, and rock formations where it preys on demersal crustaceans (Jory and Iversen, 1989). Adult groupers move farther offshore as they grow. They are most often found at depths of 100 to 400 feet (30 to 121 meters) (NOAA Fisheries, 2004). Groupers are most common in areas with average ocean salinities (30 to 35 parts per thousand), although young juveniles may move into waters where salinity is as low as 20 parts per thousand. Spawning adult groupers must inhabit water with salinity of at least 32 parts per thousand for the eggs to float (Hardy, 1978; Roe, 1976).

E.4.3.2 Greater Amberjack

Greater amberjacks (*Seriola dumerili*) are abundant in the Gulf of Mexico and are frequently encountered near structures such as reefs, sargassum patches, and oil rigs in waters ranging in depth from 65 to 1,099 feet (20 to 335 meters) (Duedero, et al., 1999; Massuti, et al., 1999). Greater amberjacks are top-level predators that feed on a variety of fishes, crustaceans, and cephalopods (Berry and Smith-Vaniz, 1977). Larvae are found in offshore open waters, most likely in warm, summer temperatures, and typical open Gulf salinity levels of 30 to 35 parts per thousand (Fahay, 1975; Thompson, 2005). Juveniles are pelagic, often associated with rip lines and floating structures, in waters with typical open Gulf salinity levels of 30 parts per thousand and above (Thompson, 2005). Adult greater amberjacks are also pelagic, but have been observed at depths ranging from surface to several hundred feet (meters) deep. Adults prefer waters with typical salinity levels of 30 parts per thousand and above, but become more scarce in waters with temperatures under 64 to 68 $^{\circ}$F (18 to 20 $^{\circ}$C) (Thompson, 2005; Berry and Smith-Vaniz, 1977; Fahay, 1975; Burch, 1979).

E.4.3.3 Tilefish

Tilefish (*Lopholatilus chamaeleonticeps*) are benthic and inhabit the outer continental shelf in the Gulf of Mexico at depths typically greater than 820 feet (250 meters) and temperatures ranging from 48 to 57 °F (9 to 14.4 °C) (Able, et al., 1987; Freeman and Turner, 1977). They are found in and around submarine canyons where they dig burrows in the sedimentary substrate (Nitschke, 2000). They predominately feed on crustaceans, fishes, and other benthic organisms (Freeman and Turner, 1977).

E.4.4 Coastal Migratory Pelagic Fishery

The coastal migratory pelagic fishery comprises many different species. Many top-tier predators such as cobia, dolphinfish, and mackerel are commercially and recreationally sought in the Gulf of Mexico. In addition to the top-tier predators, some primary consumers are important to many commercial fishermen (e.g., gulf menhaden).

E.4.4.1 Cobia

Cobia (*Rachycentron canadum*) are large pelagic fish that are distributed globally in tropical and subtropical waters including the coastal Gulf of Mexico. Cobia larvae occur in estuarine, nearshore and offshore locations, and they can be found near the surface or at depths of up to 984 feet (300 meters). The larvae are known to sustain greater salinity variation than more developed fish, and they can be reared at salinities as low as 19 parts per thousand (Ditty and Shaw, 1992; Hardy, 1978; Hassler and Rainville, 1975). Juvenile nursery and adult habitat overlap and include coastal areas, bays, and river mouths. Adult cobia, surviving on benthic invertebrates, follow general migration patterns—spring and summer in the northern Gulf, winter and fall in the southern Gulf. Spawning for cobia occurs in April through September in the northern Gulf of Mexico (Shaffer, et al., 1989; Boschung, 1957; Meyer and Franks, 1996; Knapp, 1951; Miles, 1949; Reid, 1954; Springer and Woodburn, 1960; Christmas and Waller, 1974). In addition to living in a narrow range of salinities, cobia are attracted to underwater structures such as pilings and wrecks, and they follow floating debris (Mills, 2000).

E.4.4.2 Dolphinfish

Dolphinfish (*Coryphaena hippurus*) are predatory oceanic fish that are limited to waters with high salinities (32 to 35 parts per thousand). They rarely travel to coastal waters (Oceanic Institute, 1993). Spawning of the species is poorly documented, but it is thought to occur nearly year-round in the Gulf, with a peak in the early fall. Dolphinfish larvae grow rapidly and reach maturity within one year of hatching. As with the adults, larvae and juveniles thrive in higher salinities and do not often occur in estuarine or coastal waters (GMFMC, 1998d). Young dolphinfish are most common at depths greater than 590 feet (180 meters), and adults can occur as deep as 5,900 feet (1,800 meters), although they are most common between 131 and 656 feet (40 and 200 meters) (Powles, 1981; Gibbs and Collette, 1959; Schuck, 1951; Ditty, et al., 1994). As with cobia, dolphinfish are attracted to floating objects and often aggregate around floating debris (Palko, et al., 1982). Dolphinfish also thrive in the Mississippi River plume, and they are particularly abundant in waters around the mouth of the Mississippi.

E.4.4.3 Gulf Menhaden

Gulf Menhaden (*Brevoortia patronus*) occur mostly inshore in the Mississippi Delta area in summer and largely move into deeper water in the fall. They feed in dense schools, filtering phytoplankton, but possibly also feed at the bottom. Spawning occurs from October to February, with a peak in January. Salinity tolerance ranges from 0.1 to 60 points per thousand, but the commercial catch is taken mostly

from salinity from 5 to 24 parts per thousand. Larvae stay in offshore waters for 3 to 5 weeks before moving into estuaries where they grow into adults (Patillo et al, 1997).

Commercial fisheries target this species because of the versatility they offer with products, from meal, to oils, to foodstuffs. Gulf menhaden are marketed fresh, salted, or canned, but mainly they are used as a source of fish oil and fishmeal. Construction of the SPR facilities and associated pipelines is not expected to have an impact on the commercial fishery.

E.4.4.4 King Mackerel

King mackerel (*Scomberomorus cavalla*) are found throughout the Gulf of Mexico, and they range throughout the neritic zone from close to shore to depths of 656 feet (200 meters). Spawning of king mackerel occurs throughout its range and peaks from May to October. Eggs and larvae are pelagic over depths of 98 to 590 feet (30 to 180 meters); optimally they grow in salinities more than 30 parts per thousand (Dwinell and Futch, 1973; Godcharles and Murphy, 1986; Nakamura, 1987). Although juveniles may occasionally use estuaries as nurseries, they generally live in nearshore shelf waters at depths of less than 29 feet (9 meters). As king mackerel grow, they prey on larger species of pelagic fish and squid, moving farther offshore to the edge of the continental shelf (Godcharles and Murphy, 1986).

E.4.4.5 Spanish Mackerel

Spanish Mackerel (*Scomberomorus maculates*) are primarily a neritic species, but in rare cases they inhabit inshore and estuarine waters (GMFMC, 1998d). Spanish mackerel larvae are most successful in inner continental shelf environments with salinity ranging from 28 to 37 parts per thousand, and at depths greater than 164 feet (50 meters) (Dwinell and Futch, 1973). Spanish mackerel is very similar to king mackerel in diet, and they prey primarily on pelagic fish, especially clupeids, engraulids, and carangids (GMFMC, 1998d).

E.4.5 Spiny Lobster Fishery

Although adult spiny lobsters (*Panulirus argus*) inhabit bays, lagoons, salty estuaries, and shallow banks, spawning for the spiny lobster takes place along the deeper reef fringes. After the larvae hatch, they live in the epipelagic for 6 to 12 months and exist in an offshore environment marked by relatively constant temperature and salinity, low levels of suspended sediments, and few pollutants (GMFMC, 1998f). Recruitment begins when the larval spiny lobsters adopt a secondary morphology with specialized abdominal pleopods that allow the lobsters to migrate to the nearshore. These migrations correspond with new and first quarter lunar phases (Marx and Herrnkind, 1986). The juvenile initially settle in macroalgae beds along rocky shorelines and feed on mollusks and other crustaceans. As the spiny lobster continues to grow and molt, it settles on larger biotic and abiotic structures. Adults eventually inhabit crevices in coral reefs and rock formations. Both the juveniles and adults are stenohaline, and optimally survive in water with a salinity of 32 to 36 parts per thousand (NOAA Panama City Laboratory, 2005; Buesa, 1979; Fields and Butler, 1994).

E.4.6 Highly Migratory Species

According the Fishery Conservation Amendments of 1990, (Public Law 101-627) highly migratory species (HMS) found in the deep waters of the Atlantic Ocean and Gulf of Mexico include: albacore tuna (*Thunnus alalunga*), bigeye tuna (*Thunnus obesus*), bluefin tuna (*Thunnus thynnus*), skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), marlin (*Tetrapturus* spp. and *Makaira* spp.), oceanic sharks, sailfishes (*Istiophorus* spp.), and swordfish (*Xiphias gladius*). These HMS usually feed in deep water.

E.4.6.1 Albacore Tuna

Albacore tuna (*Thunnus alalunga*) are epipelagic and mesopelagic, and are found in oceanic surface waters between 60 to 67 °F (15 to 19 °C); deeper swimming, large albacore are found in waters of 56 to 78 °F (13 to 25 °C); temperatures as low as 49.1 °F (9.5 °C) may be tolerated for short periods. The species is known to concentrate along thermal discontinuities. It forms mixed schools with skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), and bluefin tuna (*T. maccoyii*). Schools may be associated with floating objects including sargassum weeds. Primary prey includes fishes, crustaceans, and squids. Sexual maturity is reached at 35 inches (90 centimeters). Albacore tuna has high market demand.

E.4.6.2 Bigeye Tuna

Bigeye tuna (*Thunnus obesus*) occur in areas where water temperatures range from 55 to 84 °F (13 to 29 °C), but the optimum temperature for the species is between 62 and 71 °F (17 and 22 °C). Variation in occurrence is closely related to seasonal and climatic changes in surface temperature and thermocline. Juveniles and small adults collect in schools at the surface in monospecies groups or mixed with other tunas, and the schools may be associated with floating objects. Adults stay in deeper waters. Eggs and larvae are pelagic. Bigeyes feed on a wide variety of fishes, cephalopods, and crustaceans during the day and at night.

E.4.6.3 Blue Marlin

Blue Marlin (*Makaira nigricans*) is an oceanic species. Water color affects its occurrence, at least in the northern Gulf of Mexico, where the fish show preference for blue water. The species rarely gathers in schools, and it usually occurs as scattered individuals. Blue marlin feed mainly on fishes, but they also prey on octopods and squids. Feeding takes place during daytime. Sexual maturity in males is reached at about 32 inches (82 centimeters) in length and 90 pounds (40 kilograms) and for females 20 inches in length (50 centimeters) and 60 pounds (27 kilograms).

E.4.6.4 Bluefin Tuna

Bluefin Tuna (*Thunnus thynnus*) is primarily an oceanic species, but it can tolerate a wide range of temperatures, and seasonally it comes close to shore. It gathers in schools by size, and sometimes together with albacore, yellowfin, bigeye, skipjack tunas. It preys on small schooling fishes (anchovies, sauries, hakes) or on squids and red crabs. The species is pelagic and oceanodromous, and it is found in brackish to marine waters at a depth range 0 to 9,840 feet (0 to 3,000 meters). Bluefin tuna have become rare because of massive overfishing.

E.4.6.5 Skipjack Tuna

Skipjack tunas (*Katsuwonus pelamis*) are found in offshore waters. The larvae are restricted to waters with surface temperatures of 59 to 86 °F (15 to 30 °C). They exhibit a strong tendency to school in surface waters with birds, drifting objects, sharks, and whales and may show a characteristic behavior like jumping, feeding, foaming, etc. Skipjacks feed on fishes, crustaceans, cephalopods, and mollusks; cannibalism is common. They are preyed upon by large pelagic fishes. Skipjack tunas are marketed fresh, frozen or canned, dried-salted, and smoked. They spawn throughout the year in the tropics.

E.4.6.6 Swordfish

Swordfish are an oceanic species but sometimes are found in coastal waters. They generally live above the thermocline, preferring temperatures of 64 to 71 °F (18 °C to 22 °C). Larvae are frequently encountered at temperatures above 75 °F (24 °C). The larvae migrate toward temperate or cold waters in the summer, and then back to warm waters in the fall. Larger individuals may accumulate high concentrations of mercury in their flesh. In the Atlantic, spawning, which occurs in spring, takes place in the southern Sargasso Sea. The females grow faster than males. Age determination is difficult because the otoliths are very small and scales are missing in adults. Eggs are pelagic and measure 0.06 to 0.07 inches (1.6 to 1.8 millimeters). Newly hatched larvae are 0.16 inches (4 millimeters) long. The sword is well developed at a length of 0.37 inches (10 millimeters), and the young live pelagically in the upper water layers, where they quickly develop into voracious predators. The adults are opportunistic feeders, known to forage for their food from the surface to the bottom over a wide depth range. They use their sword to kill their prey, and feed mainly on fishes, crustaceans, and squids.

E.4.6.7 White Marlin

White Marlin (*Tetrapturus albidus*) are usually found above the thermocline. Its distribution varies seasonally, reaching higher latitudes in both the northern and southern hemispheres only during the respective warm seasons. The species is usually found in deep blue water (328 feet, 100 meters) with surface temperatures higher than 71 °F (22 °C) and salinities of 35 to 37 parts per thousand. Currents of 0.5 to 2 nautical miles per hour (0.9 to 3.7 kilometers per hour) occur over much of its habitat. White marlin feed on fishes and squids.

E.4.6.8 Yellowfin Tuna

Yellowfin Tuna (*Thunnus albacares*) are an oceanic species occurring above and below the thermoclines. They school primarily by size, either in monospecific or multispecies groups. Larger fish frequently gather in schools with porpoises, and they are associated with floating debris and other objects. Yellowfins feed on fishes, crustaceans, and squids. They are sensitive to low concentrations of oxygen, and therefore, they are not usually caught in waters deeper than 820 feet (250 meters) in the tropics. Peak spawning occurs in batches during the summer. Encircling nets are used to catch schools near the surface.

E.4.7 Stone Crab Fishery

The stone crab (*Menippe mercenaria*) fishery is a fairly small market in the northern Gulf of Mexico. The majority of the stone crab market comes from areas in southern Florida or southern Texas. The majority of the fishery is not located within the proposed project areas. Stone crabs do exist within the project area, but not in the larger numbers that exist in the southern Gulf of Mexico.

Stone crab larvae are hatched in the spring and fall in nearshore Gulf environments. The growth of the planktonic larvae depends on salinity and temperature, but stone crabs will usually progress through the larval stage in 14 to 27 days (Lindberg and Marshall, 1994). Juveniles settle in nearshore waters, and they can tolerate a broad range of temperature 46 to 100 ^{0}F (8 to 38 ^{0}C), and salinity (5 to 40 parts per thousand) (Brown, et al., 1992; Ong and Costlow, 1970). Both juveniles and adults are opportunistic carnivores. Adults dig and burrow to hide during hunting. Post-settlement juveniles hide in naturally occurring features such as shell hash habitat, sponges, and mats of seagrass (Culter and Mahadevan, 1982). Although they are occasionally found in the intertidal, adult stone crabs generally inhabit the shallow shelf seagrass flats and are specifically abundant in turtle grass (*Thalassia testudinum*). Adults

are euryhaline and can survive in a wide range of salinities; however, they are most common in water with salinity of at least 15 parts per thousand (NOAA Panama City Laboratory, 2005; GMFMC, 1998e).

E.4.8 Snapper Fishery

The snapper fishery comprises many different species, but the primary species sought is the red snapper. The red snapper fishery is strictly regulated because of the sensitivity of the species, and annual bag limits are set based on previous years' landings. The commercial fishing season for red snapper is during the summer, but recreational fishing can take place year round. Other snapper species are also sought, including the gray snapper.

E.4.8.1 Gray Snapper

Gray snappers (*Lutjanus griseus*) are found in coastal and offshore waters associated with seagrass, mangroves, estuaries, lagoons, deep channels, and reefs (NatureServe, 2005). Adults of the species tend to remain in the same area. Juvenile gray snapper prefer inshore areas such as seagrass beds (especially *Thalassia* seagrass), soft- and sand-bottom areas, and mangrove roots (Starck and Schroeder, 1971). Both adults and juveniles have been found in freshwater lakes and rivers in south Florida, which indicates a tolerance of a broad range of salinity levels. Juveniles are typically found in temperatures ranging from 55 to 97 ^{o}F (12 ^{o}C to 36 ^{o}C) and low salinities ranging from 0 to 66 parts per thousand (Rutherford, et al., 1989; Rutherford, et al., 1983). Adults occur in waters with depths of 0 to 591 feet (0 to 180 meters), temperatures from 56 to 90 ^{o}F (13 ^{o}C to 32 ^{o}C), and salinities ranging from 0 to 47 parts per thousand (NatureServe, 2005; Wang and Raney, 1971).

E.4.8.2 Lane Snapper

Adult lane snappers (*Lutjanus synagris*) are found in a variety of habitats throughout its range, but are most commonly observed over reefs and vegetated sandy bottoms in shallow inshore waters (Bester and Murray, 2005). Lane snappers also occur in seagrass beds associated with shrimping areas and offshore waters to depths of 1,300 feet (400 meters) (Bester and Murray, 2005). After they are established, adult lane snappers remain in the same area for their entire lives. Because the lane snapper lives in a wide range of habitats, they are opportunistic predators, feeding on a variety of prey such as smaller fishes, shrimp, cephalopods, gastropods, and crabs. Juveniles prefer protected inshore areas and are often found in waters of low salinity - 15 parts per thousand or less (Bester and Murray, 2005; Erhardt, 1976). Adults are typically found in waters at depths of 13 to 433 feet (4 to 132 meters), temperatures between 60 to 82 ^{o}C (16 ^{o}C and 29 ^{o}C), and high salinities of 30 parts per thousand or greater (Bullis and Jones, 1976; Erhardt,1976).

E.4.8.3 Red Snapper

Red snapper (*Lutjanus campechanus*) larvae and juveniles are found in offshore continental shelf waters at depths ranging from 56 to 600 feet (17 to 183 meters), temperatures ranging from 63 to 85 ^{o}F (17 to 29 ^{o}C), and salinities ranging from 32 to 37 parts per thousand. Juveniles are most often observed in association with structures, objects, or small burrows and they are less likely to be observed over barren bottoms (Collins, et al., 1980; Moseley, 1966). Adults are found in large abundance off the Yucatan, Texas, and Louisiana coasts over areas of hard limestone or gravel bottoms and irregular bottom formations including deep reefs. Adult red snappers are found in waters at depths from 132 to 361 feet (40 to 110 meters), temperatures ranging from 57 to 86 ^{o}F (14 to 30 ^{o}C), and salinities ranging from 33 to 37 parts per thousand. The red snapper is a carnivorous fish, feeding primarily on a variety of smaller fishes, squid, octopus, crustaceans, and mollusks (Bester, 2005b).

E.4.8.4 Yellowtail Snapper

Adult yellowtail snappers (*Ocyurus chrysurus*) are semipelagic, and, typically are found over sandy or hard bottom areas near deep reefs at depths of 32 to 230 feet (10 to 70 meters) (Bester, 2005a). After they are established, adult yellowtail snappers tend to remain in the same area for long periods of time (Bester, 2005a). They feed predominately on benthic and pelagic reef fishes, crustaceans, and mollusks (Randall, 1967; GMFMC, 1980). Juveniles are found in and around shallow seagrass beds (especially *Thalassia* grass), shallow reef areas, mangrove roots, and jetties and pilings in preferred water temperatures of 63 to 85 ^{o}F (24 to 30 ^{o}C) (Thompson and Munro, 1974; Wallace, 1977). Adults are found on deeper reefs, and they tolerate temperatures ranging from 64 to 93 ^{o}F (18 to 34 ^{o}C) (GMFMC, 1980; Thompson and Munro, 1974; Roe, 1976).

E.5 ASSESSMENT OF IMPACTS AND MITIGATIVE MEASURES

As described in section E.2, only five of the proposed new and expansion sites would affect EFH. The locations of the brine disposal pipelines and the modeled brine plumes have been overlain on the designated EFH areas in the figures below for the Richton (figure E.5-1), Big Hill (figure E.5- 2), Stratton Ridge (figure E.5-3), Chacahoula (figure E.5-4), and Clovelly (figure E.5-5) sites. The brine plumes in these figures represent one of the two prevalent current directions. The depiction of the other prevalent current direction can be found in the draft EIS Appendix C on the brine discharge modeling. Based on the designated EFH areas and the species' life histories presented in section E.4, DOE has identified the species of concern in table E.5-1. This table presents the overlap between both estuarine and offshore EFH areas at each of the proposed expansion sites and the species that potentially would be affected.

The potential impacts to the EFH and managed fish species are common across all of the sites that have brine disposal pipelines and brine diffusers. In an effort to consolidate the discussion of impacts, the sites are grouped together as a general category of common impacts. The sites with potentially unique impacts are listed separately.

E.5.1 Common Impacts to the EFH

This section discusses potential impacts to the EFH that are common across multiple locations and are not dependent upon whether the object is an estuarine or marine component of the EFH. Water quality impacts and disruption of the habitat are two examples of the common impacts.

Water quality impacts to the water column would be caused by increased suspension of sediments generated from construction activities. The suspension of sediment in the water column may lead to an increase in heavy metal concentration in suspension and solution, but the effect would be temporary and very localized. The disturbance of the sediments during construction also may cause nutrients to become re-suspended and thereby trigger growth of plankton populations. Table E.5.1-1 shows the approximate footprint of disturbance for each of the alternatives that would occur to the estuarine and marine bottom from the installation of the brine pipeline. The area of disturbance is a very small fraction of the amount of similar habitat within the region.

The main impact on the water column would come from constructing the proposed brine pipelines, which would increase turbidity within the water column. The significance of this impact would depend on the type of substrate located along the ROW, the resettlement rate of the sediment, and the duration of the construction activities. For example, sediment particles of sand size or larger would settle quickly (in a matter of seconds) in the vicinity of the construction activity. On the other hand, smaller silt and clay particles would be transported greater distances by the currents before settling back down to the bottom. If the current velocity is 1 foot per second (0.3 meters per second) and the silt particles take 60 seconds to settle, they might be transported 60 feet (18 meters) from the construction area. There is some probability that the construction could disturb sediments that are contaminated, which would cause potential for contaminants to be released into the water column. DOE is not aware of different conditions among the alternatives that would make it more likely to encounter contaminated sediments.

Offshore pipelines would be strung together on barges and lowered to the floor of the Gulf of Mexico. After the entire offshore pipeline and diffuser had been strung together and placed on the floor of the Gulf of Mexico, a jet-sled would be used to bury the pipeline below the substrate. The jet-sled would direct high velocity water streams below the pipeline, thus removing the sediment below the pipeline and allowing it to sink.

Figure E.5-1: Locations of the Brine Disposal Pipelines and the Modeled Brine Plumes Overlain on Designated EFH for Richton

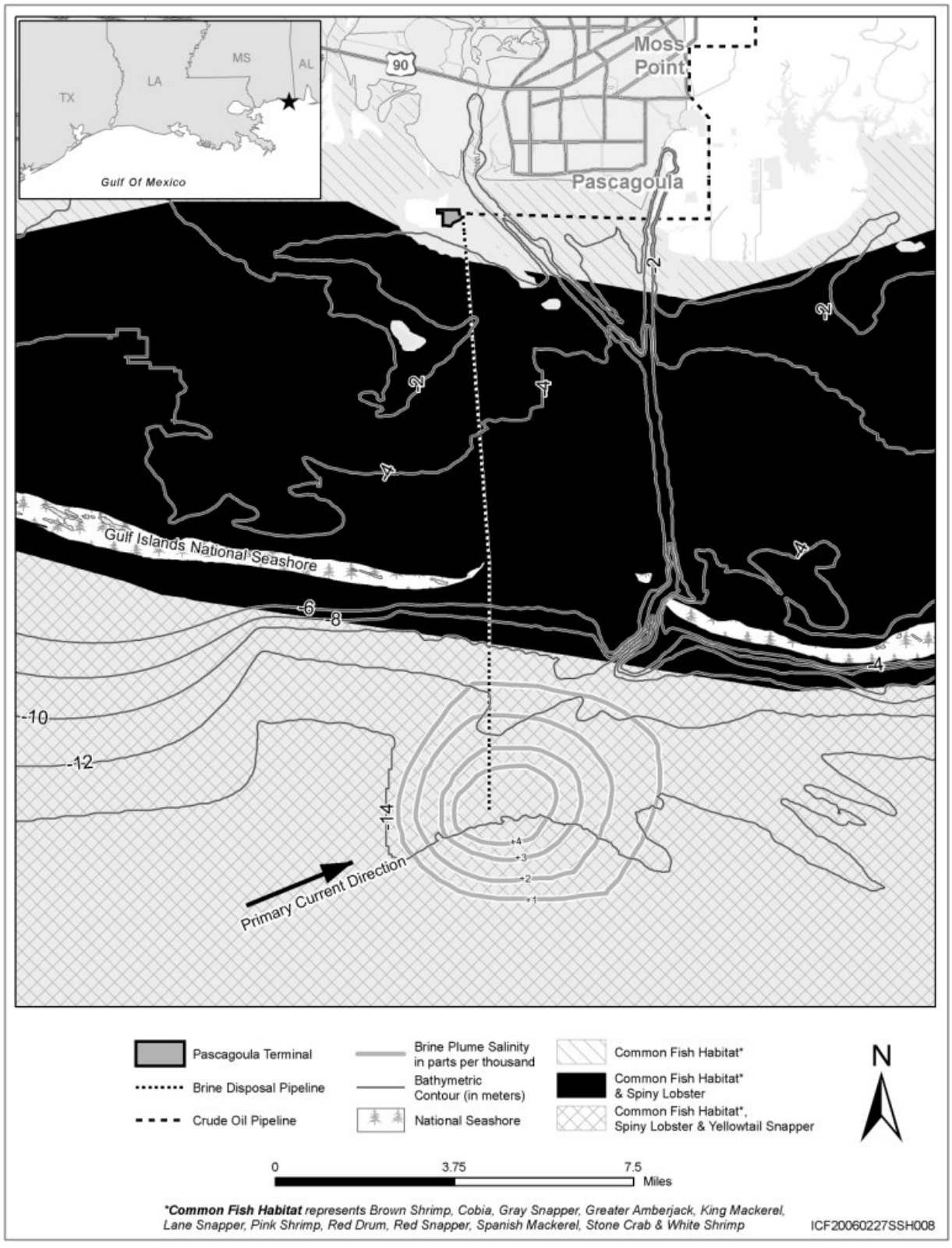


Figure E.5-2: Locations of the Brine Disposal Pipelines and the Modeled Brine Plumes Overlain on Designated EFH for Big Hill

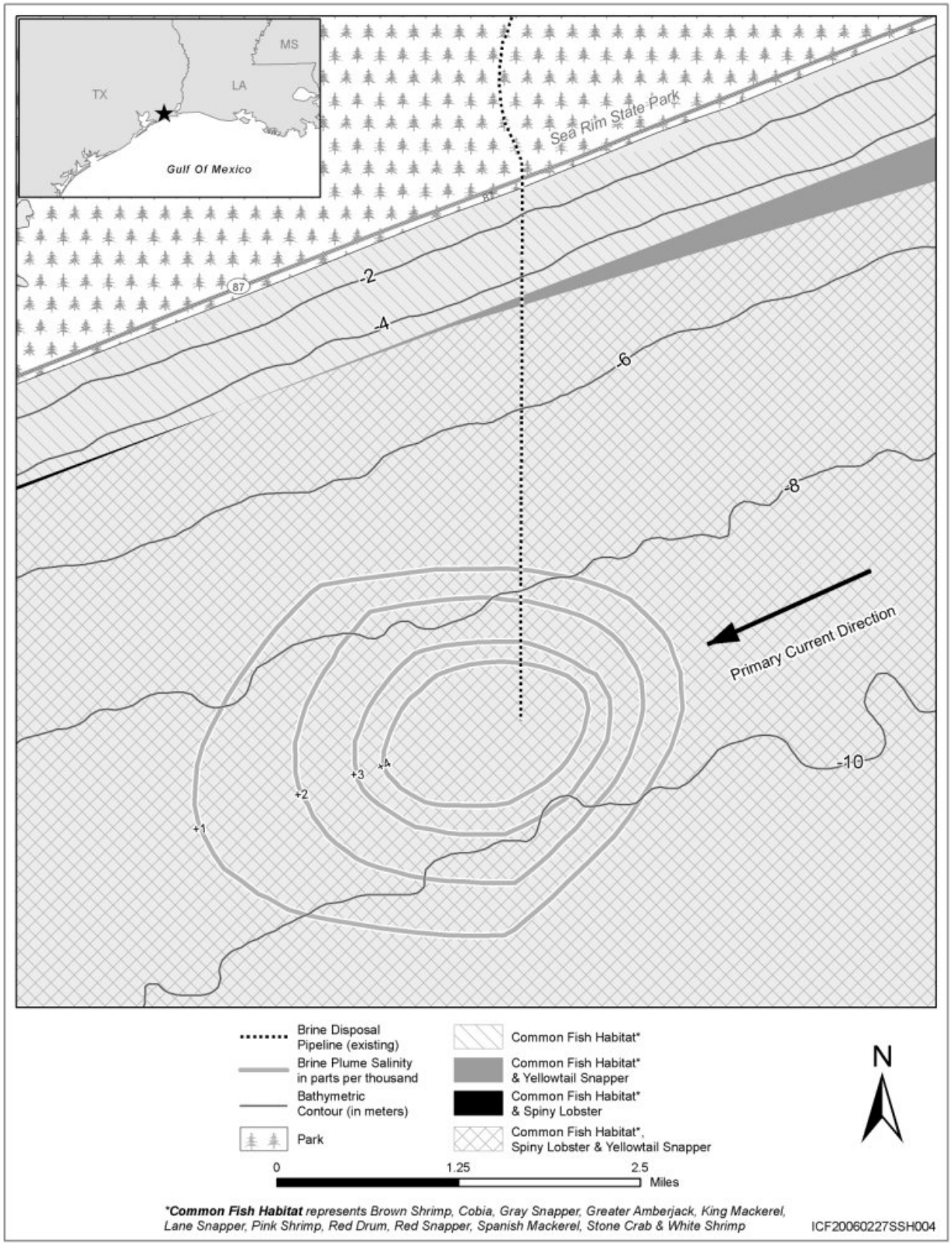


Figure E.5-3: Locations of the Brine Disposal Pipelines and the Modeled Brine Plumes Overlain on Designated EFH for Stratton Ridge

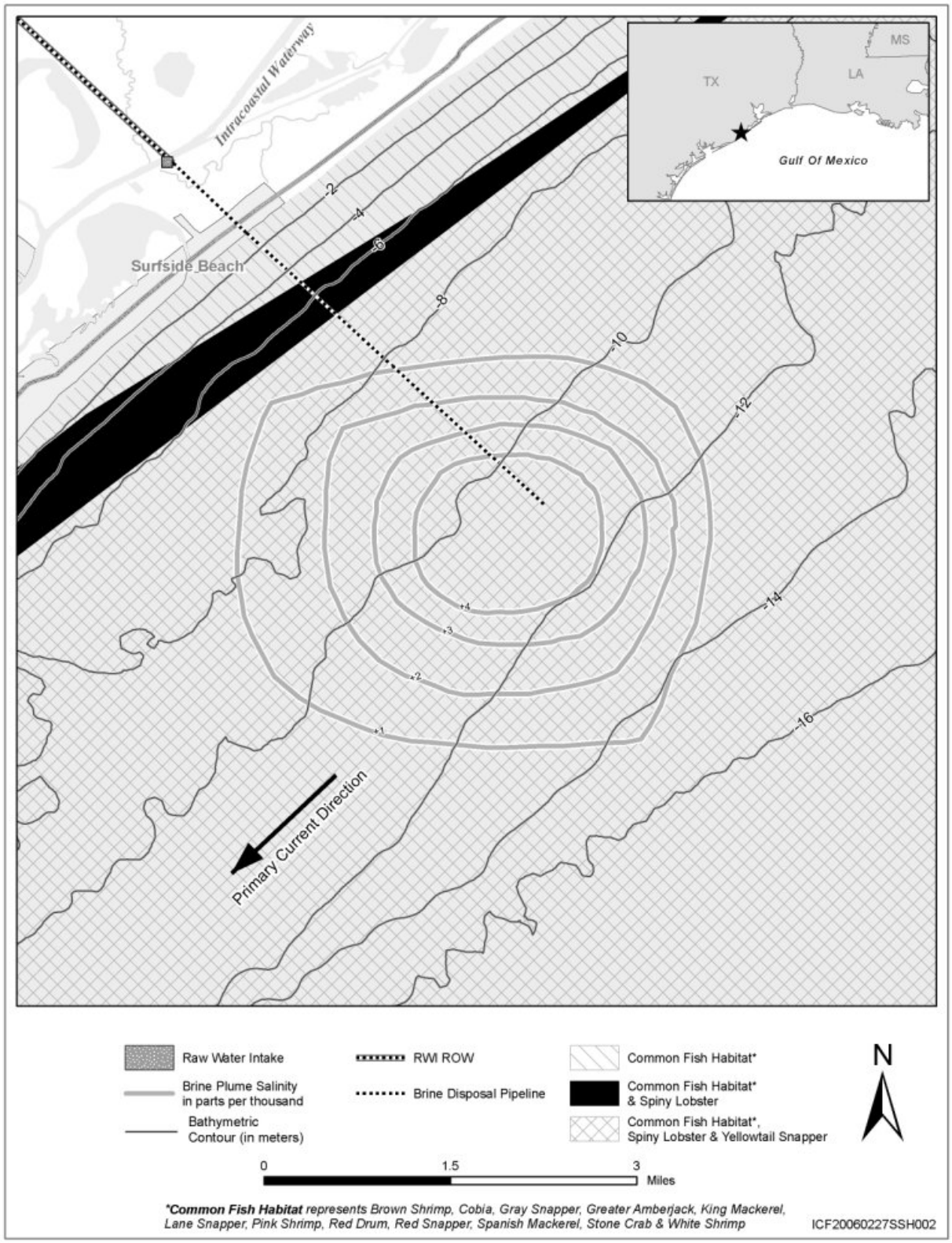


Figure E.5-4: Locations of the Brine Disposal Pipelines and the Modeled Brine Plumes Overlain on Designated EFH for Chacahoula

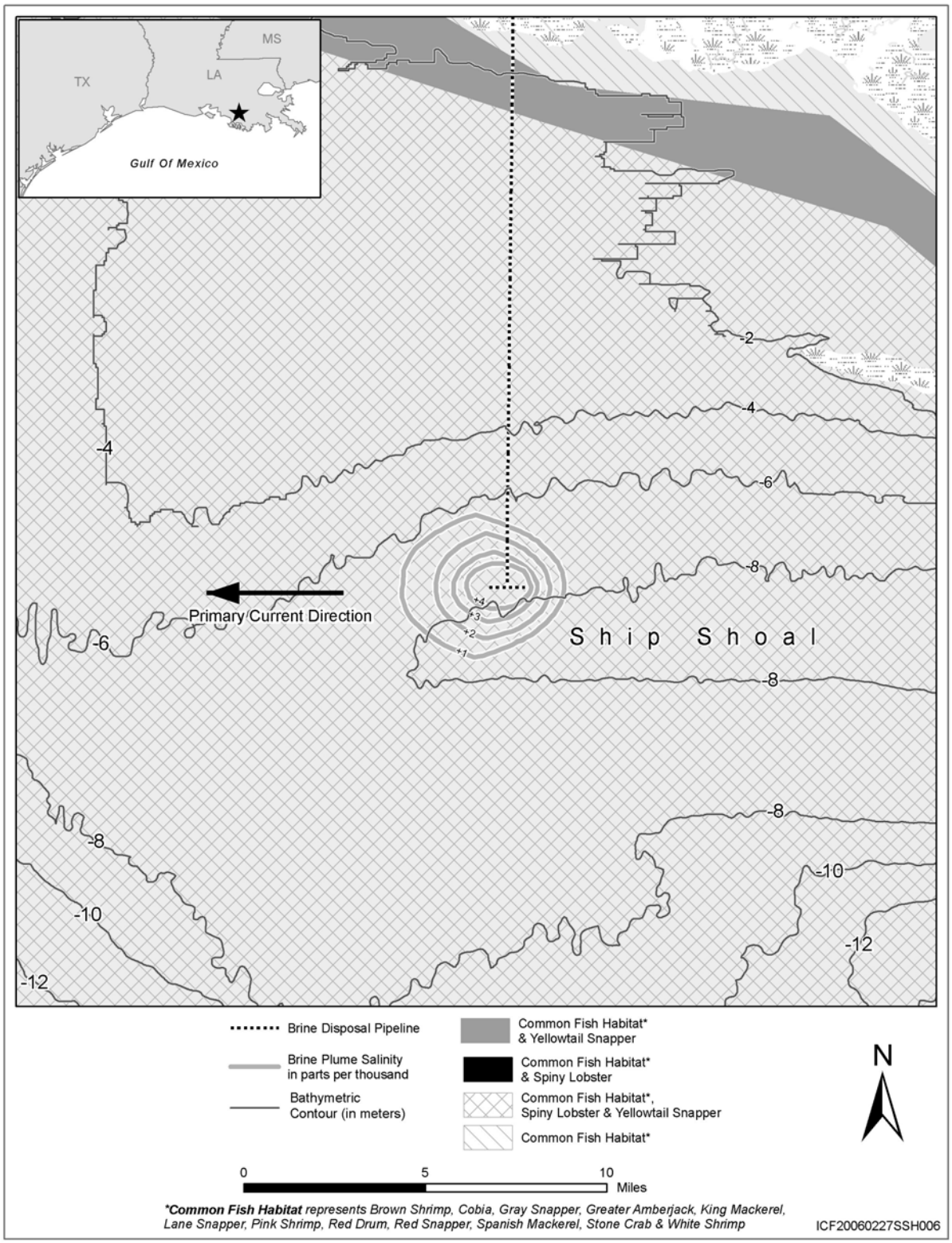


Figure E.5-5: Locations of the Brine Disposal Pipelines and the Modeled Brine Plumes Overlain on Designated EFH for Clovelly

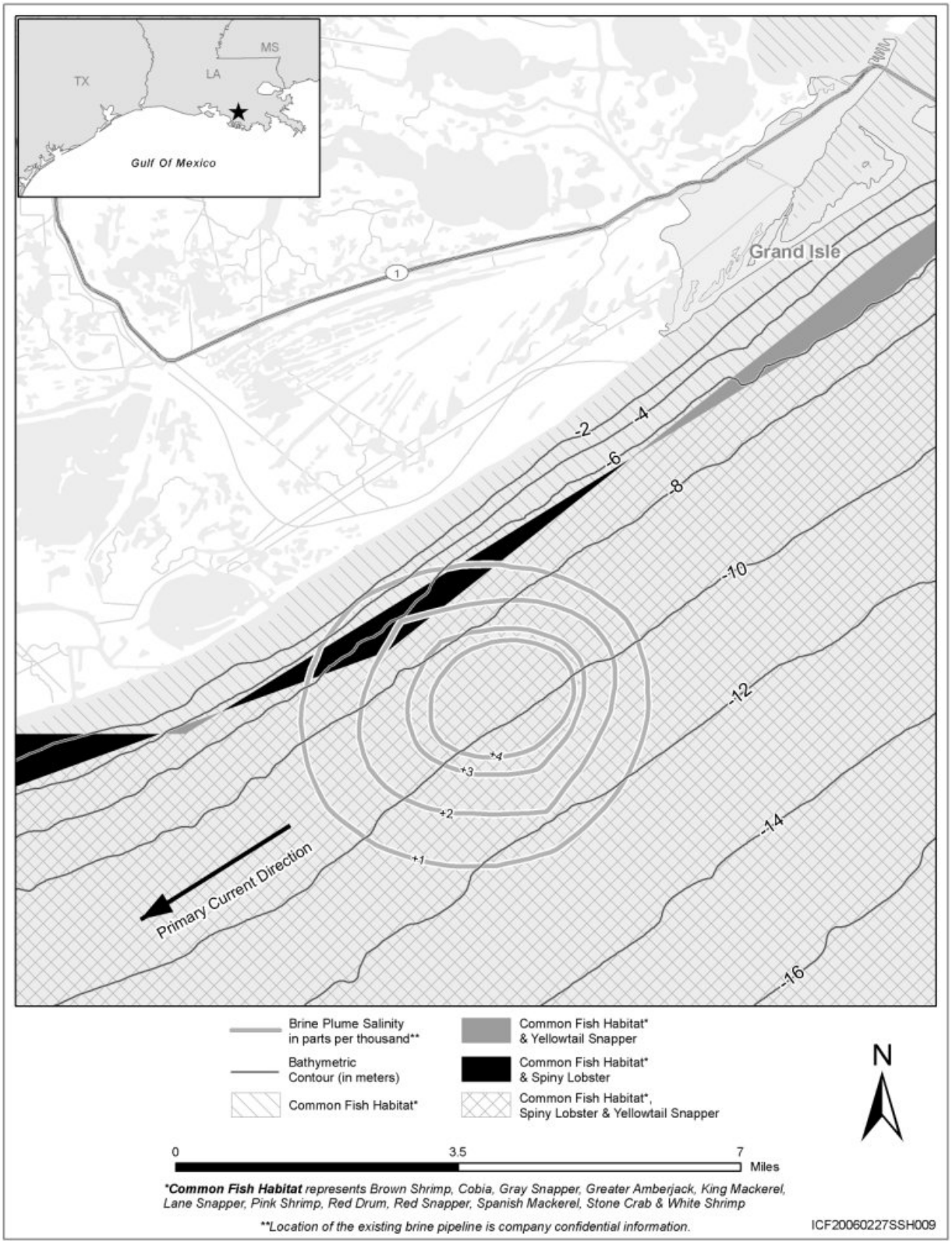


Table E.5-1: Managed Species Potentially Effected By The Candidate Alternatives

	Richton		Big Hill		Stratton Ridge		Chacahoula		Clovelly*	
	Estuary	Offshore	Estuary	Offshore	Estuary	Offshore	Estuary	Offshore	Estuary	Offshore
Cobia	--	X	--	X	--	X	--	X	--	X
Dolphinfish	--	X	--	X	--	X	--	X	--	X
Greater Amberjack	--	X	--	X	--	X	--	X	--	X
King Mackerel	--	X	--	X	X	X	--	X	--	X
Red Drum	X	X	X	X	X	X	X	X	X	X
Red Grouper	--	X	--	X	--	X	--	X	--	X
Spanish Mackerel	--	X	X	X	X	X	--	X	--	X
Tilefish	--	--	--	--	--	--	--	X	--	X
Snapper										
Gray	X	--	X	X	X	X	X	--	X	--
Lane	--	X	--	X	--	X	--	X	--	X
Red	--	--	--	--	--	--	--	X	--	X
Vermillion	--	X	--	--	--	--	--	X	--	X
Yellowtail	--	X	--	X	--	X	--	X	--	X
Gulf Stone Crab	X	--	X	--	X	--	X	--	X	--
Stone Crab	X	X	X	X	X	X	X	X	X	X
Spiny Lobster	--	X	X	X	X	X	X	X	X	X
Shrimp										
Brown	X	X	X	X	X	X	X	X	X	X
Pink	X	X	X	X	X	X	X	X	X	X
White	X	X	X	X	X	X	X	X	X	X

* Note: The Clovelly-Bruinsburg alternative would potentially affect the same species since it would utilize the existing LOOP diffuser.

The other potential impact on the water column would be increased salinity from the brine discharge. The operation of the brine diffuser system would cause some changes to the physiochemical makeup of the water column. The brine discharge would be relatively constant for the duration of cavern solution mining (up to 5 years) and then would occur sporadically for drawdown or cavern maintenance. In the case of the Clovelly-Bruinsburg alternative, the period of brine discharge would only last about 3 to 4 years because of the smaller cavern capacity needed. The brine water would leave the diffusers at a rate of 30 feet per second (9 meters per second), at or near ambient temperature (68 °F, 20 °C), and at a concentration of approximately 263 parts per thousand. The area immediately adjacent to the brine port nozzles would have a modeled estimated salinity increase of 4.3 parts per thousand over the naturally occurring concentration (25 to 31 parts per thousand). (The brine discharge modeling reports that the value of the typical plume would be 4.3 parts per thousand, and the value for the maximum plume would be 4.7 parts per thousand).

Disruption to the species of fish, the EFH, and their prey would occur during the construction of the pipelines and brine diffusers and their operation.

Other common impacts would be caused indirectly to the EFHs or the species. A reduction in the prey for any of the managed species would have impacts to managed species populations. Prey reduction would result from the destruction of habitat, loss of food source, or incidental takings, which are impacts similar to those that affect the economically important species. In addition to mobile prey species, some sessile organisms would have an increased mortality from construction; however, the duration of the construction activities would be short and the affected areas would be relatively small.

During the construction phase of the proposed SPR project, the noise generated from the construction and support vessels may affect populations in the area. Depending on the species, the loudness (in decibels) and the frequency of the noise would create navigational disruption for some species of fishes. It is likely that noise and vibration from SPR project construction would cause species to leave the area. Once construction is complete, noise levels would return to normal and populations that vacated the area would return.

Table E.5.1-1 shows the estimated temporary impact to EFH from the construction footprint of the brine diffuser system.

Table E.5.1-1: Estimated Surface Area in Square Feet (Square Meters) of Estuarine and Marine Bottom Disturbed by Brine Pipeline Construction

	Big Hill square feet (square meters)	Stratton Ridge square feet (square meters)	Clovelly square feet (square meters)	Chacahoula square feet (square meters)	Richton square feet (square meters)
Temporary construction impact	N/A because new pipeline would not impact EFH	320,179 (30,550)	N/A because no new pipeline would be constructed	1,475,865 (140,600)	1,062,758 (101,250)

Note: The approximate area of disturbance was determined by calculating the length of the proposed offshore pipeline and the estimated width of the disturbance to sediments caused by the installation

E.5.2 Impacts to the Estuarine Component of the EFH

The estuarine environment throughout most of the proposed project areas already is disturbed. In some cases, the construction of the pipeline in estuarine areas would take place using directional drilling or would follow existing utility/pipeline corridors and canals. This would prevent adverse effects to the estuarine habitat.

The proposed construction of the brine pipeline would cause a temporary impact to this type of habitat, and many of its functions and value would be restored after construction is completed. Species that typically live within this habitat during one or all of their life phases would most likely leave the area during the construction phase of the proposed project. After the construction ceases, the fish populations would begin to return. There would be some local impacts where construction occurs, but the surrounding areas that remain undisturbed would allow the disturbed areas to quickly re-establish and function as habitat again.

The construction methods used for the pipeline installation would depend on several factors including cost, distance crossed, and habitat type. The clearing of the substrate to allow for burial of the pipeline would be the most intrusive part of the project, resulting in the greatest overall impact. Because of the construction, the concentration of suspended sediment would increase in the project area causing an increase in turbidity for a 1- to 2-day period immediately following construction (NEBC, 2003). Potential direct impacts to infaunal benthic communities resulting from the construction process include abrasion, clogging of filtration systems necessary for feeding and respiration, and burial and smothering. This impact also may be accompanied by harmful indirect effects such as changes in light attenuation leading to decreased feeding efficiency and changes in substrate composition (Berry, et al., 2003).

The survivorship of benthic invertebrates and other infauna in the project area is species- and location-specific. Many estuarine organisms have evolved mechanisms to survive changes in suspended and bedded sediment, and would not be affected by the project (Maurer, et al., 1986). Open water benthic organisms are less tolerant to sediment changes, and mortality rates would likely be higher offshore. Two vulnerable populations include mollusks, which would likely experience increased mortality and impaired growth rates in the project construction area, and demersal fish eggs that lie directly in the construction path (Berry, et al., 2003). Mature fish are fairly mobile, and likely they would leave the area during the construction process and return after completion.

The disturbance to suspended and bedded sediment may change the composition of the sediment, temporarily altering the distribution and relative frequencies of organisms in the infaunal community. Complete recovery of soft-bottomed benthic communities may take up to 2 years from the time of construction (NEBC, 2003). Even though the recovery period is long, the project area affected by construction is small relative to the amount of substrate habitat that exists.

The pipeline alignment and diffuser system for both Richton and Stratton Ridge would not be located in any known areas of seagrasses. The Richton pipeline would pass to the east of Gulf Islands National Shoreline, between a shipping lane and the barrier island. Given that the line is not passing over the barrier island or through known submerged aquatic vegetation, direct impacts from construction would not occur. Indirect impacts would depend upon the proximity to submerged aquatic vegetation.

If some submerged aquatic vegetation beds were to be affected by proposed pipeline ROWs, additional permits and approvals would be required and DOE would work with Gulf Islands National Seashore to restore those areas or rehabilitate other historical beds nearby.

E.5.3 Impacts to the Marine Component of the EFH

The impacts to the marine component of the EFH would be generated from the construction of the brine diffuser and the associated offshore pipeline. There would be two different methods of offshore trenching across the intertidal zone and barge construction with a jet-blasting sled.

The construction of the shore crossing at most locations would start from the shoreline, assemble the pipeline, and lay the pipeline in a trench that was already dug. The trenching method is a construction

approach that permits low-cost construction and a shorter time frame. The construction impacts would be confined to the pipeline footprint and would be localized. The trenching method would disrupt habitat within the construction footprint only for a short time period during and immediately after construction (1-2 days). Each of the managed species would leave the area and return after completion.

Offshore construction would be conducted by barge and several support vessels. The pipeline would be first constructed on the barge and laid on the seafloor. After the pipeline was entirely assembled, a jet-blasting sled would then pass over the pipeline, burying the pipe below the sediment. The sled would straddle the pipeline and shoot high-pressure ambient water toward the sediment. After the sediment was removed from under the pipeline, the pipeline would fall into the trench created by the sled.

The main impact would come from the jet-blasting sled because it would increase the turbidity of the water column and cause mortality of sessile organisms unable to escape the immediate area. These sessile organisms would be a food resource for some of the commercially important species, and the reduction in the resource would affect some species populations; however, the construction footprint is relatively small and the duration of the construction is relatively short.

The operation of the brine diffuser system would cause some changes to the physiochemical makeup of the water column. For the Clovelly, Clovelly-Bruinsburg, and Big Hill sites the brine diffuser already exists and is already operating. Brine discharge would increase with the construction of new caverns for these sites. The brine water would leave the diffusers at a rate of 30 feet (9.14 meters) per second, at or near ambient temperature, and a concentration of about 263 parts per thousand. Consequently, the water immediately adjacent to the brine port nozzles would have a salinity of about 263 ppt. Moving away from the brine port nozzles, the salinity would decrease as the brine solution dilutes into the ambient environment and moves down current (see appendix C). The area of the mixing zone at a concentration of 4 ppt above ambient would vary by site and local conditions. At the Big Hill site, this plume would be as large as 4.3 square nautical miles (14.7 kilometers). Table E.5.3-1 highlights the ambient conditions at five of the sites. Table E.5.3-2 highlights the changes in the physiochemical characteristics that occur from the brine discharge.

Table E.5.3-1: Ambient Conditions at the Brine Diffuser Locations

Parameter	Texas		Louisiana		Mississippi
	Big Hill	Stratton Ridge	Clovelly*	Chacahoula	Richton
Ambient bottom salinity – average (ppt)	31	31	31	31	31
Ambient bottom salinity - worst case (ppt)	25	25	25	31	25
Ambient surface salinity - average (ppt)	31	31	31	25	31
Ambient surface salinity - worst case (ppt)	25	25	25	31	25
Ambient bottom temperature - average (F/C)	68/20	68/20	68/20	25	68/20
Ambient bottom temperature - worst case (F/C)	59/15	59/15	59/15	68/20	59/15
Ambient surface temperature - average (F/C)	68/20	68/20	68/20	59/15	68/20
Ambient surface temperature - worst case (F/C)	59/15	59/15	59/15	68/20	59/15
Water depth (feet/meters)	33/10.1	30/9.1	36/11	59/15	47/14.3
Ambient bottom current - average (meters per second; foot/sec)	0.30/0.09	0.30/0.09	0.30/0.09	30/9.1	0.30/0.09
Ambient bottom current - worst case (meters per second; foot/sec)	0.10/0.03	0.10/0.03	0.10/0.03	0.30/0.09	0.10/0.03

ppt = parts per thousand; F = Fahrenheit; C = Celsius
* Note: This would apply to the Clovelly-Bruinsburg alternative as well.

Table E.5.3-2: Changes to Ambient Conditions at the Brine Diffuser Locations

Parameter	Texas		Louisiana		Mississippi
	Big Hill	Stratton Ridge	Clovelly*	Chacahoula	Richton
Brine salinity (ppt)	263	263	263	263	263
Brine temperature (F/C)	68/20	68/20	68/20	68/20	68/20
Maximum number of ports	75	75	75	75	75
Number of open ports needed to reach maximum brine discharge rate	57	53	22	45	45
Port height above seafloor (feet/meters)	4/1.2	4/1.2	4/1.2	4/1.2	4/1.2
Port exit velocity (feet per second/meters per second)	30/9.1	30/9.1	30/9.1	30/9.1	30/9.1
Maximum brine discharge rate (MMBD)	1.3	1.2	0.5	1.0	1
Port diameter (inches/centimeters)	3/7.62	3/7.62	3/7.62	3/7.62	3/7.62
Port spacing (feet/meters)	60/18.3	60/18.3	60/18.3	60/18.3	60/18.3
Average area in plume for + 4 ppt salinity (nm^2)	1.2	1.1	0.4	see note A	0.9
Maximum area in plume for + 4 ppt salinity (nm^2)	4.3	4.0	1.7	see note A	3.4
Maximum vertical extent of brine jets – average (feet)	19	19	19	19	19
Maximum vertical extent of brine jets – worst case (feet)	18	18	18	18	18
Water depth (feet/meters)	33/10.1	30/9.1	36/11	30/9.1	47/14.3
Salinity increase downcurrent (ppt)					
1 nautical miles (average)	1.9	1.8	1.4	1.7	1.7
1 nautical miles (worst case)	3.4	3.3	2.3	3.1	3.1
2 nautical miles (average)	1.3	1.3	1.0	1.2	1.2
2 nautical miles (worst case)	2.5	2.4	1.8	2.2	2.2
3 nautical miles (average)	1.0	1.0	0.7	0.9	0.9
3 nautical miles (worst case)	1.9	1.8	1.2	1.7	1.7
4 nautical miles (average)	0.8	0.8	0.6	0.7	0.7
4 nautical miles (worst case)	1.5	1.5	1.0	1.4	1.4

ppt = parts per thousand

nm^2 = nautical miles squared

* Note: These results would apply to the Clovelly-Bruinsburg alternative as well.

A: Model predictions were calculated for Charcahoula, however not presented. This model was not designed to take into account the unique conditions of Ship Shoal.

The operation of the brine diffusers is one aspect of SPR operations that has the potential to adversely affect EFH. In addition to increasing the ambient salinity of the water near the diffusers, the brine can also introduce ions, metals, and other inorganics into the environment as contaminants. Based on studies of water characteristics and currently operational brine diffusers, projected brine plume modeling (see appendix C) showed that at all of the proposed sites – Big Hill, Stratton Ridge, Clovelly, Chacahoula, and Richton – salinity gradients would be generated if the proposed sites were developed. The modeling shows that there would be minor salinity peaks. Past analyses on brine contaminants showed that they can be present at slightly elevated levels around the diffusers, but that fish populations do not suffer adverse effects because the concentrations are low (Hann et. al, 1984).

The maximum amount of brine diffusion varies depending on the selected site. The Big Hill brine diffuser, which is located approximately 3.9 miles (6.3 kilometers) offshore, has the highest discharge potential at 1.3 MMBD. Stratton Ridge, which is about 3 miles (4.9 kilometers) offshore, is close behind at 1.2 MMBD. The maximum discharge from Richton and Chacahoula are lower, both at 1.2 and 0.7 MBD. The diffuser at those sites is located much farther offshore at approximately 14 and 17.5 miles (22 and 28 kilometers), respectively. The Clovelly and Clovelly-Bruinsburg alternative would utilize the existing brine diffuser of the LOOP facility to dispose of up to 0.5 MMBD of brine approximately 4 miles (6 kilometers) from shore. The Clovelly discharge is the lowest because much of the brine would be retained in the Clovelly brine pond system. For all brine plume models and impact assessments, the salinity of the brine was assumed to be 263 parts per thousand. This represents the saturation salinity for water at 68 °F (20 °C), which is slightly higher than the 250 parts per thousand levels previously observed at SPR diffusers in the past. The diffusers would sit 4 feet (1 meter) above the bottom and use a maximum of 75 potential diffusion ports spaced 60 feet (18 meters) apart, although no site would require 75 ports to operate at maximum capacity. The diffusers' depths and distances offshore vary by site, and the ambient salinity generally ranges from 25 to 31 parts per thousand at all sites, depending on the magnitude and direction of current flows.

Brine plume modeling was conducted for both an average-sized plume under typical conditions and the maximum plume under the most extreme environmental conditions. The brine dispersion modeling report indicates that "the maximum scenario is associated with an 18 centimeters per second current" and that the "large, typical and maximum scenarios [are] based upon the average percent occurrence of 0 to 3, 6 to 12, and 15 to 20 centimeters per second (see appendix C). The models provided +4 parts per thousand, +3 parts per thousand, +2 parts per thousand, and +1 parts per thousand contours for the typical and maximum plumes centered on the first brine diffuser port for each site. The brine plume contours were the largest at the Big Hill diffusion site because of its high brine discharge capacity of 1.3 MMBD. For Big Hill, the typical +4 parts per thousand contour is expected to cover an area of 1.2 square nautical miles (4.1 square kilometers), although that area would increase to 4.3 square nautical miles (14.7 square kilometers) under the maximum plume scenario. The total extent of the affected area for Big Hill, given by the area contained within the +1 part per thousand contour, was 7.2 square nautical miles (24.7 square kilometers) under typical conditions, but ranged as high as 24.4 square nautical miles (83.72 square kilometers) for the maximum condition and the +1 part per thousand contour. Brine contours were smaller at the other sites because of their lower diffusion capacities. Although the aerial extent of the brine plumes is large, the brine is heavier than seawater, and therefore, it spreads out along the seabed and does not reach the surface. Given the salinity and velocity of the brine exiting the diffusion ports, the maximum height for each plume is 18.5 feet (6 meters), which is well below the surface, even for the most shallow diffusion site, which is Stratton Ridge (30 feet, 9 meters).

The salinity increase from the brine diffusion is expected to have little or no direct impact on the fishery species in the Gulf of Mexico. The aerial extent of the brine plumes are relatively small compared to the total area occupied by the commercially important species. Furthermore, the fish and shellfish species managed in the proposed project area generally demonstrate high tolerances to changes in salinity beyond the potential +4 parts per thousand maximum salinity in the contour area. The shrimp fishery is the most profitable fishery in the Gulf of Mexico. Brown and white shrimp spend a large portion of their life cycle in estuarine environments, and they tolerate a wide range of salinity changes. Both species have been caught in salinity as high as 69 parts per thousand, which is almost double the highest projected value that can be attributed to the brine diffuser (Philips and James, 1988). Past studies indicate that a drastic increase in salinity may favor a switch in dominance from white shrimp to brown shrimp in the northern Gulf (Muncy, 1984). However, the overall impact on abundance of shrimp is expected to be negligible.

Other managed species, such as the finfish, also tolerate salinity ranges greater than what would be expected due to brine discharge. For example, Menhaden, for example, can survive in salinities up to

60 parts per thousand, and snappers and red drum are found in salinities between 45 and 50 parts per thousand (Lassuy, 1983; Reagan, 1984). Due to the freshwater influx from the Mississippi River, Gulf of Mexico species are generally euryhaline and able to tolerate salinity changes beyond what SPR operations would cause. Even in cases where species avoid the high salinities of the brine plume, the ambient salinity would return to normal levels quickly after the discharge ceases in about 4 to 5 years when the solution mining is complete. The species would repopulate the affected area fairly quickly after that period.

The species that would be most impacted from the brine discharge is the spiny lobster. Unlike the other managed species in the project area, adult and juvenile spiny lobsters are stenohaline and survive optimally in a narrow range of salinities from 32 to 36 parts per thousand. Furthermore, lobsters are confined to the benthic environments most affected by brine diffusion. Given the potential salinity changes associated with SPR operations, the proposed project would put the lobsters within the most concentrated salinity plumes at risk. Past studies indicate that lobsters exposed to high salinities relocate to areas of lower salinities (Butler, et al., 2002). This behavior continues until more favorable salinities are reached or metabolic demands associated with salinity stress lead to mortality. Given the relatively small area of the highest salinity contours (+4 and +3 parts per thousand), few lobsters would be affected and many would be able to move out of the high salinity range. Overall impacts to lobster populations are expected to be small and temporary.

Although the direct impacts to managed species are expected to be negligible, the impacts to benthic communities around the diffusion sites would temporarily impact the productivity of the environment. The heavy brine tends to sink to the bottom, and it would have a disproportionate impact on benthic species. Many of the commercially managed species in the Gulf of Mexico are demersal, and thus, they rely on the benthic organisms for a food supply. Depending on their salinity tolerance, sessile organisms (mollusks, worms) may be killed by the high salinity plume, and mobile organisms (fish, crustaceans) may be driven out of the mixing zone. Further, owing to currents, tides, storms, and other local events, neither the size nor the location of the high-salinity plume would be constant. Rather, it would move with changing conditions and affect an area of the water column and bottom that overall is larger than that estimated by the steady state models. Previous studies of the impact of brine diffusion on benthic biodiversity at the West Hackberry and Bryan Mound diffusion sites indicated a significant drop in benthic biomass within a range of 656 to 6,889 feet (200 to 2,100 meters) from the diffusers (Hann, et al., 1984). These findings are consistent with studies conducted at desalination plants that found drops in benthic macrofauna abundance around their brine diffusers (Argyrou, 2000). The change in benthic productivity would deter commercially managed species from inhabiting the project area. However, these effects would be negligible considering the relatively small area of decreased productivity compared to the surrounding unaffected area in the nearshore and offshore areas of the Gulf of Mexico.

In addition to raising ambient salinity levels, the introduced brine would cause a small increase in the concentration of metals and other inorganics in the project area. In previous studies of the West Hackberry and Bryan Mound sites, brine diffusion was accompanied by a slight increase in dissolved ion concentration compared to a control site, but all ranges were within the natural variability. The levels of nickel, copper, and lead did exceed Environmental Protection Agency (EPA) standards, but they were not significantly different from the levels observed at the control site. No evidence of any petroleum contamination was observed at either of the diffuser sites. Therefore, the operation of the brine diffusers is not expected to have a noticeable impact on water quality (Hann, et al., 1984).

A special case for the effect of brine diffusion on EFH would be posed by conditions at the Ship Shoal. Ship Shoal, located seaward of the Chacahoula site brine diffuser, is a depositional sand bar that rises from the seafloor of the 33 feet (10 meters) isobath to the 19 feet (6 meters) isobath. This sandy ecosystem is important for several fisheries, specifically white and brown shrimp and spotted sea trout.

The shrimp are important commercial fisheries, while the seatrout is an important recreational fishery. In addition, Atlantic croaker is a predatory species that is found on the shoal, but has limited commercial or recreational value. The area is being considered as a harvest site for sand used in beach replenishment, and the Mineral Management Service (MMS) is conducting an environmental assessment of the potential impacts of using Ship Shoal as a sand harvest site.

The construction of the brine disposal pipeline and the brine diffusers would not be close enough to Ship Shoal to have an adverse effect. The operation of the brine diffuser for the Chacahoula site would cause minor changes in salinity concentration near the brine diffuser, but the saturated brine would diffuse in the direction of ambient conditions in a short distance. The placement of the diffuser in the trough landward of the shoal would keep the highest salinity changes away from the shoal. DOE modified the orientation of the proposed brine diffusers at Chacahoula so they would be perpendicular to the brine pipeline and parallel to the primary current direction (see figure E.5-4). This modification would ensure more complete mixing and modify the shape of the brine plume so that it would not adversely impact Ship Shoal. The species found on Ship Shoal are euryhaline species, capable of tolerating a wide range of salinities. It is unlikely the brine would create a noticeable increase in salinity over present ambient conditions, but the species present would be able to tolerate the small and moderate salinity changes to the water.

E.5.4 Environmental Consequences of the Proposed Action

The environmental consequences of the Proposed Action, with respect to EFH, would be relatively small because the species of concern are found throughout the Gulf of Mexico region, and not limited to a specific area, and they are mobile enough to avoid areas of disturbance. The impacts caused by the construction activity would be localized to the immediate area of construction and would be temporary. The brine pipeline would be buried in the sediment and therefore would not permanently impact EFH or the water column. The only permanent footprint from the brine diffusers would be those from the diffuser ports, which are small (about 1 foot in diameter). Organisms that are intolerant of wide fluctuations in salinity would be killed by the high salinity plume or driven out of the mixing zone. The impacts to prey populations and managed species from the brine discharges have been shown by previous research to occur in a relatively small area. The discharges would comply with the National Pollutant Discharge Elimination System (NPDES) discharge limits that would be established by the resource agency with jurisdiction for the alternative selected. The permit would ensure that the water quality standards would not be violated by the discharge. Aquatic resources would not be adversely affected because the water quality standards are developed to protect aquatic resources as well as human health.

In addition, DOE would secure a Section 404 permit from the Army Corps of Engineers, a Section 401 Water Quality certification from the state, and a Section 10 Permit from the Coast Guard (if appropriate) for the proposed construction within jurisdictional waters including emergent wetlands. The permit would require avoidance and minimization of impacts to wetlands and waters (including EFH that qualifies as jurisdictional under Section 404) and compensation for unavoidable and permanent impacts. This compensation would require the preservation, restoration, or enhancement of other wetlands and waters or the purchase of credits from a wetland mitigation bank. This would ensure that there is no net loss of wetlands.

E.5.5 Proposed Mitigation Measures and Guidelines for EFH Protection

For trenching construction activities near or adjacent to EFH, the use of silt curtains would help reduce the amount of sediment that is suspended in the water body. While all increased sedimentation cannot be completely avoided, minimizing the sediment load would minimize the effects on fish and benthic organisms downcurrent.

Before construction begins, DOE and its contractor would examine the schedule and compare it to known spawning and migratory times of the year. This would be done to ensure construction would not interfere with routes used to reach spawning areas or impede migratory routes. This effort would minimize the disturbance to the EFH and to the species themselves during a more sensitive time of year.

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Appendix F
Evaluation of Federally Listed Species in Louisiana

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Appendix F
Evaluation of Federally Listed Species in Louisiana

F.1 INTRODUCTION

This evaluation of federally listed species was prepared in conjunction with the draft environmental impact statement (EIS) for expansion of the Strategic Petroleum Reserve (SPR). The draft EIS evaluates the expansion of the SPR by developing additional storage capacity at two or three existing sites (West Hackberry and Bayou Choctaw in Louisiana and Big Hill in Texas) or developing one of five new sites (Chacahoula and Clovelly in Louisiana; Richton and Bruinsburg in Mississippi; and Stratton Ridge in Texas), or a combination of the Clovelly and Bruinsburg sites.

This appendix analyzes potential effects on federally endangered and threatened species, and marine mammals protected under the Endangered Species Act (ESA) and Marine Mammal Protection Act (special status species), respectively, from the proposed development of sites in Louisiana. Potential effects on endangered and threatened species and marine mammals from development of sites in Mississippi and Texas are analyzed in appendices G and H, respectively.

The Department of Energy (DOE) prepared this evaluation of federally listed species to review and document its findings of "no effect" and "may affect" in accordance with the definitions found in the Final ESA Section 7 Consultation Handbook dated March 1998 (Consultation Handbook) (USFWS and NMFS 1998), a letter from U.S. Fish and Wildlife Service (USFWS) dated September 29, 2005 (Werner 2005), and consultations with the USFWS field offices. The evaluation was based on the following definitions of the effects to endangered or threatened species in the Handbook and letter:

- **No effect**. The proposed action would not affect federally listed species or critical habitat (i.e., suitable habitat for the species occurring in the project county is not present in or adjacent to the action area).

- **Is not likely to adversely affect**. The proposed project may affect listed species or critical habitat, or both; however, the effects would be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented to reach this level of effects.

- **Is likely to adversely affect**. Adverse effects to listed species 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 it also would be likely to cause some adverse effects to individuals of that species, then the proposed action "is likely to adversely affect" the listed species.

DOE is evaluating the impacts associated with five proposed new sites and three proposed expansion sites, some of which would have more than 100 miles (160 kilometers) of new pipelines, new tank farms, and brine disposal systems (offshore diffuser or injection wells) associated with it. When DOE issues a record of decision, it will select either one new site (or a combination of the Bruinsburg and Clovelly sites) and two or three expansion sites for future development, or the no-action alternative. For these reasons, DOE has not conducted comprehensive field surveys and can only reach "no effect" or "may affect" conclusions for this evaluation of special status species instead of using all of the classifications described earlier. For the finding of "may affect," DOE has not completed onsite surveys to support a finding of "is not likely to adversely affect" or "is likely to adversely affect"; therefore, a finding of "no effect" or "may affect" is the conclusion that DOE can reach at this time.

After the record of decision is issued that specifies the new site or sites and the expansion sites that would be developed, DOE would perform site- and species-specific surveys for all the federally listed species that received a finding of "may affect." DOE would perform the evaluation of the federally listed species in consultation with USFWS and in accordance with section 7 of the ESA and the Final ESA section 7 Consultation Handbook dated, March 1998.

F.1.1 Purpose

This evaluation analyzes the potential effects of construction, operation, and maintenance of additional SPR storage capacity on federally listed threatened and endangered species. In Louisiana, this additional capacity could be added by developing one of two new sites (Chacahoula or Clovelly) or expanding capacity at one or two existing sites (West Hackberry and Bayou Choctaw). Proposed activities vary by site (e.g., based on existing infrastructure) and may include: construction of underground storage caverns and surface facilities at the storage sites; construction of pipelines for crude oil distribution, raw water supply and brine disposal; surface or groundwater withdrawals to support solution mining of new caverns; discharge of brine in the Gulf of Mexico; and construction of miscellaneous facilities at oil distribution sites.

F.1.2 Threatened and Endangered Species Terminology

The USFWS lists a species on the Federal Endangered Species List as "threatened" when it is likely to become endangered throughout all or a significant portion of its range in the foreseeable future, and lists a species as "endangered" when it is in danger of extinction throughout all or a significant portion of its range. In addition, the USFWS maintains a list of what are called "candidate species" that are being considered for listing under the Endangered Species Act. A candidate species is a species that the USFWS has on file sufficient information to support a proposal to list as endangered or threatened, but for which preparation and publication of a proposal is precluded by higher-priority listing actions. Federal agencies are encouraged to consider these species in preparing environmental impact analysis done under NEPA in order to alleviate threats to them and thereby possibly eliminate the need to list the species as endangered or threatened.

To define all the species that are required to be addressed in the biological assessment, DOE contacted and obtained information from the USFWS and the Louisiana Department of Wildlife and Fisheries (LDWF). Appendix K, Consultants with Agencies, contains the consultation letters and lists the consultation meetings held.

F.1.3 Organization

This biological assessment includes the following information: a brief literature review for each of the species addressed (section F.2), observations made during site visits (section F.3), an assessment of the potential effects of the proposed action on the threatened and endangered species (section F.4), and recommendations for minimizing potential adverse effects on the subject species and other biological resources (section F.5). References cited in the biological assessment are identified in section F.6.

F.2 LITERATURE REVIEW

The literature review describes the natural histories of all species federally listed as threatened or endangered *and* identified as present or potentially present (e.g., based on historical records) in at least one parish where proposed new or expanded SPR facilities and associated infrastructure would be located. Although candidate species (i.e., those listed as candidates for Federal listing as threatened or endangered) are within the scope of this assessment, there were no candidate species identified in the

literature review for the Louisiana parishes with proposed new and expanded SPR facilities. Table F.2-1 lists the species evaluated in this appendix.

Table F.2-1: Federally Listed Threatened or Endangered Species in Louisiana Parishes with Proposed SPR Sites

Common Name	Scientific Name	Federal Status	Louisiana Status	Parish Where Species May Exist[a]
Birds				
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	Endangered	Calcasieu, Cameron, Iberville, Lafourche, St. James Terrebonne
Brown Pelican	*Pelecanus occidentalis*	Endangered	Endangered	Cameron, Lafourche, Terrebonne
Peregrine Falcon[b]	*Falco peregrinus*	Endangered	Threatened/ Endangered	Lafourche, Terrebonne
Piping Plover	*Charadrius melodus*	Threatened	Threatened/ Endangered	Cameron, Lafourche, Terrebonne
Red-Cockaded Woodpecker	*Picoides borealis*	Endangered	Endangered	Calcasieu
Fish				
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	Threatened	Lafourche, Terrebonne, St. James, Cameron
Pallid Sturgeon	*Scaphirhynchus albus*	Endangered	Endangered	St. James, Iberville
Mammals				
Louisiana Black Bear	*Ursus americanus luteolus*	Threatened	Threatened	Iberville
Red Wolf	*Canis rufus*	Endangered	Not Listed	Calcasieu, Cameron, Terrebonne
Marine Mammals				
Gervais Beaked Whale	*Mesoplodon europaeus*	Protected	Threatened	All coastal Parishes
Goose-Beaked Whale	*Ziphius cavirostris*	Protected	Threatened	All coastal Parishes
Pygmy Sperm Whale	*Kogia breviceps*	Protected	Threatened	All coastal Parishes
Dwarf Sperm Whale	*Kogia simus*	Protected	Threatened	All coastal Parishes
Sperm Whale	*Physeter macrophalus*	Endangered	Endangered	All coastal Parishes
Atlantic Spotted Dolphin	*Stenella frontalis*	Protected	Threatened	All coastal Parishes
Rough-Toothed Dolphin	*Steno bredanensis*	Protected	Threatened	All coastal Parishes
Killer Whale	*Orcinus orca*	Protected	Threatened	All coastal Parishes
False Killer Whale	*Pseudorca crassidens*	Protected	Threatened	All coastal Parishes
Short-finned Pilot Whale	*Globicephala macrorhynchus*	Protected	Threatened	All coastal Parishes
Pygmy Killer Whale	*Feresa attenuata*	Protected	Threatened	All coastal Parishes
West Indian Manatee	*Trichechus manatus*	Endangered	Endangered	All coastal Parishes
Bottlenose Dolphin	(*Tursiops truncatus*)	Protected	Not Listed	All coastal Parishes
Reptiles				
Atlantic Hawksbill Sea Turtle	*Eretmochelys imbricata*	Endangered	Endangered	Cameron, Lafourche, Terrebonne
Green Sea Turtle	*Chelonia mydas*	Threatened	Threatened	Cameron, Lafourche, Terrebonne

Table F.2-1: Federally Listed Threatened or Endangered Species in Louisiana Parishes with Proposed SPR Sites

Common Name	Scientific Name	Federal Status	Louisiana Status	Parish Where Species May Exist[a]
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	Endangered	Cameron, Lafourche, Terrebonne
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Endangered	Cameron, Lafourche, Terrebonne
Loggerhead Sea Turtle	*Caretta caretta*	Threatened	Threatened	Cameron, Lafourche, Terrebonne

Not Listed: No state status; species is not classified as threatened or endangered by Louisiana.
[a] Includes only parishes in Louisiana where SPR facilities are proposed.
[b] Federal endangered status of the peregrine falcon varies by subspecies; one subspecies is endangered and the other two are recovered.

F.2.1 Birds

F.2.1.1 Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is a large bird of prey with an average wingspan of 7 feet (2 meters). Adult males and females are similar in appearance, with a dark brown body and wings and a distinctive white head and tail. This species is federally listed as threatened, although a proposal to de-list it has been made.

The bald eagle can be found throughout the continental United States and Alaska. It is most likely to be found in areas with large expanses of aquatic habitat with forested shorelines or cliffs where it selects supercanopy roost trees. The bald eagle is an opportunistic forager. Although it prefers fish, it will eat a great variety of mammals, amphibians, crustaceans, and birds, including many species of waterfowl (Buehler 2000).

The bald eagle nests almost exclusively at the edges of lakes, rivers, or seacoasts. It generally nests in tall trees or cliffs near the water's edge, although it occasionally nests on the ground. Nests are often reused in successive years. The breeding season generally begins in the spring (earlier in southern states), with the young fledging after about 6 months (USFWS 1983; USFWS 1995). According to comments submitted to DOE by the USFWS (James 2005), nesting activity occurs from September to January with young fledging usually by midsummer. The bald eagle is highly sensitive to human noise and interference (USFWS 1983; USFWS 1995). It is most sensitive during the first 12 weeks of the nesting cycle. Disturbance during nesting may lead to nest abandonment or reduced hatching and survival rates. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest, lessening their likelihood of survival (Watson 2005).

F.2.1.2 Brown Pelican

The brown pelican (*Pelecanus occidentalis*) is a large water bird with a massive bill and throat pouch. Its wings and body are grayish-brown. Nonbreeding adults have a whitish head and neck, often with some yellow. The hindnecks of breeding adults are dark chestnut (NGS 1983; Palmer 1962). Larger individuals have a wing spread of more than 7 feet (2 meters) (USFWS 2005).

The brown pelican is a fish eater, and it is found almost exclusively in coastal areas along the southeast coast, the Gulf of Mexico, and throughout the west coast. It prefers to feed in shallow estuarine waters and use sand spits, offshore sand bars, and islets for nocturnal roosting. Dry roosting sites are essential to

suitable habitat (NatureServe 2005). Nests usually are built on coastal islands, on the ground, or in small bushes and trees (Palmer 1962).

The brown pelican is a federally listed endangered species. Populations in California, Texas, and Louisiana were devastated by pesticide poisoning from dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethylene (DDE), and other compounds throughout the 1950s and 1960s. Eastern and Gulf Coast populations of the brown pelican appear to be stable and possibly increasing in recent years. Contaminant levels in both populations are below the threshold for reproductive failure, but the populations are still very vulnerable to pesticide pollution (Anderson and Hickey 1970). Other threats include the disturbance of nesting birds by humans, declining fish populations, increased water turbidity resulting from dredging, oil and chemical spills, entanglement in fishing gear, and extreme weather conditions. Recently, habitat degradation has affected both roosting and nesting. For example, nesting efforts have failed in the Gulf Coast because of erosion at the nesting sites (NatureServe 2005).

In Louisiana, the brown pelican is found in the Lower Calcasieu, Lower Mississippi-New Orleans, Eastern Louisiana Coastal, East Central Louisiana Coastal, and West Central Louisiana Coastal watersheds (NatureServe 2005).

F.2.1.3 Peregrine Falcon

The peregrine falcon (*Falco peregrinus*) is a medium-sized falcon with long, pointed wings and a dark crown and nape. Juveniles have pale foreheads and are mostly brown in color; adults are predominantly black or gray. Adults average 16.1 to 20.1 inches (41 to 51 centimeters) in length, with a 35.8- to 44.1-inches (91- to 112-centimeter) wingspan (NGS 1983).

There are three subspecies of peregrine falcons: the American peregrine falcon (*Falco peregrinus anatum*), the Arctic peregrine falcon (*Falco peregrinus tundrius*), and the Eurasian peregrine falcon (*Falco peregrinus peregrinus*). Of these three subspecies, only the Eurasian peregrine falcon, which is not found in the United States, is federally listed as an endangered species. Both the American and Arctic peregrine have been federally delisted (USFWS 2005).

These birds are carnivores and feed primarily on other birds, but they also feed on small mammals, lizards, fishes, and insects (particularly the young birds) (NatureServe 2005). Peregrine populations nesting in northern latitudes are highly migratory, while those nesting in northern maritime climates, at mid-latitudes, and in the southern hemisphere are much less migratory (Cade 1982).

The peregrine falcon typically nests on ledges of vertical rocky cliffs, usually with a sheltering overhang (Palmer 1988; Campbell et al. 1990). In the United States, parts of the Atlantic Coast and the barrier islands in the Gulf Coast are important feeding areas for long-distance migrants (NatureServe 2005). The average clutch size is four hatchlings, and incubation lasts between 32 and 35 days. The peregrine falcon usually mates for the first time at 2 or 3 years of age, and most often it mates for life (Palmer 1988).

F.2.1.4 Piping Plover

The piping plover (*Charadrius melodus*) is a small, sandy-colored shorebird similar in appearance to a sandpiper. Distinguishing field marks of this species include yellow-orange legs, a black band across the forehead from eye to eye, and a black ring around the base of its neck (USFWS undated). The piping plover is federally listed as threatened in Louisiana.

A migratory species, the piping plover overwinters on beaches, mudflats, and sandflats along the Atlantic Coast and the Gulf of Mexico, including barrier island beaches and spoil islands on the Gulf Intracoastal

Waterway (ICW) (USFWS 2005). In Louisiana, the piping plover has been observed in numerous locations along the Gulf Coast (NatureServe 2005). Critical habitat for wintering piping plovers has been established for several specific locations in Louisiana parishes where proposed SPR elements would be located (USFWS 2001a):

- **Unit LA–1:** Texas-Louisiana border to Cheniere au Tigre. 6,548 acres (2,650 hectares) in Cameron and Vermilion Parishes. This unit extends in three adjacent (but slightly separated) sections from the east side of Sabine Pass (Texas-Louisiana border) to 0.81 miles (1.3 kilometers) east of where the boundary of the Paul J. Rainey Wildlife Sanctuary (National Audubon Society) meets the shoreline. All three sections of this unit include the land from the seaward boundary of the mean lower low water level (MLLW), which is defined as the annual average of the lower low water height of each tidal day, to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The shoreline in this unit is owned both by the state and privately.

- **Unit LA–3:** Point Au Fer Island. 482 acres (195 hectares) in Terrebonne Parish. This unit includes the entire small island at the northwest tip of Point Au Fer Island to MLLW, then extends from the northwest tip of Point Au Fer Island following the shoreline southeast approximately 4.8 miles (7.7 kilometers) to the point where the unnamed oil and gas canal extending southeast from Locust Bayou meets the shoreline 0.5 miles (0.8 kilometers) southeast from Locust Bayou. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. This entire unit is privately owned.

- **Unit LA–4:** Isles Dernieres. 1,964 acres (795 hectares) in Terrebonne Parish. This unit includes the state-owned Isles Dernieres chain, including Raccoon, Whiskey, Trinity, and East Islands. This unit includes the entire islands where primary constituent elements occur to the MLLW.

- **Unit LA–5:** Timbalier Island to East Grand Terre Island. 5,735 acres (2,321 hectares) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes. Most of the sections in this area are bounded on the seaward side by MLLW and on the landward side by densely vegetated habitat, not used by the piping plover, where the constituent elements no longer occur.

The piping plover begins to arrive at wintering habitats in July through September. Although a few plovers remain throughout the year, sightings are rare in late May, June, and early July (USFWS 2000).

F.2.1.5 Red-Cockaded Woodpecker

The red-cockaded woodpecker (*Picoides borealis*) is a federally listed endangered species. It is found in mature and old-growth pine forests in the southeastern United States. Red-cockaded woodpeckers are black and white with ladder backs and distinctive white cheek patches (USFWS 2003c). The species is named for barely visible red streaks called “cockades” on the heads of adult males (NatureServe 2005).

The red-cockaded woodpecker has specific habitat requirements that include open pine woodlands or savannahs with large, old pines. Large pines are required because cavity nests are built only in inactive pine heartwood. Nesting trees must be in open stands with little or no hardwood midstory and few or no overstory hardwoods (USFWS 2003c). Foraging occurs in older pine stands within 0.5 mile (0.8 kilometer) of a colony (Aycock 2005).

The red-cockaded woodpecker lives in family groups that usually include a breeding pair and nonbreeding helpers. Most helpers are male. Mating typically occurs between November and December

and March to May, and egg laying usually occurs April to early May. Incubation lasts about 10 to 12 days (Hooper et al. 1980), and hatchlings remain in the nest for 26 to 29 days (NatureServe 2005).

According to the 1985 revision of the recovery plan for this species, there were approximately 14,068 red-cockaded woodpeckers living in 5,627 groups in 11 states (USFWS 2003c). One of the six largest remaining resident populations is located in or near the Kisatchie National Forest in Louisiana (James 1995). USFWS established criteria for delisting the species based on the status and size of primary and secondary core populations named in the recovery plan. Table F.2.1.5-1 shows the locations of core populations of the red-cockaded woodpecker in Louisiana.

Table F.2.1.5-1: Louisiana Locations of Designated Core Red-Cockaded Woodpecker Populations

Designated Core Population Type	Population Locations in Louisiana
Primary	Fort Polk (includes parts of Vernon Parish)
	Vernon Unit, Calcasieu Ranger District, Kisatchie National Forest (includes parts of Vernon Parish)
Secondary	Catahoula Ranger District, Kisatchie National Forest (includes parts of Grant and Rapides Parishes)
	Winn Ranger District (portion), Kisatchie National Forest (includes parts of Grant, Natchitoches, and Winn Parishes)

F.2.2 Fish

F.2.2.1 Gulf Sturgeon

The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is an anadromous fish species found in Gulf coastal waters from Louisiana to Florida. Primitive in appearance, the Gulf sturgeon has external bony plates, an extended snout, and four large barbels. Adults range from 4 to 8 feet (1.2 to 2.4 meters) in length, with adult females measuring larger than males (USFWS 2003a). This species is federally listed as threatened.

The Gulf sturgeon preys on benthic invertebrates and small fishes. Feeding is believed to occur only during the winter and spring in offshore or estuarine waters (Cross 1992).

USFWS has designated certain Gulf of Mexico tributaries as critical habitat for the Gulf sturgeon. In these locations, the Gulf sturgeon spends the first 2 years of its life and later returns to breed. Spawning habitats generally are fresh water (sometimes tidal) and usually are over a bottom of hard clay, rubble, gravel, or shell (USFWS 2003a). In Louisiana, the critical habitats include Lake Pontchartrain and the Pearl River system (USFWS 2003a).

F.2.2.2 Pallid Sturgeon

The pallid sturgeon (*Scaphirhynchus albus*) is a large fish measuring 73.2 inches (186 centimeters) with a flat, shovel-like snout that has four fringed barbells and 37 to 43 dorsal rays and 24 to 28 anal rays. The pallid sturgeon is similar to the shovelnose sturgeon, but there are several distinct differences such as the paucity of scale-like scutes on the belly, the larger head, the wider mouth, the smaller eye, and the paler gray-white color above and on sides (Page and Burr 1991). The pallid sturgeon is one of the largest fish

species found in the Missouri and Mississippi River drainage (Gilbraith et al. 1988). Its diet consists of aquatic invertebrates (Carlson et al. 1985). This species is federally listed as endangered.

The pallid sturgeon's habitat consists of large, turbid free-flowing rivers or reservoirs. In rivers or reservoirs, the pallid sturgeon is most often found in strong currents over firm gravel or sandy substrate (USFWS 1989; Kallemeyn 1981). The pallid sturgeon's preferred temperature range is from 32 to 86 ˚Fahrenheit (0 to 30 ˚Celsius) (USFWS 1993).

The pallid sturgeon's range is quite large and includes approximately 3,515 miles (5,656 kilometers) of river encompassing 13 states including Louisiana and Mississippi (USFWS 1993). In Louisiana, the most frequent occurrence of the pallid sturgeon is in the Mississippi and Atchafalaya Rivers, where the Atchafalaya diverges from the Mississippi River (Dryer Undated).

The spawning season for the pallid sturgeon lasts from July to August. Males sexually mature at 3 to 4 years of age (Kallemeyn 1981), and females sexually mature at 7 years with several years for eggs to mature between spawnings (Conte et al. 1988). Little other information is available to describe the spawning requirements for the pallid sturgeon, so these requirements often are assumed to be similar to those of the shovelnose sturgeon. The shovelnose sturgeon spawns over rock, rubble, or gravel in the main channel of the Missouri and Mississippi Rivers and their major tributaries or in the wing dams in the main stem of larger rivers (Christiansen 1975; Elser et al. 1977; Moos 1978; Helms 1974). In addition, in June the shovelnose sturgeon responds to increased water flow from melting snow by migrating to spawn (Berg 1981).

F.2.3 Mammals

F.2.3.1 Louisiana Black Bear

The Louisiana black bear (*Ursus americanus luteolus*) is one of 16 recognized subspecies of the American black bear (Hall 1981). The Louisiana black bear is federally listed as threatened. Like other black bears, the Louisiana black bear has long black hair, and it can weigh more than 600 pounds (272 kilograms) (USFWS 1992). It is distinguished from other black bears by its longer, narrower, and flatter skull, and by its proportionately large molar teeth (Nowak 1986).

The Louisiana black bear prefers bottomland hardwood forests. It is found primarily in the Tensas and Atchafalaya River basins in Louisiana, areas that have been proposed as critical habitat. In fact, these areas of Louisiana are the locations of the only known breeding populations (Bowker and Jacobson 1995). Other areas with suspected occurrences of Louisiana black bears include the Loess Bluffs portion of the Mississippi River corridor in southwestern Mississippi and the adjacent Tunica Hills of Louisiana, as well as smaller areas in the lower East Pearl River and lower Pascagoula River basins of southern Mississippi (Wooding et al. 1993).

F.2.3.2 Red Wolf

The red wolf's (*Canis rufus*) range formerly included most of the southeastern states (NatureServe 2005), but now red wolf populations only occur in the wild in a few reintroduction sites. The red wolf is federally listed as endangered. Its diet is opportunistic and consists of a variety of invertebrates and vertebrates such as rabbits, rodents, deer, and birds, but it favors marsh rabbits, nutria, and carrion (Matthews and Moseley 1990).

The red wolf inhabits herbaceous and forested wetlands and riparian areas, coniferous, hardwood, and mixed forest, herbaceous grassland, and chaparral (NatureServe 2005). Home ranges vary depending on

the environment, but typically they are approximately 16,000 to 32,000 acres (6,500 to 13,000 hectares) (Riley and McBride 1975), or approximately 29,000 acres (11,700 hectares) for males and approximately 19,000 acres (7,800 hectares) for females (Carley 1979). The red wolf mates once a year in a season from January to February. The average gestation is 60 to 63 days. Litters average six or seven pups that reach sexual maturity in 3 years (NatureServe 2005).

F.2.4 Marine Mammals

The onshore portion, including the directional drilling from onshore to open water in the Gulf of Mexico, associated with the proposed SPR Chacahoula site and Clovelly site would not affect the marine mammals. The construction and operation of the offshore brine disposal pipeline and operation of the brine diffusion system for the Chacahoula site and the Clovelly site may affect the marine mammal species. The dispersion of the brine discharge into the Gulf of Mexico would dissipate before reaching these depths as well.

F.2.4.1 Gervais Beaked Whale

The Gervais' beaked whale (*Ziphius cavirostris*) is a pelagic species that is associated with the continental shelf and deep oceanic waters, but it is also closely associated with the Gulf Stream waters. Little is known about this species, but it is believed that sexual maturity occurs when the whale reaches 15 feet (4.5 meters) in length. The life span is believed to be about 27 years. The diet consists mainly of squid and deepwater fishes (Wynne et al. 1999).

F.2.4.2 Goose-Beaked Whale

The goose-beaked whale (*Ziphius cavirostris*), also known as Cuvier's beaked whale, typically is found in waters that are greater than 3,280 feet (1,000 meters). The goose-beak is a pelagic species that is associated with the continental shelf and deep oceanic waters, but it is also closely associated with the Gulf Stream waters. Little is known about the goose-beaked whale, but it is believed to travel in pods of 2 to 25 animals, and it typically avoids vessels. Sexual maturity is believed to occur at about 7 to 11 years. Breeding occurs in the spring, with a calf born every 2 to 3 years after a 12-month gestation. The goose-beaked whale is believed to lactate for 12 months and live more than 35 years. Its diet consists mainly of deepwater fish and squid (Wynne et al. 1999).

F.2.4.3 Pygmy Sperm Whale

The pygmy sperm whale (*Kogia breviceps*) is a pelagic, deep-water species that inhabits the areas near the continental shelf edge, slope, and deep oceanic waters. It is found throughout the Gulf of Mexico in these waters. The pygmy sperm whale is not as social as other species, and it typically is found alone or in small groups. The male reaches sexual maturity at 8.9 to 9.8 feet (2.7 to 3.0 meters) in length, and the female reaches sexual maturity at a length of 8.5 to 9.1 feet (2.6 to 2.8 meters). A single calf is born after an 11-month gestation period, and lactation lasts about 12 months. The diet of the pygmy sperm whale consists mainly of squid, fish, and crustaceans (Wynne et al. 1999).

F.2.4.4 Dwarf Sperm Whale

The dwarf sperm whale (*Kogia simus*) is a pelagic, deep-water species that inhabits the areas near the continental shelf edge, slope, and deep oceanic waters. It is found throughout the Gulf of Mexico in these waters. The dwarf sperm whale is not as social as other species, and it typically is found alone or in small groups. Sexual maturity occurs at a length of about 6.9 to 7.2 feet (2.1 to 2.2 meters) in length. A single

calf is born after a 9.5 month gestation period, and lactation lasts about 12 months. The diet of the dwarf sperm whale consists mainly of squid, fish, and crustaceans (Wynne et al. 1999).

F.2.4.5 Sperm Whale

The sperm whale (*Physeter macrophalus*) is a pelagic, deep-water species that inhabits areas near the continental slope. It is found throughout the Gulf of Mexico along the continental slope and along the Atlantic seaboard associated with Gulf Stream features. Female and young male sperm whales form breeding schools of 10 to 80 animals, while sexually inactive males form bachelor schools and older males are typically solitary. The female reaches sexual maturity at 7 to 11 years; the male reaches maturity at 19 years. A single calf is born every 3 to 6 years after a 14-month gestation period, and lactation lasts between 12 to 24 months. The diet of the sperm whale consists mainly of squid, but it can also include fish (Wynne et al. 1999).

F.2.4.6 Atlantic Spotted Dolphin

The Atlantic spotted dolphin (*Stenella frontalis*) is a tropical species that can be found in a variety of areas throughout the Gulf of Mexico ranging from coastal to pelagic environments, typically over the continental shelf and slope. It usually is associated with the Gulf Stream. The Atlantic spotted dolphin reaches sexual maturity at 8 to 15 years, and it breeds during the fall and spring. One calf is born every 1 to 2 years after a 12-month gestation period. Lactation typically lasts 3 to 5 years. The dolphin can live 25 to 30 years. The Atlantic spotted dolphin is a gregarious species, and it can be found in groups (less than 20) of other dolphins and small whales along the coast and in larger groups (less than 100) offshore. The diet of the Atlantic spotted dolphin consists of squid and a variety of fish (Wynne et al. 1999).

F.2.4.7 Rough-Toothed Dolphin

The rough-toothed dolphin (*Steno bredanensis*) is a tropical, pelagic species that is found seaward of the continental slope. Little is known about the rough-toothed dolphin, but it is thought to be sexually mature at about 10 to 14 years, and it may live as long as 32 years. The dolphin is believed to travel in pods of 10 to more than 100 and to associate with other species such as spinner dolphins, bottlenose dolphins, and pilot whales. Sometimes the rough-toothed dolphin can be found associated with large mats of Sargassum. The diet of the rough-toothed dolphin consists of deepwater octopus, squid, and fish (Wynne et al. 1999).

F.2.4.8 Killer Whale

The killer whale (*Orcinus orca*) can be found in both coastal and oceanic waters, ranging from tropical to polar waters. The killer whale is a highly social animal that travels in pods of between 3 to 55 animals, and it often cooperates in hunting and feeding efforts. The killer whale is sexually mature at 10 to 15 years and mates year round. A single calf is born every 3 to 8 years after a 17-month gestation period. Lactation lasts about 12 months. The killer whale can live more than 50 years. The diet of the killer whale is diverse and includes fish, birds, squid, turtle, and other marine mammals (Wynne et al. 1999).

F.2.4.9 False Killer Whale

The false killer whale (*Pseudorca crassidens*) is pelagic species found in the deeper waters of the Gulf of Mexico, seaward of the continental shelf. The false killer whale is a social species that can be found in groups from 10 to more than 100 with the same species or with other dolphin species. It is sexually mature at 8 to 14 years. A single calf is born every 3 to 4 years after a 16-month gestation period. This

species has been known to be aggressive toward other smaller dolphins. The diet of the false killer whale consists mainly of squid and fish (Wynne et al. 1999).

F.2.4.10 Short-Finned Pilot Whale

The short-finned pilot whale (*Globicephala macrorhynchus*) can be found in a variety of water depths, and typically it is associated with squid, its main prey. It is a tropical species that is usually associated with the Gulf Stream, and it can be found in pelagic or coastal environments, possibly moving inshore during the summer months. The short-finned pilot whale is a social species that can be found in groups of 10 to more than 100, and often it is associated with bottlenose dolphins. The short-finned pilot whale is believed to be sexually mature at 6 to 12 years, and it breeds every 3 years, giving birth to a single calf after a 15- to 16-month gestation period. Lactation lasts about 20 months Individual whales can live between 50 to 70 years. Its diet consists primarily of squid, but it has been known to prey on fish (Wynne et al. 1999).

F.2.4.11 Pygmy Killer Whale

The pygmy killer whale (*Feresa attenuata*) is a pelagic species found in the deeper waters of the Gulf of Mexico, seaward of the continental shelf. Little is known about the pygmy killer whale, but its diet is believed to consist mostly of fish, and it has been observed preying on squid. The pygmy killer whale is a gregarious species that typically associates in groups of 10 to 50 individuals. The pygmy killer whale has shown aggressive tendencies, but typically it is wary of boats (Wynne et al. 1999).

F.2.4.12 West Indian Manatee

The West Indian manatee (*Trichechus manatus*) is a slow-moving aquatic mammal with gray to brown skin, a small head, flexible flippers, and a large tail. Its large rounded body weighs on average 441 to 1,102 pounds (200 to 500 kilograms) and it is approximately 9.8 to 13 feet (3 to 4 meters) in length (Nowak 1991). Its diet is primarily submergent, emergent, and floating vegetation, although it varies according to plant availability. West Indian manatees may live several decades (O'Shea and Ludlow 1992).

The West Indian manatee is present in the coastal areas from the southeastern United States to northeastern South America. In the southeastern United States, the manatee occurs primarily in Florida and southeastern Georgia; individuals may occur as far north as Rhode Island on the Atlantic Coast (Reid 1996) and as far west as Texas on the Gulf Coast, but these sightings are rare. The West Indian manatee is federally listed as endangered in its entire range (Florida, Georgia, Puerto Rico, and Texas).

Shallow coastal waters, estuaries, bays, rivers, and lakes comprise the West Indian manatee's habitat, although it seems to prefer rivers and estuaries to marine habitats (Lefebvre et al. 1989). In addition, the West Indian manatee sometimes travels through dredged canals or quiet marinas. In the north during October to April, the manatee congregates in warmer waters because it cannot tolerate prolonged exposure to water colder than 68 ˚Fahrenheit (20 ˚Celsius). The West Indian manatee prefers waters at least 3.3 to 6.6 feet (1 to 2 meters) in depth; however, along the coast, the manatee often can be found in water 9.8 to 16.4 feet (3 to 5 meters) deep. In addition, it prefers not to be in water with strong currents, and it is consistently associated with freshwater (Lefebvre et al. 1989). Because its young are born in the water, sheltered bays, coves, and canals are important for the West Indian manatee's reproductive success (O'Shea and Ludlow 1992).

While the female manatee is sexually mature at a minimum age of 4 to 5 years, most females do not breed successfully until the age of 7 to 9 years. The male manatee breeds at 9 to 10 years, although it may

mature physically a few years earlier. Males and females mate promiscuously. Young are born after a gestational period of approximately 12 to 14 months, and typically an interval of 3 to 5 years passes before the individual female gives birth to another calf. Usually 2 years pass if a calf is lost early. Calves are born in spring or early summer, and normally a female gives birth to one calf. Young are weaned by the age of 1 to 2 years (O'Shea and Ludlow 1992).

F.2.4.13 Bottlenose Dolphin

The bottlenose dolphin (*Tursiops truncatus*) typically can be found in coastal or offshore waters. In the coastal environment, the bottlenose dolphin can be found in warm, sallow inshore waters of bays and rivers. When offshore, it is usually in deep waters over the continental shelf and slope. The female bottlenose dolphin reaches sexual maturity at 5 to 10 years of age, while the male reaches maturity at 8 to 12 years of age. The bottlenose dolphin breeds during the fall and spring, and produces one calf every 3 to 6 years after a 12-month gestation period. Lactation typically lasts 12 to 18 months. The dolphin may live more than 50 years. The bottlenose dolphin is a social species, and along the coast it can be found in small groups (less than 10) and in larger groups (10 to more than 100) offshore. This species usually can be found in mixed groups with pilot whales and right whales. The diet of the bottlenose dolphin consists of fish, invertebrates, and squid (Wynne et al. 1999).

F.2.5 Reptiles

F.2.5.1 Atlantic Hawksbill Sea Turtle

The Atlantic hawksbill sea turtle (*Eretmochelys imbricata*) has a large brown carapace with overlapping scutes and two claws on each flipper. Some individuals have a tortoiseshell pattern of radiating streaks. The young are all black or dark brown except for raised ridges, shell edges, and areas on the neck and flippers. Mature adults are usually 30 to 35 inches (76 to 89 centimeters) in length (Conant and Collins 1991). The Atlantic hawksbill sea turtle feeds on the ocean bottom and reef faces close to shore, eating a diet primarily consisting of crabs, sea urchins, shellfish, and jellyfish, but also including plant material and fish. This species is federally endangered.

The Atlantic hawksbill is a local and long distance migrant that prefers shallow coastal waters with rocky bottoms, coral reefs, mangrove-bordered bays, and estuaries (CSTC 1990), preferring to nest on undisturbed, deep-sand beaches on the Gulf Coast of Mexico, the West Indies, the Bahamas, and the Americas (Meylan 1992; Lund 1985). The adult female nests only once every 2 to 3 years from May to November and lays 4 to 6 clutches of 50 to more than 200 eggs at 14- to 18.5-day intervals (NatureServe 2005). Incubation lasts approximately 2 months; the age of sexual maturity is unknown (CSTC 1990).

F.2.5.2 Green Sea Turtle

The green sea turtle (*Chelonia mydas*) has a brown carapace covered in dark, wavy markings, radiating mottled markings, or large dark brown blotches; young are black or dark brown with white undersides. Mature adults are usually 35 to 48 inches (90 to 122 centimeters) up to more than 60 inches (153 centimeters) in length. The length of the hatchling carapace is usually between 1.6 and 2.4 inches (4 and 6 centimeters) (Conant and Collins 1991). This turtle most commonly feeds in shallow, low-energy waters containing abundant submerged vegetation. Adults are primarily herbivores, while juveniles are more invertivorous. The green sea turtle is federally threatened.

The green sea turtle is a long distance migrant preferring tidal flats, pelagic zones, and isolated sand dunes. It prefers to nest on high-energy beaches with deep sand (NatureServe 2005). Every 2 to 4 years, the female lays between 1 and 8 clutches, each averaging 90 to 140 eggs, at approximately 2-week

intervals. Nesting occurs between March and October in the Caribbean-Gulf of Mexico region, with a peak in May and June (Ehrhart and Witherington 1992). There are no nesting records for green sea turtles in Louisiana, and sightings are fairly rare (LNHP 2004).

F.2.5.3 Kemp's Ridley Sea Turtle

The Kemp's Ridley sea turtle (*Lepidochelys kempii*) is a small sea turtle that is federally listed as endangered. The turtle is found in shallow coastal and estuarine waters, including those of the Gulf of Mexico. Adults are olive green above and yellow below, and young are gray above and yellow below. The shell of the Kemp's Ridley sea turtle is nearly round, and its limbs are flattened flippers. The shell length is usually between 23 and 28 inches (58 and 70 centimeters) for adults and 1.5 to 1.7 inches (3.8 to 4.4 centimeters) for hatchlings (Conant and Collins 1991).

In coastal waters, the Kemp's Ridley sea turtle is usually found over sand or mud bottoms where it feeds on crabs. Nests are built on elevated dunes, especially on beaches backed up by large swamps or bodies of open water with seasonal, narrow ocean connections (NatureServe 2005).

During the nesting season from April to July, the female lays 1 to 4 clutches of about 100 eggs at intervals of 10 to 28 days. Eggs hatch in an average of 50 to 55 days (CSTC 1990).

F.2.5.4 Leatherback Sea Turtle

The leatherback sea turtle (*Dermochelys coricea*) has a black or dark blue carapace, often with irregular white or pink blotches, and seven prominent longitudinal ridges. The adult is usually 53 to 70 inches (135 to 178 centimeters) in length, with some as long as 74 inches (189 centimeters). The leatherback hatchling is about 2.4 to 3 inches (6 to 7.5 centimeters) long, and it is black and white and covered with small beady scales that are later shed (Conant and Collins 1991). It feeds primarily on jellyfish. This species is federally listed as endangered.

Mainly pelagic, the leatherback tends to approach land exclusively for nesting (Eckert 1992). This turtle is a long-distance migrant that prefers the open ocean, particularly along the edge of continental shelves; but it is also found in seas, gulfs, bays, and estuaries. When nesting, the leatherback seeks moist sand on sloping sandy beaches backed by vegetation near deep water and rough seas (CSTC 1990). Every 2 to 3 years, the female leatherback lays up to 10 (possibly more) clutches of 50 to 170 eggs at intervals of about 1 to 2 weeks. Nesting occurs between March and August in the Western hemisphere; eggs hatch in 8 to 10 weeks (Eckert 1992). Due to its preference for open water, this sea turtle is one of the least recorded sea turtles in Louisiana; however, it may be found anywhere along the coast (LNHP 2004).

F.2.5.5 Loggerhead Sea Turtle

The loggerhead (*Caretta caretta*) is a reddish-brown sea turtle found in a variety of habitats, including open seas to more than 500 miles (805 kilometers) from shore, bays, estuaries, lagoons, creeks, and mouths of rivers, mainly in warm temperate and subtropical regions (NatureServe 2005). Adults have a carapace length typically between 28 to 49 inches (70 to 125 centimeters); hatchlings have a shell length of 1.6 to 2 inches (4 to 5 centimeters) (Dodd 1988 and 1992; Conant and Collins 1991). The loggerhead sea turtle is federally listed as threatened.

The female loggerhead sea turtle nests on open sandy beaches above the high-tide mark, seaward of well-developed dunes. This turtle favors high-energy and steeply sloped beaches with gradually sloped offshore approaches (CSTC 1990).

Between 50,000 to 70,000 clutches are deposited each year in southeastern states (Meylan et al. 1995). Despite some natural fluctuation in the size of the loggerhead population, numbers appear to be declining in some areas, largely because of habitat destruction and incidental take by shrimp trawlers. The nesting population in the southeastern United States is believed to be declining (CSTC 1990, Taylor 1992).

Every 2 to 3 years, a mature female lays between 1 and 9 clutches of around 120 eggs at intervals of 2 weeks. Nesting occurs mainly at night, often at high tide, from April to early September. The eggs hatch in 8 to 9 weeks in the southeastern states. The sex of the hatchlings is determined by incubation temperatures, with the ratio strongly biased toward females in Atlantic coastal waters. Hatchlings emerge from the nest a few days after hatching, typically during darkness (Wibbels et al. 1991; Mrosovsky and Provancha 1992).

F.3 FIELD OBSERVATIONS

This section presents observations made during field visits to the proposed Chacahoula and Clovelly storage sites.

F.3.1 Chacahoula, Louisiana

Biologists from ICF Consulting were unable to access land within the proposed Chacahoula site boundaries due to deep water and limited time. On October 21, 2005, observations were made from two points located south of the site boundary.

F.3.1.1 Proposed Chacahoula Storage Site

The proposed Chacahoula storage site area consists mainly of bottom hardwood swamp dominated by bald cypress. Other tree species observed were red maple, coastal plain willow, water tupelo, and Chinese tallow (an invasive species). The hardwood swamp is interspersed with open areas of deeper water covered in a vegetative mat. The National Wetlands Inventory describes the area as palustrine, semipermanently flooded, broadleaf deciduous or needleleaf deciduous wetland.

Table F.3.1.1-1: Plant Species Observed at the Chacahoula Candidate Site

Common name	Scientific Name	Vegetative Layer
Bald Cypress	*Taxodium distichum*	Canopy
Sweet Gum	*Liquidambar styraciflua*	Canopy
Eastern Cottonwood	*Populus deltoids*	Canopy
Oaks	*Quercus* spp.	Canopy
Black Willow	*Salix nigra*	Canopy
Ash	*Fraxinus* spp.	Canopy
Red Maple	*Acer rubrum*	Canopy
Box Elder	*Acer negundo*	Canopy
Hackberry	*Celtis occidentalis L.*	Canopy
Pecan	*Carya illinoensis*	Canopy
Tupelo	*Nyssa aquatica*	Canopy
Spanish Moss	*Tillandsia usneoides*	Epiphyte

F.3.1.2 Proposed Chacahoula Raw Water Intake Structure

The proposed location for the raw water intake (RWI) structure is on the ICW. The biologists were unable to visit this area during the visit due to limited access and time constraints.

F.3.2 Clovelly, Louisiana

Four biologists from ICF consulting visited the proposed Clovelly site on October 20, 2005.

F.3.2.1 Existing Clovelly Storage Site

The Louisiana Offshore Oil Port (LOOP) would operate the proposed Clovelly SPR site. LOOP has an existing storage facility at the Clovelly site consisting of eight crude oil caverns and a 25-million-barrel brine reservoir for brine used to displace oil from the caverns for distribution. The storage facility is located in a brackish, tidally influenced marsh. Areas that would be dredged for site expansion are spoil banks from LOOP construction. These areas support native marsh species and a significant amount of invasive species. LOOP monitors habitat changes in and around the facility and reported no inconsistencies with control areas in beach elevation, vegetation biomass, or vegetation land area in 2003.

Table F.3.2.1-1: Plant Species Typical of LOOP

Common name	Scientific Name	Vegetative Layer
Salt Meadow Cordgrass	*Spartina patens*	Emergent
Smooth Cordgrass	*Spartina alterniflora*	Emergent
Bitter Panicgrass	*Panicum amarum*	Emergent
Seaside Purslane	*Sesuvium portulacastrum*	Emergent
Salt Grass	*Distichlis spicata*	Emergent
Seaside Goldenrod	*Solidago sempervirens*	Emergent
Coast Drop Seed	*Sporobolus virginicus*	Emergent
Large Leaf Pennywort	*Centella javanica*	Emergent
Deer Pea Vetch	*Vicia ludoviclana*	Emergent
Common Reed	*Phragmites australis*	Emergent
Narrowleaf Baccharis	*Baccharis angustifolia*	Emergent
Catchfly Gentian	*Eustoma exaltatum*	Emergent
Torpedo Grass	*Panicum repens*	Emergent
Groundnut	*Apios Americana*	Emergent
Seashore Paspalum	*Paspalum vaginatum*	Emergent
Virginia Glasswort	*Salicornia virginica*	Emergent
Roseau Cane	*Phragmites communis*	Emergent
Sea Rocket	*Cakile edentula*	Emergent
Eastern Baccharis	*Baccharis halimifolia*	Emergent
Prostate Spurge	*Euphorbia supine*	Emergent
Seashore Elder	*Iva Imbricata*	Emergent
Beach Morning Glory	*Ipomoea imperati*	Emergent
Saltmarsh Morning Glory	*Ipomoea sagittata*	Emergent
Saltwort	*Batis maritima*	Emergent
Sea Oxeye	*Borrichia frutescens*	Emergent
Slender-Leafed Goldenrod	*Solidago tenuifolia*	Emergent

Table F.3.2.1-1: Plant Species Typical of LOOP

Common name	Scientific Name	Vegetative Layer
Yellow Nutgrass	*Cyperus esculentus*	Emergent
Bushy Beardgrass	*Andropogon glomeratus*	Emergent
Northern Fogfruit	*Phyla lanceolata*	Emergent
Saltmarsh Fimbry	*Fimbristylis castanea*	Emergent
Black Mangrove	*Avicennia germinans*	Emergent
Common Threesquare Bulrush	*Scirpus pungens*	Emergent
Shortleaf Flatsedge	*Cyperus brevifolius*	Emergent
Pointed Broom Sedge	*Carex scoparia*	Emergent
Coast Roast Gentian	*Sabatia calycina*	Emergent
Common Frogfruit	*Phyla nodiflora*	Emergent
Irisleaf Yellow Eye Grass	*Xyris laxifolia*	Emergent
Joint Grass	*Calamagrostis canadensis*	Emergent
Lamb's Quarters	*Chenopodium album*	Emergent
Marsh Elder	*Iva frutescens*	Emergent
Marsh Swallow Wort	*Cynanchum angustifolium*	Emergent
Perennial Salt Marsh Aster	*Aster tenuifolius*	Emergent
Sea Lavender	*Limonium carolinianum*	Emergent
Sea Oats	*Uniola Paniculata*	Emergent
Seabeach Grass	*Panicum Amarulum*	Emergent
Silverhead	*Philoxerus vermicularis*	Emergent

F.3.2.2 Existing Clovelly RWI Structure

The RWI structure is located onsite at the LOOP facility; it is used as needed for cavern development.

F.4 HABITAT ASSESSMENT AND POTENTIAL IMPACTS

This section evaluates whether the proposed SPR development activities would take place in areas where threatened and endangered species are known to exist or where they may exist based on the natural history information presented in section F.2. For any component of the SPR proposal located in known or potential threatened, endangered, or candidate species habitat, the nature of potential impacts are described. The assessment considers potential mitigation measures that DOE would implement for selected development alternatives.

In the following sections, a separate assessment is provided for each of the proposed SPR candidate and expansion sites.

F.4.1 Chacahoula, Louisiana

The proposed Chacahoula site assessment evaluates the potential effects on threatened, endangered, and candidate species by each of the elements of the proposed action listed in table F.4.1-1.

Assessment findings for these components of the Chacahoula site proposal are presented for each of the following species.

Table F.4.1-1: Elements of the Proposed Action and Location on Chacahoula Candidate Site

Element of Proposed Action	Location by Parish or Offshore Area
Chacahoula candidate site	Lafourche
Power lines and associated rights-of-way (ROWs) to Chacahoula candidate site	Lafourche and Terrebonne
Pipeline ROWs from Chacahoula to St. James terminal	Lafourche and St. James
Pipeline ROWs from Chacahoula to LOOP storage facility at Clovelly	Lafourche
RWI in ICW and associated access road and pipeline and power line ROWs	Lafourche and Terrebonne
Brine disposal pipeline ROW to Gulf of Mexico	Lafourche, Terrebonne, Gulf of Mexico

F.4.1.1 Birds

F.4.1.1.1 Bald Eagle

The bald eagle has been recorded in all of the parishes containing elements of the proposed Chacahoula development (Lafourche, St. James, and Terrebonne). All of the proposed elements have the potential to affect bald eagles. Data provided by LDFW (Lester 2006) suggest there are 14 recorded nesting sites within 1 mile (2 kilometers) of the proposed Chacahoula site and facilities. Five of these nests are within 1,500 feet (460 meters) of a proposed element – one near the crude oil pipeline to Clovelly; two near the crude oil pipeline to St. James; and two near the RWI. Bald eagle nests in bald cypress trees near fresh to intermediate marshes or open water in the southeastern parishes (Carloss 2005); much of the habitat surrounding the site and associated infrastructure (i.e., cypress-tupelo swamp) is potential high quality habitat for this species.

Construction Impacts

All proposed ROWs have at least one documented nesting area within 1 mile (2 kilometers). The USFWS and LDWF recommend against construction activities that would occur during nesting periods in Louisiana (i.e., October to mid-May) within 1 mile (2 kilometers) of nest sites. They also recommend that large trees be saved for potential roost and perch trees (Carloss 2005). During preconstruction surveys, DOE would have a biologist identify and map all bald eagle nests within 1 mile (2 kilometers) of a proposed ROW. DOE would coordinate with the USFWS and LDWF to avoid adverse impacts. This coordination would include implementing a construction schedule and large tree preservation plan. Trees within the ROW construction easement would be cleared, but DOE would re-seed with native species within this area to re-establish native habitat.

Construction of the Chacahoula storage site would remove all trees in the 350 acre (140 hectare) site and security buffer. This would be a large area of potential nesting, roosting, and foraging habitat within 1 mile (2 kilometers) of a recorded nesting area. Because of the complexity of this site, DOE would not be able to avoid all construction activities during nesting periods. DOE would consult with USFWS and LDWF to avoid, minimize, or mitigate for affects to bald eagles.

Data provided by LDWF indicate that the proposed RWI, RWI pipeline, crude oil pipeline to Clovelly, and crude oil pipeline to St. James have recorded nesting areas within 1,500 feet (460 meters). USFWS and LDWF recommends against any activity taking place within this buffer area of an active nesting site (Carloss 2005; Watson 2005). DOE would have a biologist survey the area to identify the exact locations

of nests near the proposed RWI and ROWs. Where feasible, DOE would adjust proposed locations to avoid crossing within 1,500 feet (460 meters) of a nest tree. If nests can not be avoided, DOE would complete a biological assessment and formal Section 7 consultations. DOE would follow all recommendations provided in the Biological Opinion from USFWS.

Operation and Maintenance Impacts

Operation 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 lowmast lighting and downshield lights to minimize the impacts of photopollution. The presence of the power lines leading to the site may affect the bald eagle by obstructing its flight path.

Along the RWI and brine disposal pipeline ROWs, maintenance activity would be restricted during nesting season; therefore, operation and maintenance activities would have no effect on the bald eagle. Most of the pipelines would be built along existing ROWs, and operation and maintenance of the proposed expansion would be similar to existing conditions and should have negligible impact on the bald eagle. Near the RWI structure, DOE would enclose the raw water pump station to minimize noise impacts on wildlife, including the bald eagle. Normal operation and maintenance activities at the RWI would be restricted during nesting seasons. Operation activities associated with a drawdown of oil may happen at any time of the year, and may affect bald eagles near the RWI.

F.4.1.1.2 Brown Pelican

Of the locations listed in table F.4.1-1, Lafourche and Terrebonne Parishes have recorded brown pelicans. All elements of the development associated with the Chacahoula site would be located in these parishes, with the exception of portions of the crude oil pipeline to St. James Terminal and the offshore portion of the brine pipeline. Suitable habitat for the brown pelican is confined to the Gulf shore and associated barrier islands, sandbars, and wetlands. Consequently, the pipelines near the shore, which are the brine disposal pipeline ROW and the crude oil pipeline ROW to the storage facility at Clovelly, are the elements of the proposed development most likely to impact the brown pelican. According to USFWS, the brown pelican may roost in the vicinity of the Chacahoula ROWs close to the coast.

Construction Impacts

Nesting brown pelicans can be disturbed by human noise and activity nearby, especially if activity is closer than 330 to 1,970 feet (100 to 600 meters) to nests (NatureServe 2005). If the Chacahoula site is chosen for development, a biologist would identify brown pelican roosts along the proposed pipeline ROWs. If brown pelicans are identified in or near a pipeline ROW, construction would be scheduled to occur during periods when they are not present, if possible.

Operation and Maintenance Impacts

Operation and maintenance activities for these portions of the pipelines are expected to be infrequent and have no effect on the brown pelican. Operation and maintenance of the crude oil pipeline would be comparable to existing activities associated with the crude oil pipeline in the existing ROW. Along all pipelines, human activity would be minimal.

F.4.1.1.3 Peregrine Falcon

The peregrine falcon is a winter migratory visitor to Lafourche and Terrebonne Parishes. Barrier islands along the Gulf Coast are important feeding areas for this long-distance migrant. Based on this habitat, the only part of the development that potentially would affect the peregrine falcon is the brine disposal pipeline and ROW through Terrebonne Parish; however, because the construction of the pipeline and ROW would be fairly small in scope, and the species does not nest in Louisiana, it is expected that the construction, operation, and maintenance of the pipeline would have no effect on the peregrine falcon.

F.4.1.1.4 Piping Plover

Piping plovers have been identified in both Lafourche and Terrebonne Parishes. The piping plover overwinters on beaches, mudflats, and sandflats along the Gulf of Mexico, including barrier island beaches and spoil islands on the ICW. The piping plover uses these habitats for feeding, but not nesting. There is no beach habitat along the ROWs or at the Chacahoula site. The offshore portion of the brine disposal pipeline passes 7 miles (12 kilometers) to the west of designated critical habitat units (i.e., Unit LA–3, Point Au Fer Island, and Unit LA–4, Isles Dernieres). Construction, operation and maintenance of this ROW would not affect the piping plover since it would be located underwater and away from piping plover habitat.

F.4.1.2 Fish

F.4.1.2.1 Gulf Sturgeon

Historically, the gulf sturgeon has been found in coastal rivers in the northeastern Gulf of Mexico region. Although it is listed in all three parishes that would contain elements of the proposed Chacahoula development, none of the Federal critical habitats for gulf sturgeon in Louisiana are in these parishes (USFWS 2003a); therefore, it is expected that the Chacahoula development would have no effect on gulf sturgeon.

F.4.1.2.2 Pallid Sturgeon

Of the locations with proposed development for the Chacahoula site, only St. James Parish lists the pallid sturgeon species. The proposed element located in St. James Parish is the crude oil pipeline from the Chacahoula site to the existing St. James Terminal. The pallid sturgeon is reported to be present in the Mississippi River in St. James Parish, and it is found in other major free-flowing rivers within the Mississippi and Atchafalaya River systems in Louisiana. The proposed construction related to this element of the Chacahoula site would not cross the Mississippi River or any major tributaries, and there would be no effect on the pallid sturgeon.

F.4.1.3 Mammals

F.4.1.3.1 Red Wolf

Terrebonne Parish, which would contain portions of the proposed brine disposal pipeline, is within the historical range of the red wolf; however, the species currently exists only in a few reintroduction sites in North Carolina and Tennessee. Development of the Chacahoula site and associated infrastructure would have no effect on the red wolf species.

F.4.1.3.2 West Indian Manatee

The West Indian manatee has been reported in all three of the parishes that encompass the proposed Chacahoula site development. However, sightings of the West Indian manatee in Louisiana are rare. Consultations with USFWS and LDWF did not indicate any concerns that the proposed SPR facilities in would have any affect to the manatees (Carloss 2005; Watson 2005; Lester 2006).

F.4.1.4 Marine Mammals

The construction of the brine disposal pipeline and the operation of the brine disposal system would have no effect on the Gervais beaked whale, goose-beaked whale, pygmy sperm whale, dwarf sperm whale, sperm whale, rough-toothed dolphin, killer whale, false killer whale, short-finned pilot whale, pygmy killer whale, and the bottlenose dolphin. These species are found in deeper waters than the terminus of the offshore pipelines and the brine diffuser contours (see Appendix B, Brine Discharge Modeling).

A description of the potential impacts on the Atlantic spotted dolphin follow; impacts on the West Indian manatee were discussed earlier.

F.4.1.4.1 Atlantic Spotted Dolphin

The Atlantic spotted dolphin is a tropical species that can be found in a variety of areas through the Gulf of Mexico. It ranges from coastal to pelagic environments, typically over the continental shelf and slope. The Atlantic spotted dolphin is usually associated with the Gulf Stream.

Construction Impacts

The Atlantic spotted dolphin is usually found in deeper waters than the extent of the brine disposal system, but it is known to venture into shallower waters. The species likely would avoid or leave any construction area, and then return after construction was complete. Due to the limited construction time and the relatively small area of the Gulf of Mexico that would be impacted, no effect would result on the Atlantic spotted dolphin.

Operation and Maintenance Impacts

The Atlantic spotted dolphin may occur in the location of the brine diffusion; however, it is unlikely that the species would remain in the area for an extended period. Because the dissipation of the brine would occur in a relatively small area of the Gulf of Mexico and the species would not be restricted to such areas, there would be no effect on the Atlantic spotted dolphin.

F.4.1.5 Reptiles

F.4.1.5.1 Atlantic Hawksbill Sea Turtle

The Atlantic hawksbill sea turtle has been reported in Lafourche and Terrebonne Parishes, but the only component of the Chacahoula development with the potential to affect the Atlantic hawksbill sea turtle and its habitat is the brine disposal pipeline and ROW. The hawksbill turtle nests from May to November on sandy beaches, often in the proximity of coral reefs. The turtle is seen occasionally in Louisiana, but more commonly it is seen in more tropical waters.

Construction Impacts

Construction of the brine disposal pipeline onshore would have no effect on the Atlantic hawksbill sea turtle because the pipeline near the coast crosses through only wetland habitat, not beach. Offshore pipeline construction temporarily would disturb potential feeding habitat for Atlantic hawksbill sea turtle; however, the total area affected would be a small portion of the total available area of suitable habitat, and the species would suffer no effect.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would have no effect on the Atlantic hawksbill turtle because the pipeline does not cross beach habitat. Operation of the offshore component of the brine disposal system would have no effect on the feeding habits or habitat of the sea turtle because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat Assessment). Maintenance of the pipeline offshore would be infrequent, and it would not affect the Atlantic hawksbill sea turtle.

F.4.1.5.2 Green Sea Turtle

The green sea turtle has been reported in Lafourche and Terrebonne Parishes, but the only component of the Chacahoula development with the potential to affect the green sea turtle is the brine disposal pipeline and ROW. The green sea turtle nests from March to October, with a peak in May and June, on beaches with deep sand.

Construction Impacts

The Louisiana National Heritage Program (LNHP 2004) reports no nesting records of the green sea turtle in the state. Even if the green sea turtle is in the area, construction of the brine disposal pipeline onshore would have no effect on the species because, near the coast, the pipeline crosses only through wetland habitat, not beach. Offshore pipeline construction temporarily would disturb potential feeding habitat for the green sea turtle; however, the total area affected would be a small portion of the total available area of suitable habitat, and there would be no effect on the species.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would have no effect on the green sea turtle because the pipeline does not cross beach habitat. Operation of the offshore component of the brine disposal system would have no effect on the feeding and habitat of the green sea turtle because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat Assessment). Maintenance of the pipeline offshore would be infrequent, and it would not affect the green sea turtle.

F.4.1.5.3 Kemp's Ridley Sea Turtle

Kemp's Ridley sea turtle has been reported in Lafourche and Terrebonne Parishes, but the only component of the Chacahoula development with the potential to affect the Kemp's Ridley sea turtle is the brine disposal pipeline and ROW. The Kemp's Ridley sea turtle nests from April to July.

Construction Impacts

Construction of the brine disposal pipeline onshore would have no effect on the Kemp's Ridley sea turtle because, near the coast, the pipeline crosses only through wetland habitat, not beach. Offshore pipeline construction temporarily would disturb potential feeding habitat for the Kemp's Ridley sea turtle; however, the total area affected would be a small portion of the total available area of suitable habitat, and there would be no effect on the species.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would have no effect on the Kemp's Ridley sea turtle because the pipeline does not cross beach habitat. Operation of the offshore component of the brine disposal system would have no effect on the feeding and habitat of the species because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat Assessment). Maintenance of the pipeline offshore would be infrequent and would not affect the Kemp's Ridley sea turtle.

F.4.1.5.4 Leatherback Sea Turtle

The leatherback sea turtle has been reported in Lafourche and Terrebonne Parishes, but the only component of the Chacahoula development with the potential to affect the leatherback sea turtle is the brine disposal pipeline and ROW. The leatherback sea turtle nests from March and August, and it approaches land almost exclusively for nesting (Eckert 1992), which takes place on sloping sandy beaches backed by vegetation near deep water and rough seas (CSTC 1990).

Construction Impacts

Construction of the brine disposal pipeline onshore would have no effect on the leatherback sea turtle because, near the coast, the pipeline crosses only through wetland habitat, not beach. Offshore pipeline construction temporarily would disturb potential feeding habitat for the leatherback sea turtle; however, the total area affected would be a small portion of the total available area of suitable habitat, and there would be no effect on the species.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would have no effect on the leatherback sea turtle because the pipeline does not cross beach habitat. Operation of the offshore component of the brine disposal system would have no effect on the feeding and habitat of the species because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat Assessment). Maintenance of the pipeline offshore would be infrequent, and it would not affect the leatherback sea turtle.

F.4.1.5.5 Loggerhead Sea Turtle

The loggerhead sea turtle has been reported in Lafourche and Terrebonne Parishes, but the only component of the Chacahoula development with the potential to affect the loggerhead sea turtle is the brine disposal pipeline and ROW. The loggerhead sea turtle nests from April to early September.

Construction Impacts

Construction of the brine disposal pipeline onshore would have no effect on the loggerhead sea turtle because, near the coast, the pipeline crosses only through wetland habitat, not beach. Offshore pipeline construction temporarily would disturb potential feeding habitat for the loggerhead sea turtle; however, the total area affected would be a small portion of the total available area of suitable habitat, and there would be no effect on the species.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would have no effect on the loggerhead sea turtle because the pipeline does not cross beach habitat. Operation of the offshore component of the brine disposal system would have no effect on the feeding and habitat of the species because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat Assessment). Maintenance of the pipeline offshore would be infrequent, and it would not affect the loggerhead sea turtle.

F.4.2 Clovelly, Louisiana

The assessment for the proposed Clovelly site evaluates the potential effects on threatened, endangered, and candidate species by each of the elements of the proposal listed in table F.4.2-1:

Table F.4.2-1: Elements of the Proposed Action and Location on the Clovelly Candidate Site

Element of Proposed Action	Location by Parish or Offshore Area
Clovelly candidate site	Lafourche
Connection to existing crude oil distribution system	Lafourche
RWI system upgrade	Lafourche
Brine disposal system upgrade	Lafourche

Development of the Clovelly candidate site would use existing infrastructure of the adjacent LOOP storage facility at Clovelly. No new construction would be required for the raw water, brine disposal, and crude oil distribution systems. Only minor upgrades and connections to these systems would be necessary; therefore, effects on threatened, endangered, and candidate species from normal operations and maintenance activities of these elements would be insignificant. This DOE evaluation of potential effects associated with the Clovelly site addresses only the potential construction, operation, and maintenance impacts.

The following paragraphs describe evaluation findings for each potentially affected species. Note that all proposed actions associated with the Clovelly site would be located in Lafourche Parish (except operation and maintenance of the offshore brine pipeline and diffuser, which would be located in the Gulf of Mexico).

F.4.2.1 Birds

F.4.2.1.1 Bald Eagle

The Clovelly site is located amidst mixed coastal wetlands and open water habitat suitable for the bald eagle, and the Louisiana Natural Heritage Program reports that the bald eagle is present in Lafourche Parish. Data from LDWF reports no bald eagle nests within 1 mile (2 kilometers) of the proposed storage

site. Further, the Clovelly site is an existing oil storage facility with frequent human activity. Bald eagles that would be near the area would be tolerant to human activity. The proposed Clovelly storage site would not affect bald eagles.

F.4.2.1.2 Brown Pelican

According to the LDWF (Carloss 2005), colonial nesting birds, including the brown pelican, are known to exist in the vicinity of the Clovelly site.

Construction Impacts

Suitable habitat for the brown pelican in Lafourche Parish would be confined to the Gulf shore and associated barrier islands, sandbars, and wetlands, and nearby shallow estuarine waters, sand spits, offshore sand bars, and islets (for nocturnal roosting). Data from LDWF did not report any rookeries within 1 mile (2 kilometers) of the site, but LDWF points out that the locations of rookeries may change from year to year (Lester 2006). Habitat at the site is considered poor quality due to previous disturbance and the existing human activity associated with the LOOP storage facility at Clovelly. Because the site is disturbed with daily human activities, any pelicans that moved into the area would be considered tolerant of human activity. The proposed Clovelly storage site would have no affect on the brown pelican.

F.4.2.1.3 Peregrine Falcon

The peregrine falcon, which is listed by the State of Louisiana as threatened/endangered, is a migratory visitor to Louisiana in the winter. Barrier islands along the Gulf Coast are important feeding areas for long-distance migrants. Nesting does not occur along the Gulf Coast. Any peregrine falcon feeding in the vicinity of proposed development would be expected to move to adjacent undisturbed areas, which are plentiful, and thus, construction at the site and associated infrastructure upgrades would have no effect on this species. Likewise, operation and maintenance activities would be comparable to those associated with the adjacent LOOP existing storage facility at Clovelly and would have no effect on the species.

F.4.2.1.4 Piping Plover

The piping plover is a migratory species that overwinters on beaches, mudflats, and sandflats along Gulf of Mexico, including barrier island beaches and spoil islands (USFWS 2005). Suitable habitat for the piping plover exists in Lafourche Parish, but has not been identified at the Clovelly storage site. The Clovelly storage site is an existing facility with daily human activity. The site is located 25 miles (40 kilometers) from the nearest designated critical habitat area. Thus, the proposed site would not affect the piping plover.

F.4.2.2 Fish

The only endangered, threatened, or candidate species of fish in Lafourche Parish is the gulf sturgeon. The USFWS has designated as critical habitat certain Gulf Coast rivers where the gulf sturgeon spawns. The Clovelly candidate site is not in critical habitat and the existing site conditions are not suitable for spawning by this species. Gulf sturgeon, particularly adults, may feed in the area of proposed development. Construction of storage caverns, surface facilities, and infrastructure would cause temporary disturbance and long-term loss of potential feeding habitat; however, any gulf sturgeon present at the site would be expected to move to adjacent undisturbed areas during construction. The loss of suitable feeding area would have no effect on the gulf sturgeon because the area disturbed would be an insignificant portion of the suitable habitat in the region. Operation and maintenance activities would be

comparable to existing activities of the LOOP existing storage facility at Clovelly, and therefore, would have no additional effect on the species.

F.4.2.3 Mammals

The only endangered, threatened, or candidate mammal species in Lafourche Parish is the West Indian manatee. Although the manatee occurs primarily along the Gulf of Mexico coast in Florida, individuals range as far west as Texas. The West Indian manatee has been reported as possibly present in Lafourche Parish. The Clovelly site includes shallow coastal waters, such as canals, that are suitable habitat for this species. If the manatee is present at the site, construction of storage caverns, surface facilities, and infrastructure potentially would cause a temporary disturbance and some minor long-term loss of suitable habitat. Any manatee present at the site would be expected to move to adjacent undisturbed areas during construction. Because suitable habitat is abundant in the vicinity of the candidate site and any manatee present in the area likely would be occasional visitors rather than long-term residents, there would be no long-term effect on the species. Operation and maintenance impacts would be comparable to those of the existing LOOP existing storage facility at Clovelly and would have no additional effect on the manatee.

F.4.2.4 Marine Mammals

The operation of the brine disposal system would have no effect on the Gervais beaked whale, goose-beaked whale, pygmy sperm whale, dwarf sperm whale, sperm whale, rough-toothed dolphin, killer whale, false killer whale, short-finned pilot whale, pygmy killer whale, and the bottlenose dolphin. These species are found in deeper waters than the brine diffuser contours (see Appendix B, Brine Discharge Modeling).

Descriptions of potential impacts on the Atlantic spotted dolphin follow; descriptions of impacts on the West Indian manatee were described in the preceding section.

F.4.2.4.1 Atlantic Spotted Dolphin

The Atlantic spotted dolphin is a tropical species that can be found in a variety of areas through the Gulf of Mexico. It ranges from coastal to pelagic environments, typically over the continental shelf and slope. The Atlantic spotted dolphin is usually associated with the Gulf Stream.

Operation Impacts

The Atlantic spotted dolphin may occur in the location of the brine diffuser; however, it is unlikely that the species would remain in the area for an extended period. Because the dissipation of the brine would occur in a relatively small area of the Gulf of Mexico and the species would not be restricted to such areas, there would be no effect on the Atlantic spotted dolphin.

F.4.2.5 Reptiles

F.4.2.5.1 Atlantic Hawksbill Sea Turtle

The Atlantic hawksbill sea turtle is a migratory species that prefers shallow coastal waters with rocky bottoms, coral reefs, mangrove-bordered bays, and estuaries (CSTC 1990). The Atlantic hawksbill sea turtle prefers to nest from May to November on undisturbed, deep-sand beaches (Meylan 1992; Lund 1985), often in the proximity of coral reefs.

Construction Impacts

Other than modifications and upgrades to the pipeline, RWI, and brine disposal systems, construction would be limited primarily to the site. The only upland habitat available for nesting at the Clovelly site is revegetated dredge spoil, which is not considered suitable for this species. Although the species is seen occasionally in Louisiana, and it has been reported in Lafourche Parish, it is more commonly found in more tropical waters. The hawksbill sea turtle is not expected to be found at the Clovelly site, and it would not be affected by construction. Because the existing LOOP brine disposal pipeline would be used, no construction would take place on the beach where the species might nest.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would have no effect on the Atlantic hawksbill turtle because the pipeline would be buried. Operation of the offshore component of the brine disposal system would have no effect on the feeding and habitat of the species because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E Essential Fish Habitat Assessment). Maintenance of the pipeline offshore should be infrequent and not affect the Atlantic hawksbill turtle.

F.4.2.5.2 Green Sea Turtle

The green sea turtle most commonly feeds in shallow, low-energy waters containing abundant submerged vegetation. Its preferred habitat includes tidal flats, pelagic zones, and isolated sand dunes. Nesting typically occurs from March to October on high-energy beaches with deep sand (NatureServe 2005). With these habitat preferences, this migratory species might occasionally occur at or near the Clovelly candidate site, but it is unlikely to nest there.

Construction Impacts

Other than modifications and upgrades to the pipeline, RWI, and brine disposal systems, construction would be limited primarily to the candidate site. The only upland habitat available for nesting at the Clovelly site is revegetated dredge spoil, which is not considered suitable for this species. If any green sea turtle is present at the Clovelly site, it would be expected to avoid any temporary disturbance associated with construction activities, and it would not be affected by construction. Because the existing LOOP brine disposal pipeline would be used, no construction would take place on the beach where the turtle might nest.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would have no effect on the green sea turtle because the pipeline would be buried. Operation of the offshore component of the brine disposal system would have no effect on the feeding and habitat of the species because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat Assessment). Maintenance of the pipeline offshore should be infrequent and not affect the green sea turtle.

F.4.2.5.3 Kemp's Ridley Sea Turtle

In coastal waters, the Kemp's Ridley sea turtle usually feeds over sand or mud bottoms in shallow coastal and estuarine waters. It nests on elevated dunes, especially on beaches backed up by large swamps or bodies of open water having seasonal, narrow ocean connections (NatureServe 2005). Although canals

and open water areas on and near the Clovelly site are suitable for feeding the Kemp's Ridley sea turtle, the available habitat is not suitable for nesting.

Construction Impacts

Other than modifications and upgrades to the pipeline, RWI, and brine disposal systems, construction would be limited primarily to the candidate site. If the Kemp's Ridley sea turtle is present at the Clovelly site, it would be expected to avoid the temporary disturbance associated with construction activities, and it would not be affected by construction. Temporary construction impacts and the long-term loss of marginal quality habitat would have no effect on this species, if it is present.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would have no effect on the Kemp's Ridley sea turtle because the pipeline would be buried. Operation of the offshore component of the brine disposal system would have no effect on the feeding and habitat of the species because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat Assessment). Maintenance of the pipeline offshore should be infrequent and not affect the Kemp's Ridley sea turtle.

F.4.2.5.4 Leatherback Sea Turtle

The leatherback sea turtle has been recorded in Lafourche Parish, but it is unlikely to be found at the Clovelly site. This species spends most of its life in open ocean waters, where it feeds primarily on jellyfish. It approaches land almost exclusively for nesting (Eckert 1992), which takes place on sloping sandy beaches backed by vegetation near deep water and rough seas (CSTC 1990).

Construction Impacts

Other than modifications and upgrades to the pipeline, RWI, and brine disposal systems, construction would be limited primarily to the Clovelly site. Because there are no suitable nesting areas in the vicinity of the Clovelly site, no effects on this species are anticipated from construction.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would have no effect on the leatherback sea turtle because the pipeline would be buried. Operation of the offshore component of the brine disposal system would not affect the feeding and habitat of the species because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat Assessment). Maintenance of the pipeline offshore should be infrequent, and it would not affect the leatherback sea turtle.

F.4.2.5.5 Loggerhead Sea Turtle

The loggerhead sea turtle is found in a variety of habitats, including open seas, bays, estuaries, lagoons, creeks, and mouths of rivers (NatureServe 2005). It tends to nest on open and sandy, high-energy beaches with well-developed dunes (CSTC 1990). Based on these habitat preferences, portions of the Clovelly site may be suitable habitat for the loggerhead sea turtle, but not for nesting. The loggerhead has been reported in Lafourche Parish but not specifically at the Clovelly site.

Construction Impacts

Other than modifications and upgrades to the pipeline, RWI, and brine disposal systems, construction would be limited primarily to the Clovelly site. If any loggerhead sea turtle is present at the Clovelly site, it would be expected to avoid any temporary disturbance associated with construction activities, and it would not be affected by construction. Temporary construction impacts and the long-term loss of marginal quality habitat would have no effect on this species, if it is present.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would have no effect on the loggerhead sea turtle because the pipeline would be buried. Operation of the offshore component of the brine disposal system would not affect the feeding and habitat of the species because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat Assessment). Maintenance of the pipeline offshore should be infrequent, and it would not affect the loggerhead sea turtle.

F.4.3 Bayou Choctaw, Louisiana

This assessment for the proposed Bayou Choctaw expansion site evaluates the potential effects on threatened, endangered, and candidate species by each of the elements of the proposed action listed in table F.4.3-1.

Table F.4.3-1: Elements of the Proposed Action and Location on Bayou Choctaw Site

Element of Proposed Action	Location by Parish or Offshore Area
Bayou Choctaw site	Iberville
Brine Injection Well Area	Iberville

The proposed action would involve developing two additional caverns on the existing DOE site, acquiring one existing cavern co-located on the same salt dome, and developing six new offsite brine injection wells south of the storage facility. Approximately 3,000 feet (900 meters) of new pipeline would be required to connect the existing brine injection wells to the new injection wells. No offsite construction would be required for the existing RWI and crude oil distribution pipelines; therefore the Bayou Choctaw site and the new brine injections wells are the only elements assessed for the effects of construction on threatened, endangered, and candidate species.

If DOE proceeds with expansion at the Bayou Choctaw site, regular operation and maintenance activities associated with the site would be similar to current activities associated with storage caverns currently located there, and additional effects would be negligible or none.

Descriptions of evaluation findings for this element of the Bayou Choctaw site for each species follow. Note that all proposed elements associated with the Bayou Choctaw site are located in Iberville Parish.

F.4.3.1 Birds

The bald eagle is the only threatened, endangered, or candidate bird species reported in Iberville Parish. The Bayou Choctaw site is located near areas with potentially suitable habitat for the bald eagle, including open waters or wetlands adjacent to forest lands; however, no nests have been identified near the site. The Bayou Choctaw site is an existing petroleum storage site, and proposed construction

activities would be limited to the current site location. Because there are no known bald eagle nests in the area and the site is already developed, construction, operation, and maintenance activities for the proposed action would have no effect on the bald eagle.

F.4.3.2 Fish

F.4.3.2.1 Gulf Sturgeon

The gulf sturgeon can be found in some rivers, streams, and estuarine and coastal waters in Louisiana, especially in the eastern part of the state (USFWS 2003a). The gulf sturgeon reportedly occurs in Iberville Parish (USFWS 2003b); however, available information sources do not identify specific gulf sturgeon habitat areas in this parish. Critical habitat for the gulf sturgeon has been designated in riverine and estuarine areas of Louisiana (USFWS 2003a), but the areas in or near Iberville Parish are not included in the critical habitat units for the gulf sturgeon listed by USFWS. The proposed Bayou Choctaw expansion site is located on Cavern Lake, which is connected to the ICW by a canal, and potentially it would serve as habitat for the gulf sturgeon. Considering the site's location relative to the coast and the minimal effects that expansion of this site would have on aquatic habitat in Cavern Lake, the proposed action would have no effect on the gulf sturgeon.

F.4.3.2.2 Pallid Sturgeon

The pallid sturgeon inhabits larger channels of the Mississippi and Atchafalaya River systems in Louisiana. Iberville Parish, where the proposed action would be located, borders the Mississippi river, and it is reported to be within the known range of the pallid sturgeon; however, the proposed site is not located on the Mississippi River, its tributaries, or any large, free-flowing river (listed as the desired habitat of the pallid sturgeon). The proposed action would have no effect on the pallid sturgeon.

F.4.3.3 Mammals

The range of the Louisiana black bear once included all of Louisiana, including the location of the proposed Bayou Choctaw expansion site. Today, the only known breeding populations are in Louisiana in the Tensas and Atchafalaya river basins (Bowker and Jacobson 1995), areas that have been designated as critical habitat. The Bayou Choctaw site is not located in the designated critical habitat of the Louisiana black bear. All construction, operation and maintenance activities would occur within the current boundary of the Bayou Choctaw storage site. The Louisiana black bear has never been sighted at the existing facility. Thus, the expansion at the Bayou Choctaw site would have no effect on the Louisiana black bear.

F.4.3.4 Marine Mammals

No offshore elements are associated with Bayou Choctaw; no marine mammals would be affected.

F.4.4 West Hackberry, Louisiana

The assessment for the proposed West Hackberry site evaluates the potential effects on threatened, endangered, and candidate species by each of the elements of the proposed action listed in table F.4.4-1.

The proposed action would involve acquiring three existing caverns adjacent to the existing DOE site and construction at the site to connect the caverns to the existing RWI, brine disposal, and oil distribution systems. The construction associated with making the connections would be relatively minor and limited

to onsite work; therefore, the West Hackberry site is the only element assessed for effects to threatened, endangered, and candidate species.

Table F.4.4-1: Elements of the Proposed Action and Location on West Hackberry Site

Element of Proposed Action	Location by Parish or Offshore Area
West Hackberry site	Cameron and Calcasieu

If DOE proceeded with expansion at the West Hackberry site, regular operation and maintenance activities associated with the site would be comparable to current activities associated with storage caverns currently located there, and additional incremental effects would be negligible or none.

Following are descriptions of the evaluation findings for this element of the West Hackberry site for each species.

F.4.4.1 Birds

F.4.4.1.1 Bald Eagle

The bald eagle has been reported in Cameron and Calcasieu Parishes in Louisiana. The West Hackberry candidate site is located near areas with potentially suitable habitat for the bald eagle, including open waters or wetlands adjacent to forest lands. DOE has reported occurrence of the bald eagle at the West Hackberry site or on lands through which the SPR pipelines pass (DOE 2002); however there are currently no known bald eagle nests near the site. The West Hackberry site is an existing petroleum storage site. Proposed construction activities would be limited to the current site location, and operation and maintenance would be similar to current activities; therefore, construction, operation, and maintenance activities for the proposed action would have no effect on the bald eagle.

F.4.4.1.2 Brown Pelican

The brown pelican has been reported in parishes along the Gulf Coast of Louisiana including Cameron Parish where the West Hackberry site is located. The brown pelican typically is found in coastal areas, including barrier islands, sandbars, and wetlands, and nearby shallow estuarine waters, sand spits, offshore sand bars, and islets (for nocturnal roosting). Although the West Hackberry expansion site does not have ideal habitat for the brown pelican, this species has been reported by DOE in locations near or on the site (DOE 2002). Because the area is not prime habitat for the brown pelican and construction would be restricted to onsite areas, construction activities are expected to have no effect on the species. Impacts from operation and maintenance activities would be comparable to those resulting from ongoing activities, and they would also have no effect on the brown pelican.

F.4.4.1.3 Piping Plover

The piping plover is found along the Gulf Coast of Louisiana, including Cameron Parish where the West Hackberry site is located. The habitat of the piping plover consists of areas directly adjacent to the coast (e.g., beaches, mudflats, sandflats, and dune systems). Due to the inland location of the West Hackberry site, construction, operation, and maintenance of the proposed action would have no effect on the piping plover.

Unit LA-1 in Cameron Parish is on the Federal list of designated critical habitat for the piping plover; however, all piping plover critical habitat areas in Louisiana, including Unit LA-1, are restricted to areas

in the immediate vicinity of the shoreline, and they do not extend inland beyond where densely vegetated habitat is located. Construction, operation, and maintenance activities associated with the West Hackberry site (all located inland) would have no effect on any areas of critical habitat.

F.4.4.1.4 Red-Cockaded Woodpecker

The red-cockaded woodpecker is reported to be present in Calcasieu Parish where the proposed West Hackberry expansion site is located. The landscape of the storage site and area surrounding the site has emergent wetlands and open water areas, with abundant lakes, bayous, and canals. The red-cockaded woodpecker's usual habitat includes open pine woodlands or savannahs with large, old pines, and it is unlikely that the habitat in the vicinity of the West Hackberry site would be preferable to this species. There are designated primary and secondary core populations of the red-cockaded woodpecker in Louisiana, as described in section F.2.1.5; however, these populations are located in the central part of the state, more than 50 miles (80 kilometers) from the West Hackberry site.

Considering the site characteristics and the distance from known core populations of red-cockaded woodpecker, there would be no effect from construction and operation and maintenance activities on this species at the West Hackberry site.

F.4.4.2 Fish

The gulf sturgeon is potentially found in rivers, streams, estuarine, and coastal waters in Louisiana, especially in the eastern part of the state (USFWS 2003a). The gulf sturgeon reportedly occurs in Cameron Parish (USFWS 2003b). Critical habitat for the gulf sturgeon has been designated in riverine and estuarine areas of Louisiana (USFWS 2003a); however, the Federal list of designated critical habitat for the gulf sturgeon in Louisiana includes areas only in the eastern part of the state, and areas in or near Iberville Parish are not included. Available information sources do not identify specific gulf sturgeon habitat areas in this parish. The proposed West Hackberry expansion site is located near water bodies that potentially would serve as habitat for the gulf sturgeon; however, considering the site's location relative to the coast and the minimal impacts expansion of this site would have on aquatic habitat near the site, the proposed action would have no effect on the gulf sturgeon.

F.4.4.3 Mammals

F.4.4.3.1 Red Wolf

The historical range of the red wolf included coastal areas of Louisiana, including Cameron and Calcasieu Parishes; however, the red wolf is now considered to be extinct from Louisiana (Davis and Schmidly 1997). The red wolf population along the Texas and Louisiana coast was rendered functionally extinct due to hybridization with the coyote (NatureServe 2005). Based on this current range information, construction, operation, and maintenance activities at the proposed West Hackberry site and associated infrastructure would have no effect on the red wolf.

F.4.4.3.2 West Indian Manatee

The West Indian manatee has been reported to occasionally inhabit the coastal waters off of Louisiana, including coastal areas of Cameron Parish. Construction activities associated with expansion at the West Hackberry site would occur only on land, and it would not affect the aquatic habitat of the manatee. Operation and maintenance activities also would have no effect on the manatee.

F.4.4.4 Marine Mammals

No offshore elements are associated with West Hackberry; no marine mammals would be affected.

F.4.4.5 Reptiles

There are five species of endangered or threatened sea turtles that have been reported to inhabit coastal parishes in Louisiana, including Cameron Parish:

- Atlantic hawksbill sea turtle,
- Green sea turtle,
- Kemp's Ridley sea turtle,
- Leatherback sea turtle, and
- Loggerhead sea turtle.

These turtles all inhabit open ocean waters and nest on beaches or similar regions (e.g., tidal flats, pelagic zones, and isolated sand dunes). Loggerhead and Kemp's Ridley sea turtles also are occasionally found in near-shore or estuarine waters.

Because the West Hackberry site is located on the north side of Cameron Parish away from the coast, construction activities at the site would not affect areas inhabited by these species of sea turtles. Regular operation and maintenance activities at the site and the associated existing oil pipelines and RWI would also have no effect on these species.

F.4.5 Assessment Summary

Tables F.4.5-1 though F.4.5-8 identify the threatened, endangered, and candidate species that may be affected by each element of the four proposed new and expansion Louisiana sites. The potential for effects for each element was estimated based on information about the presence or absence of the species or suitable habitat in areas that would be affected. The evaluation also considered the potential mitigation factors. Tables F.4.5-1, F.4.5-3, F.4.5-5, and F.4.5-7 identify whether construction activities for each site may affect species. Tables F.4.5-2, F.4.5-4, F.4.5-6, and F.4.5-8 summarize whether operation and maintenance activities for each site may affect species.

Tables F.4.5-9 and F.4.5-10 summarize the number of species that may be affected by construction and operation and maintenance for the four sites. This summary is presented in table F.4.5-9 for the Chacahoula and Clovelly sites and in table F.4.5-10 for the Bayou Choctaw and West Hackberry expansion sites. Based on current information, only two species (bald eagle and brown pelican) may be affected by the Chacahoula site proposal and no species are expected to be affected at the other two sites.

F.5 RECOMMENDATIONS

The evaluation summarized in section F.4 considered how some potential effects would be minimized, avoided, or more accurately forecasted by the use of preconstruction field investigations, mitigation measures, and other precautionary measures. The recommendations below summarize the types of measures identified in section F.4 that would lessen the potential for effects resulting from the development of the SPR candidate sites in Louisiana. Additional measures may be identified during detailed planning if either the Chacahoula or Clovelly site is selected for development.

Table F.4.5-1: Summary of Potential Construction-Related Impacts to Threatened, Endangered, and Candidate Species from Development of the Chacahoula Site

Species	Site	Power lines to Site	Chacahoula to St. James ROW	Chacahoula to Clovelly ROW	RWI and ROW to ICW	ROW to Gulf of Mexico	Offshore Brine Diffuser
Birds							
Bald Eagle	May affect	May affect	May affect	May affect	May affect	No effect	No effect
Brown Pelican	No effect	No effect	No effect	May affect	No effect	May affect	No effect
Peregrine Falcon	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Piping Plover	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Fish							
Gulf Sturgeon	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Pallid Sturgeon	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Mammals							
Red Wolf	No effect	No effect	No effect	No effect	No effect	No effect	No effect
West Indian Manatee	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Marine Mammals							
Atlantic Spotted Dolphin	No effect	No effect	No effect	No effect	No effect	No effect	No effect
West Indian Manatee	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Reptiles							
Atlantic Hawksbill Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Green Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Kemps Ridley Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Leatherback Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Loggerhead Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect

Table F.4.5-2: Summary of Potential Operation and Maintenance Impacts on Threatened, Endangered, and Candidate Species from Development of Chacahoula Site

Species	Site	Power lines to Site	Chacahoula to St. James ROW	Chacahoula to Clovelly ROW	RWI and ROW to ICW	ROW to Gulf of Mexico	Offshore Brine Diffuser
Birds							
Bald Eagle	May affect	May affect	May affect	May affect	May affect	No effect	No effect
Brown Pelican	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Peregrine Falcon	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Piping Plover	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Fish							
Gulf Sturgeon	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Pallid Sturgeon	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Mammals							
Red Wolf	No effect	No effect	No effect	No effect	No effect	No effect	No effect
West Indian Manatee	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Marine Mammals							
Atlantic Spotted Dolphin	No effect	No effect	No effect	No effect	No effect	No effect	No effect
West Indian Manatee	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Reptiles							
Atlantic Hawksbill Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Green Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Kemps Ridley Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Leatherback Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Loggerhead Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect

Table F.4.5-3: Summary of Potential Construction-Related Impacts to Threatened, Endangered, and Candidate Species from Clovelly Site Development

Species	Site (including connections to existing oil pipelines)
Birds	
Bald Eagle	No effect
Brown Pelican	No effect
Peregrine Falcon	No effect
Piping Plover	No effect
Fish	
Gulf Sturgeon	No effect
Marine Mammals	
Atlantic Spotted Dolphin	No effect
West Indian Manatee	No effect
Reptiles	
Atlantic Hawksbill Sea Turtle	No effect
Green Sea Turtle	No effect
Kemp's Ridley Sea Turtle	No effect
Leatherback Sea Turtle	No effect
Loggerhead Sea Turtle	No effect

Table F.4.5-4: Summary of Potential Operation and Maintenance Impacts to Threatened, Endangered, and Candidate Species from Clovelly Site Development

Species	Site (including connections to existing oil pipelines)
Birds	
Bald Eagle	No effect
Brown Pelican	No effect
Peregrine Falcon	No effect
Piping Plover	No effect
Fish	
Gulf Sturgeon	No effect
Marine Mammals	
Atlantic Spotted Dolphin	No effect
West Indian Manatee	No effect
Reptiles	
Atlantic Hawksbill Sea Turtle	No effect
Green Sea Turtle	No effect
Kemp's Ridley Sea Turtle	No effect
Leatherback Sea Turtle	No effect
Loggerhead Sea Turtle	No effect

Table F.4.5-5: Summary of Potential Construction-Related Impacts to Threatened, Endangered, and Candidate Species by Development of Bayou Choctaw Site

Species	Site	Brine Injection Wells
Birds		
Bald Eagle	No effect	No effect
Fish		
Gulf Sturgeon	No effect	No effect
Pallid Sturgeon	No effect	No effect
Mammals		
Louisiana Black Bear	No effect	No effect

Table F.4.5-6: Summary of Potential Operation and Maintenance Impacts to Threatened, Endangered, and Candidate Species by Development of the Bayou Choctaw Site

Species	Site	Brine Injection Wells
Birds		
Bald Eagle	No effect	No effect
Fish		
Gulf Sturgeon	No effect	No effect
Pallid Sturgeon	No effect	No effect
Mammals		
Louisiana Black Bear	No effect	No effect

Table F.4.5-7: Summary of Potential Construction-Related Impacts to Threatened, Endangered, and Candidate Species by Development of the West Hackberry Site

Species	Site
Birds	
Bald Eagle	No effect
Brown Pelican	No effect
Piping Plover	No effect
Red-Cockaded Woodpecker	No effect
Fish	
Gulf Sturgeon	No effect
Mammals	
Red Wolf	No effect
West Indian Manatee	No effect
Reptiles	
Atlantic Hawksbill Sea Turtle	No effect
Green Sea Turtle	No effect
Kemp's Ridley Sea Turtle	No effect
Leatherback Sea Turtle	No effect
Loggerhead Sea Turtle	No effect

Table F.4.5-8: Summary of Potential Operation and Maintenance Impacts to Threatened, Endangered, and Candidate Species Affected by Development of the West Hackberry Site

Species	Site
Birds	
Bald Eagle	No effect
Brown Pelican	No effect
Piping Plover	No effect
Red-Cockaded Woodpecker	No effect
Fish	
Gulf Sturgeon	No effect
Mammals	
Red Wolf	No effect
West Indian Manatee	No effect
Reptiles	
Atlantic Hawksbill Sea Turtle	No effect
Green Sea Turtle	No effect
Kemp's Ridley Sea Turtle	No effect
Leatherback Sea Turtle	No effect
Loggerhead Sea Turtle	No effect

Table F.4.5-9: Summary of the Number of Species Potentially Affected at the Chacahoula and Clovelly Sites

Potential for Effect	Number of Species			
	Chacahoula, Louisiana		Clovelly, Louisiana	
	Construction	Operation and Maintenance	Construction	Operation and Maintenance
No effect	12	13	12	12
May affect	2	1	0	0

Table F.4.5-10: Summary of the Number of Species Potentially Affected at the Bayou Choctaw and West Hackberry Sites

Potential for Effect	Number of Species			
	Bayou Choctaw, Louisiana		West Hackberry, Louisiana	
	Construction	Operation and Maintenance	Construction	Operation and Maintenance
No effect	4	4	12	12
May affect	0	0	0	0

F.5.1 Chacahoula, Louisiana

Following are the recommendations of the types of measures that could lessen the potential effects from developing the Chacahoula site:

- Conduct a preconstruction survey to identify bald eagle nests near the proposed site and on all pipeline ROWs. If any nests are found, DOE would coordinate with the USFWS and LDWF to avoid adverse impacts. Construction activities along ROWs would be scheduled to avoid nesting periods and pipeline ROWs routed around nesting trees, if possible. If ROWs cannot be rerouted, nesting trees and other large trees nearby would be left undisturbed if possible. Construction activities should be timed to avoid the nesting season and all activity should be restricted within 1,500 feet (450 meters) of active nests.

- Conduct a preconstruction survey to identify brown pelican roosts on or near the proposed brine disposal ROW in Terrebonne Parish or the crude oil pipeline ROW to Clovelly. If evidence of this species is found in or near a pipeline ROW, construction would be scheduled to occur during periods when the potentially affected species are not present, if possible. In all cases, bird nests and roosts should be left undisturbed, and all activity should be restricted within 1,320 feet (402 meters) of any sensitive species.

- Notify USFWS and the appropriate state wildlife officials if any protected species are observed either during preconstruction field surveys or during construction.

- Use directional drilling to construct the pipeline crossing, if feasible, at a proposed pipeline ROW that intersects a surface water body where there is confirmation of one or more endangered, threatened, or candidate species.

- Install and maintain sediment basins, silt fences, and hay bale barriers before or concurrent with soil disturbing activities when directional drilling is not used to construct a pipeline crossing a surface water body where an endangered, threatened, or candidate species may be present; silt curtains or other instream sediment barriers should be used to mitigate water quality impacts and downstream siltation.

- Schedule activities, to the extent practicable, to avoid sensitive life-cycle stages (e.g., spawning, nesting) identified in section F.2 when construction, operation, or maintenance activities would occur in areas identified as habitat for a threatened, endangered, or candidate species.

F.5.2 Clovelly, Louisiana

Following are the recommendations of the types of measures that could lessen the potential effects from developing the Clovelly site:

- Conduct a preconstruction survey to identify brown pelican roosts or rookeries within 2,300 feet (700 meters) of proposed development. If evidence of these species is found nearby, construction activities should be scheduled to avoid nesting season (spring and summer).

- Notify USFWS and the appropriate state wildlife officials if any protected species are observed either during preconstruction field surveys or construction.

- Schedule activities, to the extent practicable, to avoid sensitive life-cycle stages (e.g., spawning, nesting) identified in section F.2 when construction, operation, or maintenance activities would occur in areas identified as habitat for a threatened or endangered species.

F.5.3 Bayou Choctaw, Louisiana

Following is the recommendation of a measure that could lessen the potential effects from developing the Bayou Choctaw site and brine injection wells:

- Notify USFWS and the appropriate state wildlife officials if any protected species are observed either during preconstruction field surveys or construction.

F.5.4 West Hackberry, Louisiana

Following is the recommendation of a measure that could lessen the potential effects from developing the West Hackberry site:

- Notify USFWS and the appropriate state wildlife officials if any protected species are observed either during preconstruction field surveys or construction.

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Appendix G
Evaluation of Federally Listed Species in Mississippi

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Appendix G
Evaluation of Federally Listed Species in Mississippi

G.1 INTRODUCTION

This evaluation of federally listed species was prepared in conjunction with the draft environmental impact statement (EIS) for expansion of the Strategic Petroleum Reserve (SPR). The draft EIS evaluates the expansion of the SPR by developing additional storage capacity at two or three existing sites (West Hackberry and Bayou Choctaw in Louisiana and Big Hill in Texas) or developing one of five new sites (Chacahoula and Clovelly in Louisiana; Richton and Bruinsburg in Mississippi; and Stratton Ridge in Texas), or a combination of the Clovelly and Bruinsburg sites.

This appendix analyzes potential effects on federally endangered, threatened and candidate species, and marine mammals protected under the Endangered Species Act (ESA) and Marine Mammal Protection Act (special status species), respectively, from the proposed development of sites in Mississippi. Potential effects on endangered, threatened and candidate species and marine mammals from development of sites in Louisiana and Texas are analyzed in appendices F and H, respectively.

The Department of Energy (DOE) prepared this evaluation of federally listed species to review and document its findings of no effect and may affect in accordance with the definitions found in the Final ESA Section 7 Consultation Handbook dated March 1998 (Consultation Handbook) (USFWS and NMFS 1998), a letter from U.S. Fish and Wildlife Service (USFWS) dated September 29, 2005 (Werner 2005), and consultations with the USFWS field offices. The evaluation was based on the definitions of the effects to endangered or threatened species in the Handbook and letter, as provided below.

- **No effect**. The proposed action would not affect federally listed species or habitat (i.e., suitable habitat for the species occurring in the project county is not present in or adjacent to the action area).

- **Is not likely to adversely affect**. The project may affect listed species and/or critical habitat; however, the effects would be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effects.

- **Is likely to adversely affect**. Adverse effects to listed species 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, then the proposed action "is likely to adversely affect" the listed species.

DOE is evaluating the impacts associated with five proposed new sites and three proposed expansion sites, some of which may have more than 100 miles (161 kilometers) of new pipelines, new tank farms, and brine disposal systems (offshore diffuser or injection wells) associated with it. When DOE issues a record of decision, it will select either one new site (or a combination of the Bruinsburg and Clovelly sites) and two or three expansion sites for future development, or the no-action alternative. For these reasons, DOE has not conducted comprehensive field surveys and can reach only “no effect” or “may affect” conclusions for this evaluation of special status species instead of using all of the classifications described earlier. For the finding of “may affect,” DOE has not completed onsite surveys to support a finding of “is not likely to adversely affect” or “is likely to adversely affect;” therefore, a finding of “no effect” or “may affect” is the conclusion that DOE can reach at this time.

After issuing the record of decision that specifies the new site or sites and the expansion sites that would be developed, DOE would perform site- and species-specific surveys for all the federally listed species that received a finding of "may affect." DOE would perform the evaluation of the federally listed species in consultation with USFWS and in accordance with section 7 of the ESA and the Final ESA section 7 Consultation Handbook dated March 1998.

G.1.1 Purpose

This evaluation analyzes the potential effects on federally listed threatened and endangered species of construction, operation, and maintenance of additional SPR storage capacity. Proposed activities vary by site (e.g., based on existing infrastructure) and may include construction of underground storage caverns and surface facilities at the storage sites; construction of pipelines for crude oil distribution, raw water supply, and brine disposal; surface or groundwater withdrawals to support solution mining of new caverns; discharge of brine in the Gulf of Mexico; and construction of miscellaneous facilities at oil distribution sites.

G.1.2 Threatened and Endangered Species Terminology

USFWS lists a species on the Federal Endangered Species List as "threatened" when it is likely to become endangered throughout all or a significant portion of its range in the foreseeable future, and lists a species as "endangered" when it is in danger of extinction throughout all or a significant portion of its range. In addition, the USFWS maintains a list of what are called "candidate species" that are being considered for listing under the Endangered Species Act. A candidate species is a species that the USFWS has on file sufficient information to support a proposal to list as endangered or threatened, but for which preparation and publication of a proposal is precluded by higher-priority listing actions. Federal agencies are encouraged to consider these species in preparing environmental impact analysis done under NEPA in order to alleviate threats to them and thereby possibly eliminate the need to list the species as endangered or threatened.

To define all the species that are required to be addressed in the biological assessment, DOE contacted and obtained information from the USFWS, National Oceanic and Atmospheric Administration (NOAA) Fisheries, and the Mississippi Department of Wildlife, Fisheries, and Parks. Appendix K contains lists of the consultation meetings held.

G.1.3 Organization

This appendix includes the following: a brief literature review for each of the species addressed (section G.2); observations made during site visits (section G.3); an assessment of the potential effects of the proposed action on the threatened, endangered, and candidate species (section G.4); and recommendations for minimizing potential adverse effects on the subject species and on other biological resources (section G.5). References cited in this appendix are identified in section G.6.

G.2 LITERATURE REVIEW

The literature review describes the natural histories of all species federally listed as threatened, endangered, or candidate *and* identified as present or potentially present (e.g., based on historical records) in at least one county or parish where proposed new and expanded SPR facilities and associated infrastructure would be located. Table G.2-1 lists the species evaluated in this appendix. Although table

G.2-1 pertains only to the Bruinsburg and Richton candidate sites in Mississippi, it includes species present in Louisiana parishes because the Bruinsburg oil distribution pipeline would cross into Louisiana from Mississippi.

Table G.2-1: Federally Listed Threatened or Endangered Species in Louisiana Parishes and Mississippi Counties Associated with Proposed SPR Sites in Mississippi

Common Name	Scientific Name	Federal Status	Mississippi and Louisiana Status[a]	Counties/Parishes Where Species May Exist[b]
Birds				
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	*Mississippi*: Critically imperiled (breeding); imperiled (nonbreeding) *Louisiana*: Endangered	*Mississippi*: Adams, Jackson, Warren, Wilkinson *Louisiana*: East Baton Rouge, West Feliciana
Brown Pelican	*Pelecanus occidentalis*	Endangered	*Mississippi*: Critically imperiled (nonbreeding)	*Mississippi*: Jackson
Interior Least Tern	*Sterna antillarum ath alassos*	Endangered	*Mississippi*: Rare or uncommon	*Mississippi:* Claiborne, Warren
Mississippi Sandhill Crane	*Grus canadensis pulla*	Endangered	*Mississippi*: Critically imperiled	*Mississippi*: Jackson
Piping Plover	*Charadrius melodus*	Threatened	*Mississippi*: Not Listed	*Mississippi*: Jackson
Red-Cockaded Woodpecker	*Picoides borealis*	Endangered	*Mississippi*: Critically imperiled	*Mississippi*: Amite, Forrest, George, Greene, Jackson, Perry, Wilkinson
Fish				
Bayou Darter	*Etheostoma rubrum*	Threatened	*Mississippi*: Critically imperiled	*Mississippi*: Claiborne, Copiah, Hinds
Gulf Sturgeon	*Acipenser oxyrhynchus desotoi*	Threatened	*Mississippi*: Critically imperiled *Louisiana*: Threatened	*Mississippi*: Forrest, Copiah, George, Greene, Jackson, Hinds, Marion, Pike, Perry, Walthall *Louisiana*: East Baton Rouge, East Feliciana
Pallid Sturgeon	*Scaphirhynchus albus*	Endangered	*Mississippi*: Critically imperiled *Louisiana*: Endangered	*Mississippi*: Adams (P), Claiborne (P), Jefferson (P), Warren (P), Wilkinson (P) *Louisiana*: East Baton Rouge, East Feliciana, West Baton Rouge, West Feliciana
Pearl Darter	*Percina aurora*	Candidate	*Mississippi*: Not listed	*Mississippi*: Forrest, George, Jackson, Perry
Invertebrates				
Alabama Heelsplitter Mussel	*Potamilus inflatus*	Threatened	*Louisiana*: Threatened	*Louisiana*: East Baton Rouge

Table G.2-1: Federally Listed Threatened or Endangered Species in Louisiana Parishes and Mississippi Counties Associated with Proposed SPR Sites in Mississippi

Common Name	Scientific Name	Federal Status	Mississippi and Louisiana Status[a]	Counties/Parishes Where Species May Exist[b]
Camp Shelby Burrowing Crayfish	*Fallicambarus gordoni*	Candidate	*Mississippi*: Critically imperiled	*Mississippi*: Perry
Fat Pocketbook Mussel	*Potamilus capax*	Endangered	*Mississippi*: Critically imperiled	*Mississippi*: Jefferson
Mammals				
Gray Myotis (Gray Bat)	*Myotis grisescens*	Endangered	*Mississippi*: Not listed	*Mississippi*: Perry (P)
Louisiana Black Bear	*Ursus americanus luteolus*	Threatened	*Mississippi*: Critically imperiled *Louisiana*: Threatened	Mississippi: Adams, Amite, Claiborne, Copiah, Forrest, George, Greene, Hinds, Jackson, Jefferson, Lamar (P), Marion, Perry, Pike (P), Walthall (P), Warren, Wilkinson *Louisiana*: West Feliciana
Marine Mammals				
Gervais Beaked Whale	*Mesoplodon europaeus*	Protected	Threatened	*Mississippi*: Jackson
Goose-Beaked Whale	*Ziphius cavirostris*	Protected	Threatened	*Mississippi*: Jackson
Pygmy Sperm Whale	*Kogia breviceps*	Protected	Threatened	*Mississippi*: Jackson
Dwarf Sperm Whale	*Kogia simus*	Protected	Threatened	*Mississippi*: Jackson
Sperm Whale	*Physeter macrophalus*	Endangered	Endangered	*Mississippi*: Jackson
Atlantic Spotted Dolphin	*Stenella frontalis*	Protected	Threatened	*Mississippi*: Jackson
Rough-Toothed Dolphin	*Steno bredanesis*	Protected	Threatened	*Mississippi*: Jackson
Killer Whale	*Orcinus orca*	Protected	Threatened	*Mississippi*: Jackson
False Killer Whale	*Pseudorca crassidens*	Protected	Threatened	*Mississippi*: Jackson
Short-Finned Pilot Whale	*Globicephala macrorhynchus*	Protected	Threatened	*Mississippi*: Jackson
Pygmy Killer Whale	*Feresa attenuate*	Protected	Threatened	*Mississippi*: Jackson
West Indian Manatee	*Trichechus manatus*	Endangered	Endangered	*Mississippi*: Jackson *Louisiana: East Baton Rouge*
Bottlenose Dolphin	(*Tursiops truncatus*)	Protected	Not listed	*Mississippi*: Jackson
Plants				
Louisiana Quillwort	*Isoetes louisianensis*	Endangered	*Mississippi*: Imperiled	*Mississippi*: Forrest, George, Greene, Jackson, Perry
Reptiles				
Alabama Red-Belly Turtle	*Pseudemys alabamensis*	Endangered	*Mississippi:* Endangered	*Mississippi:* Jackson

Table G.2-1: Federally Listed Threatened or Endangered Species in Louisiana Parishes and Mississippi Counties Associated with Proposed SPR Sites in Mississippi

Common Name	Scientific Name	Federal Status	Mississippi and Louisiana Status[a]	Counties/Parishes Where Species May Exist[b]
Black Pine Snake	*Pituophis melanoleucuc spp. Lodingi*	Candidate	*Mississippi:* Imperiled	*Mississippi*: Forrest, George, Marion, Perry
Eastern Indigo Snake	*Drymarchon corais couperi*	Threatened	*Mississippi:* Critically imperiled	*Mississippi*: Forrest (P), George (P), Greene (P), Jackson (P), Marion, Perry (P)
Gopher Tortoise	*Gopherus polyphemus*	Threatened	*Mississippi:* Imperiled	*Mississippi*: Forrest, George, Greene, Jackson, Lamar, Marion, Perry, Walthall
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	*Mississippi:* Critically imperiled (nonbreeding)	*Mississippi*: Jackson
Loggerhead Sea Turtle	*Caretta caretta*	Threatened	*Mississippi:* Critically imperiled (breeding); imperiled (nonbreeding)	*Mississippi*: Jackson
Ringed Map Turtle	*Graptemys oculifera*	Threatened	*Mississippi:* Imperiled	Mississippi: Copiah, Hinds, Marion
Yellow-Blotched Map Turtle	*Graptemys flavimaculata*	Threatened	*Mississippi:* Imperiled	*Mississippi*: Forrest, George, Greene, Jackson, Perry

Not listed: No state status; species is not classified as threatened or endangered by Louisiana.
[a] State status for Mississippi is provided for every species; state status for Louisiana is provided for only those species also present or potentially present in at least one Louisiana parish where SPR facilities are proposed.
[b] Includes only counties in Mississippi where SPR facilities are proposed.
(P) Potentially or historically present in the county.

G.2.1 Birds

G.2.1.1 Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is a large bird of prey with an average wingspan of about 7 feet (2 meters). The adult male and female are similar in appearance, with a dark brown body and wings, and a distinctive white head and tail. This species is federally listed as threatened, although delisting has been proposed.

The bald eagle may be found throughout the continental United States and Alaska. It is most likely to be found in areas with large expanses of aquatic habitat with forested shorelines or cliffs where it selects supercanopy roost trees. The bald eagle is an opportunistic forager. Although it prefers fish, it will eat a great variety of mammals, amphibians, crustaceans, and birds, including many species of waterfowl (Buehler 2000).

The bald eagle nests almost exclusively at the edges of lakes, rivers, or seacoasts. It generally nests in tall trees or cliffs near the water's edge, although it occasionally nests on the ground. Nests are often reused in successive years. The breeding season generally begins in the spring (earlier in southern states), with the young fledging after about 6 months (USFWS 1983; USFWS 1995). According to comments submitted to DOE by the USFWS (James 2005), nesting activity occurs from September to January with

young fledged usually by midsummer. Although resident breeding populations occur along the eastern Gulf Coast, the bald eagle in Mississippi is likely to be a nonbreeding migrant (NatureServe 2005).

The bald eagle is highly sensitive to human noise and interference (USFWS 1983; USFWS 1995). It is most sensitive during the first 12 weeks of the nesting cycle. Disturbance during nesting may lead to nest abandonment or reduced hatching and survival rates. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest, lessening their likelihood of survival (Watson 2005).

G.2.1.2 Brown Pelican

The brown pelican (*Pelecanus occidentalis*) is a large water bird with a massive bill and throat pouch. Its wings and body are grayish-brown. The nonbreeding adult has a whitish head and neck, often with some yellow. The hindneck of a breeding adult is dark chestnut (NGS 1983, Palmer 1962). A larger individual has a wingspread of more than 7 feet (2 meters) (USFWS 2005).

The brown pelican is a fish eater, and it is found almost exclusively in coastal areas along the southern east coast, the Gulf of Mexico, and throughout the west coast. It prefers to feed in shallow estuarine waters and use sand spits, offshore sand bars, and islets for nocturnal roosting. Dry roosting sites are essential to suitable habitat (NatureServe 2005). Nests usually are built on coastal islands, on the ground or in small bushes and trees (Palmer 1962).

The brown pelican is a federally listed endangered species. Populations in California, Texas, and Louisiana were devastated by pesticide poisoning from dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethylene (DDE), and other compounds throughout the 1950s and 1960s; nevertheless, eastern and Gulf Coast populations of the brown pelican appear to be stable and possibly have been increasing in recent years. Contaminant levels in both populations are below the threshold for reproductive failure, but the populations are still very vulnerable to pesticide pollution (Anderson and Hickey 1970). Other threats include the disturbance of nesting birds by humans, a decline in fish populations, increased water turbidity resulting from dredging, oil and chemicals spills, entanglement in fishing gear, and extreme weather conditions. Recently, habitat degradation has affected both roosting and nesting. For example, nesting efforts have failed in the Gulf Coast because of erosion at the nesting sites (NatureServe 2005).

The brown pelican is classified as vulnerable in Texas and imperiled in Louisiana. The State of Mississippi has no listed conservation status for the species, although the species is found in Jackson and Harrison Counties.

G.2.1.3 Interior Least Tern

The least tern (*Sterna antillarum*) is the smallest North American tern, with an average body length of about 9 inches (23 centimeters). The breeding adult is mainly gray, topped by a black cap and nape and a white forehead. The least tern is classified by the USFWS as endangered in Louisiana in areas along the Mississippi River and its tributaries, Mississippi along the Mississippi River, and all of Texas except in areas within 50 miles (80.5 kilometers) of the coast (USFWS 2005).

There are two recognized subspecies of the least tern, one of which—the interior least tern (*Sterna antillarum athalassos*)—is found in Texas, Louisiana, and Mississippi. This subspecies includes interior populations of the bird (not a taxonomic variation), which tend to be more critically endangered because of habitat loss caused by large-scale water management projects that destroy breeding grounds (NatureServe 2005).

Breeding grounds for the least tern are found locally throughout the Mississippi River system. Nesting occurs on and near the river with eggs often resting directly on sandbars (Aycock 2005). Good nesting areas are above the high-tide mark, have shells or stones for egg camouflage, and are near a plentiful source of small fish (Burger and Gochfeld 1990). Hatching success is easily disrupted by poor weather, tides, predation, and human disturbance.

The breeding season of the least tern is from May through August, although adult birds may roost near the nesting sites for up to a month before laying occurs (usually in May or June). The least tern that breeds in the southern Atlantic states migrates to wintering grounds in the Caribbean between August and September (NatureServe 2005).

The primary prey of the least tern is small fish from shallow rivers, streams, and lakes. When available, crustaceans, insects, mollusks, and annelids may also form part of the diet (Whitman 1988).

G.2.1.4 Mississippi Sandhill Crane

The Mississippi sandhill crane (*Grus canadensis pulla*) is an endangered subspecies. Like other sandhill cranes, the Mississippi subspecies is a tall, about 4 feet (1 meter), long-necked crane that is uniformly gray-brown except for a red crown. The Mississippi subspecies is darker than other sandhill cranes (Valentine and Lohoefener 1991). The entire wild population of this subspecies, which consists of slightly more than 100 birds, is found on and near the Mississippi Sandhill Crane National Wildlife Refuge in Jackson County, MS.

The habitats preferred by Mississippi sandhill crane include open savannas, swamp edges, young pine plantations, and wetlands along edges of pine forests (NatureServe 2005). The diet of this species consists primarily of aquatic invertebrates, reptiles, amphibians, insects, and aquatic plants (Ehrlich et al. 1992).

G.2.1.5 Piping Plover

The piping plover (*Charadrius melodus*) is a small, sandy-colored shorebird similar in appearance to a sandpiper. Distinguishing field marks of this species include yellow-orange legs, a black band across the forehead from eye to eye, and a black ring around the base of its neck (USFWS 2005). The piping plover is federally listed as threatened in Mississippi.

A migratory species, the piping plover overwinters on beaches, mudflats, and sandflats along the Atlantic coast and the Gulf of Mexico including barrier island beaches and spoil islands on the Gulf Intracoastal Waterway (USFWS 2005). Critical habitat for the wintering piping plover has been proposed for the following several specific locations in Jackson County, MS (USFWS 2001c):

- **Unit MS–10:** Ocean Springs West. 1.2 miles (1.9 kilometers) of shoreline in Jackson County. This unit extends from U.S. 90 and includes the shore of Biloxi Bay following the shoreline southeast to the Ocean Springs Harbor inlet. The shoreline of this unit is privately owned.

- **Unit MS–11:** Ocean Springs East. 1.6 miles (2.6 kilometers) of shoreline in Jackson County. This unit extends from Weeks Bayou and includes the shore of Biloxi Bay following the shoreline southeast to Halstead Bayou. The shoreline of this unit is privately owned.

- **Unit MS–12:** Deer Island. 9.1 miles (14.6 kilometers) of shoreline in Harrison County. The entire unit is on Deer Island. This unit includes privately owned Mississippi Sound shoreline.

- **Unit MS–13:** Round Island. 1.6 miles (2.6 kilometers) of shoreline in Jackson County. This unit includes privately owned Mississippi Sound shoreline.

- **Unit MS–14:** Mississippi Barrier Islands. 81.1 miles (130.5 kilometers) of shoreline in Harrison and Jackson Counties. This unit includes shoreline of the Mississippi Sound and Gulf of Mexico on Cat, East and West Ship, Horn, Spoil, and Petit Bois Islands. Approximately 24.8 miles (39.9 kilometers) are privately owned, and 59.4 miles (95.6 kilometers) are part of Gulf Islands National Seashore.

- **Unit MS–15:** North and South Rigolets. 3.7 miles (5.9 kilometers) of shoreline in Jackson County, MS, and Mobile County, AL. This unit extends from the southwestern tip of South Rigolets Island and includes the shore of Point Aux Chenes Bay, the Mississippi Sound, and Grand Bay following the shoreline east around the western tip, then north to the South Rigolets Bayou; then from the southeastern corner of North Rigolets Island north to the northeastern most point of the island. Approximately 2.7 miles (4.3 kilometers) are in Mississippi and 1.0 mile (1.6 kilometers) is in Alabama. Almost half the Mississippi shoreline length is in the Grand Bay National Wildlife Refuge.

The piping plover begins to arrive at wintering habitats in July and remains through September. Although a few plovers remain throughout the year, sightings are rare in late May, June, and early July (USFWS 2001c).

G.2.1.6 Red-Cockaded Woodpecker

The red-cockaded woodpecker (*Picoides borealis*) is a federally listed endangered species found in mature and old-growth pine forests in the southeastern United States. The red-cockaded woodpecker is black and white with a ladder back and distinctive white cheek patches (USFWS 2003b). The species is named for barely visible red streaks called “cockades” on the head of the adult male (NatureServe 2005).

The red-cockaded woodpecker has specific habitat requirements that include open pine woodlands or savannahs with large, old pines. Large pines are required because cavity nests are built only in inactive pine heartwood. Nesting trees must be in open stands with little or no hardwood midstory and few or no overstory hardwoods (USFWS 2003b). Foraging occurs in older pine stands within 0.5 mile (0.8 kilometer) of a colony (Aycock 2005).

The red-cockaded woodpecker lives in family groups that usually include a breeding pair and nonbreeding helpers. Most helpers are male. Mating typically occurs in November and December and March through May, and egg laying usually occurs in April and early May. Incubation lasts about 10 to12 days (Hooper et al. 1980) and hatchlings remain in the nest for 26 to 29 days (NatureServe 2005).

According to the 1985 revision of the recovery plan for this species, there were approximately 14,068 red-cockaded woodpeckers living in 5,627 groups in 11 states (USFWS 2003b). USFWS established criteria for delisting the species based on the status and size of primary and secondary core populations named in the recovery plan. Table G.2.1.6-1 shows the locations of core populations of red-cockaded woodpeckers in Mississippi.

Table G.2.1.6-1: Locations of Designated Core Red-Cockaded Woodpecker Populations in Mississippi

Designated Core Population Type	Population Locations in Mississippi
Primary	Chickasawhay Ranger District, De Soto National Forest (includes parts of Jones, Wayne, and Green Counties)
	Bienville National Forest (includes parts of Jasper, Newton, Scott, and Smith Counties)
Secondary	De Soto Ranger District, De Soto National Forest (includes parts of Pearl River, Forrest, Perry, Greene, George, Stone, Harrison, and Jackson Counties)
	Homochitto National Forest (includes parts of Amite, Adams, Copiah, Franklin, Jefferson, Lincoln, and Wilkinson Counties)

G.2.2 Fish

G.2.2.1 Bayou Darter

The bayou darter (*Etheostoma rubrum*) is a threatened fish species found in western Mississippi in the Bayou Pierre and the lower reaches of its tributaries: White Oak Creek, Foster Creek, and Turkey Creek (USFWS 2005). The largest concentrations of the 2-inch (5.1-centimeter) fish are found in the sections of Bayou Pierre and Foster Creek in Copiah County, north of state highway 548 (Page and Burr 1991). Although the population density was stable in the 1980s and 1990s, continuing geomorphic changes have shifted the distribution upstream (Ross et al. 2001).

The typical habitat of the bayou darter includes creeks and small to medium rivers. The adult bayou darter is commonly collected near heads of gravel riffles in water less than 6 to 12 inches (15 to 30 centimeters) deep, which reflects the bayou darter's preference for stable, moderately swift riffles of large gravel and rock (USFWS 1990b). In the winter, the bayou darter is often found near logs, cobble, and boulders, which may provide refuge during periods of high stream flow (Ross et al. 1990, 1992).

The female usually starts spawning after its first year, and it spawns at least twice per reproductive season, and lives 3 years (Burris and Bagley 1983; USFWS 1990b; Knight and Ross 1992). Clutch size ranges from 20 to 75 ova depending on the size of the female (USFWS 2005). Reproduction occurs mid-April or early May to mid-August at a water temperature of 68 to 86 degrees Fahrenheit (20 to 30 degrees Celsius). The juvenile has been collected from late July to late August, but it also has been reported as early as June. The peak-spawning season is April to late May, or early June during rising water temperatures 72 to 84 degrees Fahrenheit (22 to 29 degrees Celsius) (Burris and Bagley 1983; USFWS 1990b; Knight and Ross 1992). After spawning, the bayou darter buries its eggs for protection (Ross and Wilkins 1993).

G.2.2.2 Gulf Sturgeon

The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is a threatened anadromous fish species found in Gulf coastal waters from Louisiana to Florida. Primitive in appearance, the Gulf sturgeon has external bony plates, an extended snout, and four large barbels. Adults range from 4 to 8 feet (1.2 to 2.4 meters) in length, with the adult female measuring larger than the male (USFWS 2003a).

The Gulf sturgeon preys on benthic invertebrates and small fishes. Feeding is believed to occur only during the winter and spring in offshore or estuarine waters (Cross 1992).

USFWS has designated certain Gulf of Mexico rivers and tributaries as critical habitat for the Gulf sturgeon; it spends the first 2 years of its life in these habitats, and later it returns to breed. Spawning habitats are generally fresh water (sometimes tidal) and usually over a bottom of hard clay, rubble, gravel, or shell. Eggs of the Gulf sturgeon are demersal (heavy, sinking to the bottom) and adhesive (USFWS 2003a). In Mississippi, the designated critical habitats include major portions of the Pascagoula, Leaf, Chickasawhay, Pearl, and Bogue Chitto Rivers (USFWS 2003a).

G.2.2.3 Pallid Sturgeon

The endangered pallid sturgeon (*Scaphirhynchus albus*) is a large fish, up 73 inches (186 centimeters), with a flat, shovel-like snout that has four fringed barbells. The pallid sturgeon has 37 to 43 dorsal rays and 24 to 28 anal rays. It is similar to the shovelnose sturgeon, but it has several distinct differences such as the paucity of scale-like scutes on the belly, a larger head, a wider mouth, smaller eyes, and a paler gray-white color above and on the sides (Page and Burr 1991). The pallid sturgeon is one of the largest fish species found in the Missouri/Mississippi River drainage (Gilbraith et al. 1988). Its diet consists of aquatic invertebrates (Carlson et al. 1985).

The pallid sturgeon's habitat consists of large, turbid free-flowing rivers or reservoirs. In a river or reservoir, the pallid sturgeon is most often found in strong current over firm gravel or sandy substrate (USFWS 1989a; Kallemeyn 1981). The pallid sturgeon's preferred temperature range is from 32 to 86 degrees Fahrenheit (0 to 30 degrees Celsius) (Dryer and Sandoval 1993).

The pallid sturgeon's range is quite large, covering about 3,515 miles (5,656 kilometers) of river through 13 states including Louisiana and Mississippi (Dryer and Sandoval 1993). In Louisiana, the most frequent occurrence of the pallid sturgeon is in the Mississippi and Atchafalaya Rivers, where the Atchafalaya diverges from the Mississippi River (Dryer and Sandoval 1993).

The spawning season for the pallid sturgeon lasts from July to August. The male becomes sexually mature at 3 to 4 years of age (Kallemeyn 1981), and the female becomes sexually mature at 7 years. It takes several years for eggs to mature between spawnings (Conte et al 1988). Little other information is available to describe the spawning requirements for the pallid sturgeon, so these requirements are often assumed to be similar to those of the shovelnose sturgeon. The shovelnose sturgeon spawns over rock, rubble, or gravel in the main channel of the Missouri and Mississippi Rivers and their major tributaries, or in the wing dams in the main stem of larger rivers (Christiansen 1975; Elser et al. 1977; Moos 1978; Helms 1974). In addition, in June the shovelnose sturgeon responds to increased waterflow from melting snow by migrating to spawn (Berg 1981).

G.2.2.4 Pearl Darter

The pearl darter (*Percina aurora*) is a candidate endangered fish. It has a blunt snout, horizontal mouth, and large eyes set high on its head. Both sexes have a black spot at the base of the caudal fin, and the breeding male has dark bands on and at the base of the dorsal fin (Ross, in press). The female pearl darter reaches a maximum of 2.3 inches (57 millimeters) in length, and the male reaches a maximum length of 2.6 inches (6.6 centimeters) (Suttkus et al. 1994).

Historically, the pearl darter inhabited the Pearl and Pascagoula drainage systems in Mississippi and Louisiana. No pearl darters have been collected from the Pearl River drainage system since 1973, and it is now believed to exist only in the Pascagoula River drainage system, where specimens are rarely found

(NatureServe 2005). In surveys since 1983, pearl darters have been found only in the Pascagoula, Chickasawhay, Chunky, Leaf, and Bouie Rivers and Okatoma and Black Creeks in Mississippi (USFWS 2001a). The only documented location where spawning is known to occur is in the Leaf River in the vicinity of Eastabutchie and the confluence of the Bouie and Leaf Rivers near Hattiesburg (USFWS 2001a).

Although the habitat requirements of the pearl darter are not well known, the choice may be similar to those of the channel darter. The channel darter generally inhabits rivers and large creeks in areas of moderate current, usually over sand and gravel substrates. These habitat conditions are typical of the lower ends of riffles or the edges of deep channels (NatureServe 2005). The pearl darter is deemed to be threatened by changes in the flow regime of its host rivers, by pollutant loadings from streambank erosion and nonpoint source runoff, and the potential for catastrophic losses resulting from oil toxicity or chemical spills (USFWS 2001a).

G.2.3 Invertebrates

G.2.3.1 Alabama Heelsplitter Mussel

The Alabama heelsplitter (*Potamilus inflatus*), also known as the inflated heelsplitter, is a bivalve mollusk with an adult shell size of approximately 5.5 inches (14 centimeters) in length. Shells are typically brown or black, and they may be streaked with green rays in juveniles (NatureServe 2005). The specific feeding habits of the heelsplitter are unknown, but its prey likely includes detritus, diatoms, phytoplankton, and zooplankton. As with other freshwater mussels, the heelsplitter feeds by filtering food particles from the water column (Churchill and Lewis 1924).

The Alabama heelsplitter prefers stable and soft substrata including sand, sandy-gravel, mud, and silt (Stern 1976; Hartfield 1988). It tends to collect on the protected side of bars, and it is found in water up to 20 feet (6 meters) deep (Hartfield 1988). Historically, the Alabama heelsplitter was found in the Pearl River of Mississippi, as well as some rivers in Alabama and Louisiana (Hurd 1974; Stern 1976; Hartfield 1988). Currently, this species is not abundant in any of its historical range.

Little is known about the life history of this species. The reproductive cycle is similar to that of other freshwater mussels; the male releases sperm into the water column, which are in turn taken in by the female's siphons during feeding and respiration. The female keeps the fertilized eggs until the larvae (glochidia) develop. After the larvae are fully developed, the mussel glochidia are released into the water, where they must attach to an appropriate type of fish while they further develop into juvenile mussels (Hartfield 1988). Studies have indicated that the freshwater drum (*Aplodinotus grunniens*) is a suitable host for heelsplitter glochidia (Roe et al. 1997).

G.2.3.2 Camp Shelby Burrowing Crayfish

The Camp Shelby burrowing crayfish (*Fallicambarus gordoni*) is a nonpetitioned candidate species. All known occurrences of this species are in flat, woodland pitcher plant wetlands, locally referred to as pitcher plant bogs, in central Perry County, MS (Fitzpatrick 1987, 1991). In particular, all known habitat for the species occur on U.S. Forest Service lands leased by U.S. Army National Guard. No SPR development is proposed in this area of Perry County.

G.2.3.3 Fat Pocketbook Mussel

The fat pocketbook mussel (*Potamilus capax*) is endangered through its range in the United States (USFWS 2005). A freshwater mussel, the fat pocketbook prefers a mixture of sand, silt, and clay beds in

flowing water 2 inches to 8 feet deep (5 centimeters to 2.4 meters) (Parmalee 1967; Jenkinson and Ahlstedt 1988). Its lifecycle is unknown, but its reproductive anatomy is believed to be similar to the others in the *Lamsilinae* subfamily (Ortman 1912). It is a long-term breeder and is fertile during the late summer from July through October. (Ortman 1914) Nearly all mussels require a host, usually a fish, during the parasitic larval portion of the lifecycle. A host for this species has not been conclusively identified (USFWS 1989b, NatureServe 2005), but the red drum (*Sciaenops ocellatus*) is a suspected host (Aycock 2005).

The fat pocketbook was once common from Louisiana and Mississippi in the south to Minnesota, Wisconsin, and New York in the north. It is now presumed extinct in Minnesota and Wisconsin, and there is a high likelihood that it is also extinct in New York (NatureServe 2005). Before 1970, the fat pocketbook was most commonly found in the Mississippi River above St. Louis, MO, the Wabash River in Indiana, and the St. Francis River in Arkansas (Dennis 1985). Since 1970, the range has decreased and the mussel seems to be primarily restricted to the St. Francis River, with very scattered populations in the Wabash and Ohio Rivers and southeastern Missouri (NatureServe 2005). The Mississippi River is the one exception because, although the population has decreased significantly, a new population was recently discovered in Jefferson County (Jones et al. 2005).

The depletion of fat pocketbook mussel populations in many of the rivers once inhabited results largely from navigation and flood management activities. It is especially vulnerable to perturbations from channel maintenance because it is a fairly large mussel species and requires flowing water for survival. Its absence in the upper Mississippi River suggests that it may be particularly sensitive to dredging activities. Siltation and pollution are two other factors that probably have had an effect, although less than dredging, on the declining populations (USFWS 1989b).

G.2.4 Mammals

G.2.4.1 Gray Myotis (Gray Bat)

Literature gathered for this biological assessment indicates that the gray bat is unlikely to be present in Mississippi. For example, the range of the gray bat as characterized by USFWS (2005) and NatureServe (2005) either does not include Mississippi or includes only the northeast corner of the state. One source (USFWS 2000) indicated that, based on historical records, the gray bat potentially is present in Perry County where the proposed Richton site would be located.

Roost sites of this species are nearly exclusively restricted to caves year round (Barbour and Davis 1969). No caves within the known range of this species have been identified in areas where SPR activities are proposed.

G.2.4.2 Louisiana Black Bear

The endangered Louisiana black bear (*Ursus americanus luteolus*) is one of 16 recognized subspecies of the American black bear (Hall 1981). Like other black bears, the Louisiana black bear has long black hair, and it may weigh more than 600 pounds (272 kilograms) (USFWS 1992). It is distinguished from other black bears by its longer, narrower, and flatter skull, and by its proportionately large molar teeth (Nowak 1986).

The Louisiana black bear prefers bottomland hardwood forests. It is found primarily in the Tensas and Atchafalaya River basins in Louisiana, areas that have been proposed as designated critical habitat. In fact, these areas of Louisiana are the locations of the only known breeding populations of the Louisiana black bear (Bowker and Jacobson 1995). Other areas with suspected occurrences of Louisiana black

bears include the Loess Bluffs portion of the Mississippi River corridor in southwestern Mississippi and the adjacent Tunica Hills of Louisiana, as well as smaller areas in the lower East Pearl River and lower Pascagoula River basins of southern Mississippi (Wooding et al. 1993). According to the Sierra Club (Gillette 2005), the Louisiana black bear has been sighted several times recently in Vancleave, Jackson County, MS.

G.2.5 Marine Mammals

The onshore portion, including the directional drilling from onshore to open water in the Gulf of Mexico associated with the proposed SPR Richton site would not affect marine mammals. The construction and operation of the offshore brine disposal pipeline and operation of the brine diffusion system may affect marine mammal species. The location of the offshore pipeline and the diffuser system would not reach the depths of Gulf of Mexico where the majority of these species can be found because the diffuser systems are at an approximately 30-foot (9-meter) depth. Also, the dispersion of the brine discharge into the Gulf of Mexico would dissipate before reaching these depths.

G.2.5.1 Gervais Beaked Whale

The Gervais beaked whale (*Ziphius cavirostris*) is a pelagic species associated with the continental shelf and deep oceanic waters, but it is also closely associated with the Gulf Stream waters. Little is known about this species, but sexual maturity is believed to occur when the whale reaches 15 feet (4.5 meters) in length. The whale is believed to live about 27 years. Its diet consists mainly of squid and deepwater fishes (Wynne et al., 1999).

G.2.5.2 Goose-Beaked Whale

The goose-beaked whale (*Ziphius cavirostris*), also known as Cuvier's beaked whale, is typically found in waters that are greater than 1,000 meters (3,280 feet) in depth. The goose-beaked whale is a pelagic species that is associated with the continental shelf and deep oceanic waters, but it is also closely associated with the Gulf Stream waters. Little is known about the species, but it is believed to travel in pods of 2 to 25 animals, typically avoiding vessels. Sexual maturity is believed to occur at 7 to 11 years, with breeding in the spring and birth of a single calf occurring every 2 to 3 years after a 12-month gestation. The goose-beaked whale is believed to lactate for 12 months and live more than 35 years. Its diet consists mainly of deepwater fish and squid (Wynne et al., 1999).

G.2.5.3 Pygmy Sperm Whale

The pygmy sperm whale (*Kogia breviceps*) is a pelagic, deep-water species that inhabits the areas near the continental shelf edge, slope, and deep oceanic waters. It is found throughout the Gulf of Mexico in these waters. The pygmy sperm whale is not as social as other species, and it is typically found alone or in small groups. The male reaches sexual maturity at 2.7 to 3.0 meters (8.9 to 9.8 feet) in length; the female reaches sexual maturity at 2.6 to 2.8 meters (8.5 to 9.1 feet) in length. A single calf is born after an 11-month gestation period, and lactation lasts about 12 months. The pygmy sperm whale has a diet of mainly squid, fish, and crustaceans (Wynne et al., 1999).

G.2.5.4 Dwarf Sperm Whale

The dwarf sperm whale (*Kogia simus*) is a pelagic, deep-water species that inhabits areas near the continental shelf edge, slope, and deep oceanic waters. It is found throughout the Gulf of Mexico in these waters. The dwarf sperm whale is not as social as other species, and it is typically found alone or in small groups. It reaches sexual maturity at 2.1 to 2.2 meters (6.9 to 7.2 feet) in length. A single calf is born

after a 9.5 month gestation period, and lactation lasts about 12 months. The diet of the dwarf sperm whale consists mainly of squid, fish, and crustaceans (Wynne et al., 1999).

G.2.5.5 Sperm Whale

The sperm whale (*Physeter macrophalus*) is pelagic, deep-water species that inhabits the areas near the continental slope. It is found throughout the Gulf of Mexico along the continental slope, and along the Atlantic seaboard associated with Gulf Stream features. Female and young sperm whales form breeding schools of 10 to 80 animals, while sexually inactive males form bachelor schools; older males are typically solitary. The female reaches sexual maturity at 7 to 11 years; the male reaches maturity at 19 years. A single calf is born every 3 to 6 years after a 14-month gestation period, and lactation lasts between 12 to 24 months. The diet of the sperm whale consists mainly of squid, but it also eats fish (Wynne et al, 1999).

G.2.5.6 Atlantic Spotted Dolphin

The Atlantic spotted dolphin (*Stenella frontalis*) is a tropical species found in a variety of areas throughout the Gulf of Mexico. It ranges from coastal to pelagic environments, typically over the continental shelf and slope, and it is usually associated with the Gulf Stream. The Atlantic spotted dolphin reaches sexual maturity at 8 to 15 years, breeding in fall and spring. One calf is born to a female every 1 to 2 years after a 12-month gestation period; lactation typically lasts 3 to 5 years. The dolphin may live 25 to 30 years. The Atlantic spotted dolphin is a gregarious species, and it can be found in groups (fewer than 20) of other dolphins and small whales along the coast and in larger groups (fewer than 100) offshore. The diet of the Atlantic spotted dolphin consists of squid and a variety of fish (Wynne et al., 1999).

G.2.5.7 Rough-Toothed Dolphin

The rough-toothed dolphin (*Steno bredanensis*) is a tropical, pelagic species found seaward of the continental slope. Little is known about the species, but it is thought to be sexually mature at 10 to 14 years, and it may live as long as 32 years. The rough-toothed dolphin is believed to travel in pods of 10 to more than 100, and it associates with other species such as the spinner dolphin, bottlenose dolphin, and pilot whale. Sometimes the rough-toothed dolphin is associated with large mats of Sargassum. The diet of the rough-toothed dolphin diet consists of deepwater octopus, squid, and fish (Wynne et al., 1999).

G.2.5.8 Killer Whale

The killer whale (*Orcinus orca*) can be found in both coastal and ocean waters ranging from tropical to polar. The killer whale is a highly social animal that travels in pods of 3 to 55 animals, and it often cooperates in hunting and feeding efforts. The species is sexually mature at 10 to 15 years, mating year round. The female gives birth to a single calf every 3 to 8 years after a 17-month gestation period; lactation typically lasts about 12 months. Individuals may live more than 50 years. The killer whale has a diverse diet that includes fish, birds, squid, turtle, and other marine mammals (Wynne et al., 1999).

G.2.5.9 False Killer Whale

The false killer whale (*Pseudorca crassidens*) is pelagic species found in the deeper waters of the Gulf of Mexico, seaward of the continental shelf. The false killer whale is a social species that can be found in groups from 10 to more than 100 with the same species or with other dolphin species. It is sexually mature at 8 to 14 years, and the female has a single calf every 3 to 4 years after a 16-month gestation

period. This species has been known to be aggressive toward other smaller dolphins. The diet of the false killer whale consists mainly of squid and fish (Wynne et al., 1999).

G.2.5.10 Short-Finned Pilot Whale

The short-finned pilot whale (*Globicephala macrorhynchus*) can be found in a variety of water depths, and it is typically associated with squid, its main prey. The short-fin is a tropical species that is usually associated with the Gulf Stream, and it can be found in pelagic or coastal environments, possibly moving inshore during the summer months. The short-finned pilot whale is a social species that can be found in groups of 10 to more than 100, and it is often associated with the bottlenose dolphin. The species is believed to be sexually mature at 6 to 12 years, breeding every 3 years. The female gives birth to a single calf after a 15- to 16-month gestation period. Lactation lasts about 20 months, and an individual whale may live between 50 to 70 years. The diet of the short-finned pilot whale consists primarily of squid, but it also has been known to prey on fish (Wynne et al., 999).

G.2.5.11 Pygmy Killer Whale

The pygmy killer whale (*Feresa attenuata*) is a pelagic species found in the deeper waters of the Gulf of Mexico seaward of the continental shelf. Little is known about the life of this whale, but its diet is believed to consist mostly of fish, and it has been observed preying on squid. The pygmy killer whale is a gregarious species that typically associates in groups of 10 to 50 individuals. The pygmy killer whale has shown aggressive tendencies, but typically it is wary of boats (Wynne et al., 1999).

G.2.5.12 West Indian Manatee

The West Indian manatee (*Trichechus manatus)* is a slow-moving aquatic mammal with gray to brown skin, a small head, flexible flippers, and a large tail. Its large rounded body weighs on average 441 to 1,102 pounds (200 to 500 kilograms), and it is approximately 9.8 to 13.1 feet (3 to 4 meters) long (Nowak 1991). Its diet is primarily submergent, emergent, and floating vegetation, although it varies according to plant availability. The West Indian manatee may live several decades (O'Shea and Ludlow 1992).

The West Indian Manatee is present in the coastal areas from the southeastern United States to northeastern South America. In the southeastern United States, the manatee occurs primarily in Florida and southeastern Georgia; however, individual manatees may also range as far north as Rhode Island on the Atlantic coast (Reid 1996) and as far west as Texas on the Gulf Coast. Some believe the manatee in Texas may be a wanderer from the Mexican population. An individual manatee captured in Texas was linked to the Florida population through deoxyribonucleic acid (DNA) testing (Ettel undated). The West Indian manatee is federally listed as endangered in Florida, Georgia, Puerto Rico, and Texas.

The West Indian manatee's habitat comprises shallow coastal waters, estuaries, bays, rivers, and lakes, although it seems to prefer rivers and estuaries to marine habitats (Lefebvre et al. 1989). In addition, the West Indian manatee sometimes travels through dredged canals or quiet marinas. In the north during October to April, the manatee congregates in warmer waters because it cannot tolerate prolonged exposure to water colder than 68 degrees Fahrenheit (20 degrees Celsius). The West Indian manatee prefers water depths of at least 3.3 to 6.6 feet (1 to 2 meters); however, along the coast the manatee is often in water 9.8 to 16.4 feet (3 to 5 meters) deep. It also prefers not to be in water with strong currents, and it is consistently associated with freshwater (Lefebvre et al. 1989). Because the young are born in the water, sheltered bays, coves, and canals are important for the West Indian manatee's reproductive success (O'Shea and Ludlow 1992).

While the female manatee is sexually mature at a minimum age of 4 to 5 years, it does not breed successfully until the age of 7 to 9 years. The male manatee breeds at 9 to 10 years, although it may mature physically a few years earlier. The species mates promiscuously. A single calf is born in spring or early summer after a gestational period of approximately 12 to 14 months, and typically an interval of 3 to 5 years passes before a female gives birth to another calf (possibly 2 years if a calf is lost early). The calf is weaned by the age of 1 to 2 years (O'Shea and Ludlow 1992).

G.2.5.13 Bottlenose Dolphin

The bottlenose dolphin (*Tursiops truncatus*) typically is found in coastal or offshore waters. In the coastal environment, the bottlenose dolphin can be found in warm, sallow inshore waters of bays and rivers. When offshore, it usually is in deep waters over the continental shelf and slope. The female bottlenose dolphin reaches sexual maturity at 5 to 10 years; the male reaches maturity at 8 to 12years. The species breeds during fall and spring, and produces one calf every 3 to 6 years after a 12-month gestation period. Lactation typically lasts 12 to 18 months, and the dolphin may live more than 50 years. The bottlenose dolphin is a social species, and along the coast it can be found in small groups (less than 10) and larger groups offshore (10 to more than 100). This species can usually be found in mixed groups with pilot whales and right whales. The bottlenose dolphin's diet consists of fish, invertebrates, and squid (Wynne et al., 1999).

G.2.6 Plants

Louisiana quillwort is an endangered, semi-aquatic, seedless plant related to ferns. It has a shallowly rooted, two-lobed stem and numerous grassy leaves of approximately 0.6 to 1.6 inches (1.5 to 4 centimeters) long. It produces reproductive spores in the spring and fall (NatureServe 2005).

This species is found in shallow blackwater streams in riparian woodland and headwater pine forest. The plants are found on stable sand and gravel bars, moist overflow channels with silty sand substrates, and low, sloping banks near and below water level (NatureServe 2005).

According to the USFWS recovery plan prepared in 1996, reproducing populations of Louisiana quillwort are known to exist only in Washington and St. Tammany Parishes in southeastern Louisiana and Perry and Jackson Counties in Mississippi (Larke 1996). The Mississippi population is found in the following locations:

- **Jackson County**—De Soto National Forest, Red Creek Wildlife Management Area; approximately 50 plants in overflow channels near the head of a branch of Bayou Billie.

- **Perry County**—De Soto National Forest, Camp Shelby National Guard Training Site, Pascagoula River watershed; approximately 2,500 plants in five colonies near the headwaters of Pearces Creek; 1,500 plants along a small tributary to Joes Creek; and 20 plants near an intermittent stream draining into Whiskey Creek (Larke 1996).

A more recent information source (NatureServe 2005) describes distribution of this species as consisting of 9 localized populations in St. Tammany and Washington Parishes in Louisiana and more than 50 populations in 10 counties in Mississippi. According to comments submitted by the USFWS (James 2005), this species is present in Forrest, George, and Greene Counties in Mississippi. Specific locations were not identified.

G.2.7 Reptiles

G.2.7.1 Alabama Red-Belly Turtle

The Alabama red-belly turtle (*Pseudemys alabamensis*) has an orange or reddish plastron and a brown to olive carapace with yellow, orange, or reddish streaks and mottling. The skin is olive to black with yellow or light orange stripes, and the adult is usually 8 to 12 inches (20 to 30.5 centimeters) long (NatureServe 2005; Dobie 1985). Aquatic plants are the primary food source of red-belly turtle (Mount 1975).

Although this species is primarily (though not historically) restricted to the northern Mobile Bay and associated tributary streams in Alabama, it was recently recorded in Mississippi as well (NatureServe 2005). James (2005) identified locations in Jackson County, MS, as the lower Pascagoula River and its tributaries, Bluff Creek, and the Escatawpa River. Currently, the red-belly turtle is most abundant in river channels and the quiet backwaters of the upper Mobile Bay, particularly in areas with dense submerged vegetation and water no more than 6.6 feet (2 meters) deep (McCoy and Vogt 1985). The female red-belly lays clutches of between three and nine eggs each from May to July (Behler and King 1979; Dobie and Bagley 1988). Preferred nesting sites include sand banks, natural levees, and along rivers (Dobie and Bagley 1988; Nelson 2003).

G.2.7.2 Black Pine Snake

The black pine snake (*Pituophis melanoleucus lodingi*) inhabits upland longleaf pine forests that once covered the southeastern United States. It prefers areas with sandy, well-drained soils with an overstory of longleaf pine, a fire-suppressed midstory, and a dense herbaceous ground cover (Duran 1998b). The snake is rarely found in riparian areas, hardwood forests, or closed canopy conditions (Duran 1998a). A petition to list the black pine snake was published on May 11, 2004.

The current population of the black pine snake occurs in fragmented areas in Mississippi and Alabama. The species is probably extinct in Louisiana (NatureServe 2005). The reason for its decline is the deforestation of many of the pine forests throughout the southeastern United States—the forests now cover only 5 percent of their original land area (Frost 1993), and they have been converted into urban developments, agriculture, and pine plantations. The largest populations of the black pine snake are now found on private land and in the De Soto National Forest in Mississippi (NatureServe 2005).

G.2.7.3 Eastern Indigo Snake

The eastern indigo snake is a threatened species currently known to occur throughout Florida and the coastal plain of Georgia (USFWS 1991). Although the USFWS Threatened and Endangered Species System (TESS) does not include Mississippi in this species' current range (USFWS 2005), other sources suggest that it may occur in six Mississippi counties where SPR activities are proposed. A list prepared by the U.S. Fish and Wildlife Service (2000) identifies the eastern indigo as present in Marion County and potentially present or historically recorded in Forrest, Greene, George, Jackson, and Perry Counties.

The eastern indigo snake is a large, shiny bluish-black snake with some red or cream coloring on the chin and sides of the head (USFWS 1991). With a maximum length of about 8 feet (2.4 meters), it is the longest North American snake (NatureServe 2005).

The principal habitat of the eastern indigo snake includes high, dry, well-drained sandy soils, closely paralleling the sandhill habitat preferred by the gopher tortoise. The eastern indigo snake uses gopher

tortoise burrows and other subterranean cavities as dens and for egg laying. In warmer months, these snakes may be found near streams and swamps (USFWS 1991).

G.2.7.4 Gopher Tortoise

The gopher tortoise (*Gopherus polyphemus*) is the only tortoise indigenous to the southeastern United States. It is relatively large. The carapace length is often 5.9 to 11 inches (15 to 28 centimeters), but it can measure up to 15 inches (38 centimeters). It has a smooth, dark-brown to grayish-black shell. The gopher tortoise is primarily an herbivore, but it sometimes eats insects, carrion, and fruit (NatureServe 2005).

The preferred habitat of the gopher tortoise is characterized by well-drained, sandy soils suitable for burrowing; abundant herbaceous ground cover; and generally open canopy and sparse shrub cover that allow sunlight to reach the forest floor (Landers 1980). The gopher tortoise digs burrows that average approximately 14.8 feet (4.5 meters) long and about 6.6 feet (2 meters) deep (Diemer 1989). Burrows, which are used for shelter and nesting, generally can be identified by a mound of excavated subsoil at the mouth of the burrow. Nesting occurs from late April to mid-July (mainly mid-May to mid-June) (Iverson 1980). The adult female lays only one clutch per year, but she does not necessarily nest every year. Hatching occurs in August and September, and the offspring demonstrate temperature-dependent sex determination (Burke et al. 1996).

The gopher tortoise is found only in the southeastern United States, and its population has declined rapidly over the past century. It is estimated that the population is now only 80 percent of what it was 100 years ago, and the species is listed as threatened west of the Mobile and Tombigbee Rivers in Alabama, Mississippi, and Louisiana (Auffenberg and Franz 1982; NatureServe 2005). The most important cause of the decline is habitat loss and degradation caused by urban development and agricultural conversion, although mining has also affected the gopher tortoise population in some areas (NatureServe 2005). Road kill, a byproduct of urban development, is also a minor problem.

G.2.7.5 Kemp's Ridley Sea Turtle

The Kemp's Ridley sea turtle (*Lepidochelys kempii*) is a small endangered sea turtle found in shallow coastal and estuarine waters, including those of the Gulf of Mexico. The adult is olive green above and yellow below, and the young are gray above and yellow below. The shell is nearly round and the limbs are flattened flippers. The shell length is usually between 22.8 and 27.6 inches (58 and 70 centimeters) for adults and 1.5 and 1.7 inches (3.8 to 4.4 centimeters) for hatchlings (Conant and Collins 1991).

In coastal waters, the Kemp's Ridley sea turtle is usually found over sand or mud bottoms where it feeds on crabs. Nests are built on elevated dunes, especially on beaches backed up by large swamps or bodies of open water having seasonal, narrow ocean connections (NatureServe 2005).

During the nesting season from April to July, the female lays one to four clutches of about 100 eggs at intervals of 10 to 28 days. Eggs hatch in an average of 50 to 55 days (CSTC 1990).

G.2.7.6 Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*) is a reddish-brown sea turtle found in a variety of habitats including open seas to more than 500 miles (805 kilometers) from shore, bays, estuaries, lagoons, creeks, and mouths of rivers, mainly in warm temperate and subtropical regions (NatureServe 2005). The adult has a carapace length typically between 27.6 and 49.2 inches (70 and 125 centimeters), and hatchlings have a shell length of 1.6 to 2 inches (4 to 5 centimeters) (Dodd 1988, 1992; Conant and Collins 1991).

The female loggerhead sea turtle nests on open sandy beaches above the high-tide mark, seaward of well-developed dunes. High-energy and steeply sloped beaches with gradually sloped offshore approaches are favored (CSTC 1990). Between 50,000 to 70,000 clutches are deposited each year in southeastern states (Meylan et al. 1995). Despite some natural fluctuation in the size of the loggerhead population, numbers appear to be declining in some areas largely because of habitat destruction and incidental take by shrimp trawlers. The nesting population in the southeastern United States is believed to be declining (CSTC 1990, Taylor 1992).

Every 2 to 3 years, a mature female lays between 1 and 9 clutches of around 120 eggs at intervals of 2 weeks. Nesting occurs mainly at night, often at high tide, from April to early September. The eggs hatch in 8 to 9 weeks in the southeastern states, with the sex of the hatchlings is determined by incubation temperatures, with the ratio strongly biased toward females in Atlantic coastal waters. Hatchlings emerge from the nest a few days after hatching, typically during darkness (Wibbels et al. 1991, Mrosovsky and Provancha 1992).

G.2.7.7 Ringed Map Turtle

The ringed map turtle or ringed sawback turtle (*Graptemys oculifera*) is small. Typically, the male is 4 inches (10 centimeters) and the female is 7.1 inches (18 centimeters) in plastron length. It has a yellow ring bordered with dark olive-brown on its upper shell. Its undershell is yellow, and it has a yellow dot behind its eye, yellow stripes from its orbit backwards, and another yellow strip on its lower jaw (Cagle 1953). In 1986, this turtle was federally listed as threatened (USFWS 1992).

The preferred riverine habitat of the ringed map turtle includes many logs, a moderate current, and large, high riparian sand and gravel bars for laying eggs in nests (USFWS 1992). Because the ringed map turtle spends most of its day basking in the sun, it requires a channel wide enough for the sun to reach the logs from during the day (McCoy and Vogt 1980, Dickerson and Reine 1996). In addition, the ringed map turtle must have high water quality to support its main food sources, which include insects, mollusks, and crustaceans (NatureServe 2005). This species is not found in tributaries or tidal areas.

The ringed map turtle is present in the Pearl River system in Mississippi, specifically in the main streams of the Pearl River and the Bogue Chitto River. The turtle's range is from near the upstream mouth of the Pearl River to Neshoba County, MS, and from the upstream confluence of the Bogue Chitto River and the Pearl River to near Franklinton, LA (Jones 1991).

In total, the population size of the ringed map turtle is likely greater than 10,000 (Dickerson and Reine 1996). In the Pearl River, a mark-and-recapture study estimated the population at 137 to 549 turtles per mile (85 to 341 per kilometer) (Jones and Hartfield 1995). Another study estimated (40 turtles per mile (25 turtles per kilometer) in the Pearl River (Lindeman 1999). Dickerson and Reine (1996) estimated the population in two upper Pearl River sections at greater than 119 basking turtles per mile (74 basking turtles per kilometer). In 1999, the population of ringed map turtles in the Bogue Chitto River was estimated at between 5,411 and 16,348 (NatureServe 2005). The population per distance in the Pearl River is highest above Ross Barnett Reservoir and below the confluence with the Strong River in Simpson County (Matthews and Moseley 1990). The highest population is in the Bogue Chitto River, downstream from Franklinton (NatureServe 2005).

The ringed map turtle lays a clutch in June and then most likely another clutch later. The clutch averages about 3 to 4 eggs (Kofron 1991) (4 to 8 eggs according to Matthews and Moseley (1990)). The male is typically mature at 3.5 years, while the female is mature at 10 to 16 years (Jones and Hartfield 1995).

G.2.7.8 Yellow-Blotched Map Turtle

The yellow-blotched map turtle (*Graptemys flavimaculata*) is named for yellow or orange blotches in the center of each olive to light greenish-brown shell plate. Some individuals have yellow bars, circles, or semicircles in place of blotches. Plates along the edge of the shell have orange bars or semicircles. The juvenile and adult male have prominent spine-like projections flanked by irregular orange blotches on the first four central shell plates. These spines are much smaller on the female. The sexes also differ significantly in size, with shells ranging from about 3.5 to 4.7 inches (9 to 12 centimeters) in the male and from about inches 3.9 to 8.3 inches (10 to 21 centimeters) for the female (Jones 1993).

The yellow-blotched map turtle inhabits rivers and large creeks with moderate currents, abundant basking sites, and sandbars. 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 flood pools (Jones 1996). It is not usually found in smaller streams shaded by bank vegetation for much of the day. 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 nesting season is from mid to late May through early to mid August (NatureServe 2005).

The yellow-blotched map turtle is found only in rivers of southeastern Mississippi, including the following sites:

- Leaf River from the U.S. Highway 84 bridge in Covington County (Cliburn 1971) downstream to the confluence of the Leaf and the Chickasawhay Rivers;
- Chickasawhay River upstream to Enterprise in Clarke County (McCoy and Vogt 1987);
- Pascagoula River from its point of origin in George County, south to where the river forks into the East and West Pascagoula channels near Vancleave, Jackson County;
- West Pascagoula River to just south of the I-10 bridge (Dobie 1991); and
- East Pascagoula River from the downstream to approximately 1 mile (1.6 kilometers) north of the I-10 Bridge (Jones 1993).

Small populations also have been reported in the lower Escatawpa River in Jackson County (Jones 1993); Tallahala Creek in Perry County; and Red Creek in Jackson County (Cliburn 1971).

Habitat alteration resulting from channel modification and water quality degradation from siltation and pollution are the primary causes for the decline of this species. Channel modification removes materials used for basking and water quality degradation impairs feeding resources. This species is also threatened by commercial collection for retail sale (USFWS 1992).

G.3 FIELD OBSERVATIONS

This section presents observations made by ICF Consulting staff during field visits to the Bruinsburg and Richton sites.

G.3.1 Bruinsburg, MS

Four biologists from ICF Consulting conducted a pedestrian survey of the Bruinsburg candidate site on November 21, 2005. Proposed pipeline ROW surveys were continued on November 22, 2005. Surveys of the proposed ROWs were conducted by following the routes by car and making vegetative and land use observations along the route at predetermined way points.

G.3.1.1 Bruinsburg Candidate Site

The Bruinsburg site is 10 miles west of Port Gibson, MS, off of Rodney Road. The site is situated within the Northern Holocene Meander Belt and the Bluff Hills Ecoregions of Mississippi (Chapman et al. 2004). Approximately two-thirds of the proposed Bruinsburg site is located in a relatively flat landscape, which is currently occupied by cultivated cotton fields, cypress swamp, and deciduous forest. Two intermittent streams converge to form Mammy Judy Bayou, which is the only permanent stream within the proposed boundaries. Areas adjacent to the Bayou are permanently flooded, while the remaining areas show signs of intermittent or semipermanent flooding. The remaining third of the proposed site, where the administrative buildings, pumps, and brine pond would be located, is an upland forested area outside of the floodplain of the Mississippi River.

The study area has the following principal habitat types:

- Cypress swamp;
- Cultivated row-crop (cotton fields);
- Palustrine forested wetlands; and
- Mixed hardwood forest.

Each of the principal habitat types in the study area are described below, and table G.3.1.1-1 lists plant species observed on site.

Cypress Swamp: Inundated portions of the site are characterized by a cypress swamp ecosystem with duckweed floating in the 3 to 4 feet (0.9 and 1.2 meters) of standing water. Spanish moss was prevalent on the branches of the bald cypress trees. Dryer areas surrounding the cypress swamps contained freshwater emergent wetland vegetation dominated by sedges and grasses. The natural hydrology of the site has been altered by a levee extending across the center of the site separating Mammy Judy Bayou from the cotton fields to the north. Beaver dams have further altered the hydrography by creating temporary ponds along the intermittent streams crossing the center portion of the site.

Cultivated Row-Crop: Large portions of the site were actively maintained as cultivated cotton fields. The center of the fields held a large shed surrounded by farm equipment. At the time of the site visit, cotton had already been harvested. Remnants of the harvested crop remained on the field to retain soil during the winter months.

Palustrine Forested Wetlands: Portions of the forest that were not inundated during the site visit displayed signs of periodic inundation through vegetative composition, water marks on trees, and tree buttressing. These forested wetland areas were characterized by white oak, box elder, and tupelo trees. The intermittent or semipermanent forested wetland areas on the site were dominated by a white oak and hickory canopy. Other trees common throughout the forest included sweet gum, basswood, water oak, tupelo, and box elder. The understory included holly, bamboo, and arrowood, while groundcover consisted of various grasses and sedges, horsetail, clearweed, and smartweed.

Table G.3.1.1-1: Plant Species Observed at the Bruinsburg Candidate Site

Common Name	Scientific Name	Vegetative Layer
Cypress Swamp		
Bald Cypress	*Taxodium distichum*	Canopy
Spanish Moss	*Tillandsia usneoides*	Epiphyte
Duckweed	*Lemna minor*	Floating aquatic plant
Palustrine Forested Wetland		
White Oak	*Quercus alba L.*	Canopy
Hickory	*Carya spp.*	Canopy
Post Oak	*Quercus stellata*	Canopy
Cherry	*Prunus sp.*	Canopy
Tupelo	*Nyssa aquatica*	Canopy
Honey Locust	*Gleditsia triacanthos*	Canopy
Sycamore	*Platanus occidentalis*	Canopy
Box Elder	*Acer negundo*	Canopy
Sweetgum	*Liquidambar styraciflua*	Canopy
Southern Arrowood	*Viburnum dentatum*	Understory
Holly	*Ilex spp.*	Understory
Horsetail	*Equisetum arvense L.*	Groundcover
Smartweed	*Polygonum coccineum*	Groundcover
Clearweed	*Pilea pumila*	Groundcover
Lizard Tail	*Saururus cernuus*	Groundcover
Water Locust	*Gleditsia aquatica*	Canopy
Eastern Cottonwood	*Populus deltoides*	Canopy
Pecan	*Carya illinoinensis*	Canopy
Black Willow	*Salix nigra*	Canopy

Mixed Hardwood Forest: The proposed administrative buildings would be located on the west side of the site. This area is characterized by steep rolling hills and ravines covered with mixed hardwood/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 composed of herbaceous cover, shrubs, and seedlings.

G.3.1.2 Bruinsburg Raw Water Intake Structure

The area along the proposed raw water pipeline ROW was similar to that of the area surrounding the proposed site. The RWI structure would be located on the Mississippi River to the south west of the candidate site. The RWI would be located on or adjacent to the protective levee system that runs along the Mississippi River. The area is mostly forested along the levee, with similar species composition to that of the storage facility. Nearby some forested areas have been cleared and planted with corn or soybean to attract deer during hunting season. The beachfront along the east side of the Mississippi River is approximately 20 feet (6.1 meters) below the top of the levee system. The beachfront is a narrow strip of sand extending approximately 20 feet (6.1 meters) from the bottom of the levee to the river.

G.3.2 Richton, MS

Four biologists from ICF Consulting conducted a pedestrian survey of the project area on October 17 and 18, 2005. The biologists walked over the proposed site and RWI structure. The proposed pipeline ROWs were observed at road intersections at a distance from vehicles. Except for the proposed ROW to Pascagoula terminal, which would follow an existing pipeline ROW, the proposed routes of the ROWs had not been defined precisely.

None of the species addressed by the biological assessment (see section G.2) were observed directly during the mid-October site inspection.

G.3.2.1 Richton Candidate Site

The proposed Richton storage site would be about 350 acres (140 hectares), which includes a 300-foot (91-meter) buffer cleared for security purposes and an access road. The site is an actively managed pine plantation. The slash pine plantation, which is estimated to be between 10 to 20 years old, covers approximately 312.4 acres (133.2 hectares), or 88 percent, of the site. The overgrown fields, which include portions of former timber stands and cropland, occupy 22.6 acres (9.15 hectares), or 7 percent. Forested, open-water, and emergent wetlands flank a manmade pond located on the western site boundary. These wetlands are limited to the perimeter of the pond. Another forested and emergent wetland area is associated with a small depression and Pine Branch, which is an intermittent creek that originates in the center of the site and flows south to cross beneath Highway 42. The stream channel and the depression in the southwestern portion of the site are palustrine forested wetland areas, while the pond contains submergent and emergent wetlands, with a small area of forested wetlands.

The study area includes the following principal habitat types:

- Ponds (open water);
- Evergreen forest (slash-pine plantation);
- Palustrine emergent and forested wetlands; and
- Old fields (former pine plantation and row crops).

Each of the principal habitat types in the study area are described below, and table G.3.2.1-1 lists plant species observed on site.

Table G.3.2.1-1: Plant Species Observed at the Richton Candidate Site

Common name	Scientific Name	Vegetative Layer
Evergreen Forest - 176.5 acres (71.4 hectares) (72 percent of the site)		
Slash Pine	*Pinus elliottii*	Canopy
Blackberry	*Rubus argutus*	Understory/Ground cover
Poison Ivy	*Toxicodendron radicans*	Understory/Ground cover
Trumpet Creeper	*Campsis radicans*	Understory/Ground cover
Old Field - 47.5 acres (19.2 hectares) (19 percent of the site)		
Chinese Tallow Tree	*Triadica sebifera*	Understory/Ground cover
Horseweed	*Conyza canadensis*	Understory/Ground cover
Thistle	*Carduus*	Understory/Ground cover
Goldenrod	*Solidago spp.*	Understory/Ground cover

Table G.3.2.1-1: Plant Species Observed at the Richton Candidate Site

Common name	Scientific Name	Vegetative Layer
Deciduous Forest and Palustrine Wetlands - 21.8 acres (8.8 hectares) (9 percent of the site)		
Red Maple	*Acer rubrum*	Canopy
Chinese Tallow Tree	*Sapium sebiferum*	Understory/Ground cover
Sweet Gum	*Liquidambar styraciflua*	Canopy
Tupelo	*Nyssa aquatica*	Canopy
Smartweed	*Polygonum roccineum*	Understory/Ground cover
Greenbriar	*Smilax spp.*	Understory/Ground cover
Palustrine Wetlands		
Sedge	*Carex spp.*	Ground cover
Pitcher Plant	*Sarracenia spp.*	Ground cover
Soft Rush	*Juncus effuses*	Ground cover
Smartweed	*Polygonum coccineum*	Ground cover
Bulrush	*Scirpus spp.*	Ground cover
Spike Rush	*Eleocharis quadrangulata*	Ground cover

Ponds: The manmade pond, located on the western portion of the site, is fed by a stream that originates offsite. The pond appears to be large enough to support common aquatic species.

Evergreen Forest: The evergreen forest is an even-aged, managed timber stand canopy dominated almost entirely of slash pine. Limited understory is present in the slash pine plantation because of the dense mat of pine needles and timbering activities. At locations where the mobile timber-harvesting base was sent up, the debris (branches and wood chips) may cover up to an acre along the roadside within the slash pine plantation. Numerous timber access roads crisscross the site, and they are littered with branches, bark, and wood chips from the timber-harvesting activities.

Palustrine Emergent and Forested Wetlands: The wetlands on the site are associated with a manmade pond, an intermittent stream channel, and a topographical depression. The forested wetland community associated with Pine Branch is primarily made up with red maple in the canopy and a variety of sedge, rush, bulrush, and pitcher plants within and adjacent to the stream channel. At the time of the survey, the stream channel did not contain any standing water; however, standing water was present in Pine Branch on the south side of Highway 42.

Old Field: The old fields occupied the southeast portion of the site, and they included old timber stands and fallow fields. The old fields adjacent to the chicken farm appeared to be old croplands because no evidence of former timber stands was observed and historical information indicates that the area was formerly cropland (DOE 1992). The old fields north of the chicken farm were old slash pine timber stands, deduced because of the evenly spaced stumps located throughout the area.

G.3.2.2 Raw Water Intake Structure

The Richton RWI structure is proposed on the Leaf River. The opposing bank had a large beach area void of vegetation, suggesting seasonal changes in depth and width. The bank of the proposed raw water intake structure had a vertical drop of approximately 30 feet (9.1 meters) to the water surface. The site was a mature deciduous mixed hardwood and pine forest typical of the area. Effects of Hurricane Katrina were dramatic—the mature forest had only 20 percent of its canopy remaining intact. Many of the trees still standing are likely to die within a year or so because of canopy damage.

G.4 HABITAT ASSESSMENT AND POTENTIAL EFFECTS

This section evaluates whether the proposed SPR development activities would take place in areas where threatened, endangered, and candidate species are known to exist or where they may exist based on the natural history information presented in section G.2. For any element of the SPR proposal located in known or potential threatened, endangered, or candidate species habitat, the nature and potential for effects on the species are described. The assessment considers potential mitigation measures that DOE would implement for each element of the proposed action.

In sections G.4.1 and G.4.2, separate assessments are provided for the Bruinsburg and Richton sites, respectively. Section G.4.3 provides an overall summary of impacts for both sites.

G.4.1 Bruinsburg, MS

The assessment for the Bruinsburg site evaluates the potential effects on threatened, endangered, and candidate species by each element of the proposed action listed in table G.4.1-1.

Table G.4.1-1: Elements of the Proposed Action and Location on Bruinsburg Candidate Site

Element of Proposed Action	Location by County or Parish
Bruinsburg site	*Mississippi*: Claiborne
Pipeline and power line ROW from Bruinsburg to Peetsville	*Mississippi*: Claiborne, Copiah, Lincoln
Pipeline ROW from Bruinsburg to Anchorage	*Mississippi*: Adams, Claiborne, Jefferson, Wilkinson *Louisiana*: East Baton Rouge, East Feliciana, West Baton Rouge, West Feliciana
Pipeline ROW from Bruinsburg to Jackson terminal	*Mississippi:* Copiah, Warren, Hinds
Pipeline and power line ROW from Bruinsburg to Entergy power plant	*Mississippi:* Warren, Hinds
Raw water intake and associated pipeline and power line ROWs	*Mississippi*: Claiborne
Brine disposal pipeline ROW	*Mississippi*: Claiborne
Marine terminal in Anchorage	*Louisiana*: West Feliciana

Evaluation findings for these components of the Bruinsburg site are presented for each species below.

G.4.1.1 Birds

G.4.1.1.1 Bald Eagle

Of the locations listed in table G.4.1-1 USFWS (2000), and the Mississippi and Louisiana Natural Heritage programs report the bald eagle only in Jackson, Warren, and Wilkinson County in Mississippi (MMNS 2002) and East Baton Rouge and West Feliciana Parishes in Louisiana (LNHP 2004). This includes the proposed crude oil pipeline to Anchorage. Data provided by MNHP identify the closest recorded occurrence of the bald eagle to be 9 miles (14 kilometers) from the proposed crude oil pipeline to Anchorage. Information submitted by USFWS (James 2005) identifies the bald eagle as potentially present Statewide in Mississippi, and this species is conservatively assumed to be potentially present throughout Louisiana as well. Natural history data indicate that any bald eagle in the region likely is a nonbreeding seasonal migrant (NatureServe 2005). A non-nesting transitory bald eagle would be

expected to avoid human activity and move to undisturbed areas. DOE would consult with USFWS and state wildlife agencies if bald eagle nests were identified during preconstruction surveys.

G.4.1.1.2 Interior Least Tern

Interior least terns breed locally throughout the Mississippi River system. Nesting occurs on and near the river with eggs often resting directly on sandbars (Aycock 2005). Of the elements of the proposed action listed in table G.4.1-1, only the RWI structure with connecting RWI pipeline and power line, and the crude oil pipeline tie-in to the Entergy facility in Vicksburg would be built near the Mississippi River.

Data provided by MNHP (2006) show no known nesting areas within 2 miles (3 kilometers) of the raw water intake structure. Because this area is potential suitable habitat, DOE would complete a preconstruction survey to verify there are no signs of active nesting. If nesting activity is verified, construction of the RWI structure would be timed to avoid the period when the terns would be nesting. Operation and maintenance of the raw water intake involve little human activity and would not affect interior least terns in the area.

MNHP identified one nesting area approximately 3 miles (5 kilometers) downstream from the Entergy facility at Vicksburg. The area immediately surrounding the Entergy facility is not suitable habitat for the interior least tern because it is an urbanized area with frequent human disturbance. The construction, operation, and maintenance of the proposed tie-in to the Entergy facility would not affect the least interior tern.

G.4.1.1.3 Red-Cockaded Woodpecker

According to the recovery plan for the red-cockaded woodpecker (USFWS 2003b), the Homochitto National Forest in southwestern Mississippi contains a secondary core population of this species. Two elements of the proposed activity would pass thorough or near the Homochitto National Forest. The pipeline ROW from Bruinsburg to the Peetsville station would pass through the National Forest in Copiah and Lincoln Counties parallel to existing ROWs, and the pipeline ROW from Bruinsburg to Anchorage would pass near the National Forest in Adams and Wilkinson Counties parallel to an existing ROW. In these four counties, the red-cockaded woodpecker has been reported only in Lincoln and Wilkinson (MMNS 2002). MNHP (2006) confirms two occurrences of the red-cockaded woodpecker within 2 miles (3 kilometers) of the crude oil pipeline to Peetsville, and one within 2 miles (3 kilometers) of the crude oil pipeline to Anchorage. All of these populations are located in Homochitto National Forest.

In consultations with USFWS, MNHP, and U.S. Forest Service (USFS), DOE reviewed proposed pipeline alignments to discuss potential impacts to the red-cockaded woodpecker population. These consultations did not reveal specific concerns of impacts to known red-cockaded woodpecker population. The proposed pipelines follow existing ROWs, and they would affect disturbed habitat. The USFS (Howell 2006) confirmed that the proposed pipeline to Peetsville would not cross potential red-cockaded woodpecker habitat. The Red-cockaded woodpecker has specific habitat requirements of pine stands over 60 years of age for nesting and 30 years of age for foraging. If mature pine stands of 30 years or more are identified in preconstruction ROW alignment surveys, DOE would have a biologist survey the area for red-cockaded woodpecker nesting cavities and foraging activity. Nesting cavity trees would be marked and, if feasible, the ROW alignment adjusted to avoid impacts to stands more than 30 years old within 0.5 miles (0.8 kilometers) of the nesting cavity (Aycock 2005). DOE would engage in further consultation with USFWS and MNHP to avoid impacts to the red-cockaded woodpecker along the proposed ROW.

G.4.1.2 Fish

G.4.1.2.1 Bayou Darter

Of the counties listed in table G.4.1-1 where elements of the Bruinsburg site and its associated infrastructure would be located, the bayou darter is present only in Claiborne, Copiah, and Hinds Counties in Mississippi. Elements of the proposed action in these counties are the Bruinsburg site, the pipeline ROW from Bruinsburg to the Jackson terminal, the pipeline ROW from Bruinsburg to Peetsville, the pipeline ROW from Bruinsburg to Anchorage, the brine disposal system, and the raw water intake system.

The range of the bayou darter is limited to Bayou Pierre and three of its tributaries including White Oak Creek, Turkey Creek, and Foster Creek. The pipelines to the Jackson terminal and the Entergy docks would be directionally drilled under Bayou Pierre. None of these water bodies would be crossed through open water construction or otherwise affected by any element of the proposed action; therefore, the proposed action would not affect this species.

G.4.1.2.2 Gulf Sturgeon

Critical habitat for the Gulf sturgeon has been designated in two counties where infrastructure associated with the proposed Bruinsburg site would be located: Copiah and Hinds Counties. The pipeline ROW from Bruinsburg to Peetsville would pass through the southwest corner of Copiah County. Designated critical habitat for the Gulf sturgeon in Copiah County is located in the Pearl River, which forms the eastern boundary of Copiah County. Because the ROW from Bruinsburg to Peetsville would not cross the Pearl River, it would not affect the Gulf sturgeon or its designated critical habitat.

The endpoint of the pipeline ROW from Bruinsburg to the Jackson terminal would be a connection to the Capline pipeline in Hinds County. Hinds County, like Copiah County discussed above, is bordered to the east by the Pearl River. Because the ROW from Bruinsburg to the Jackson terminal would end in Hinds County and would not cross the Pearl River, this element of the proposed action would not affect the Gulf sturgeon or its designated critical habitat.

The Gulf sturgeon is found in coastal waters from Florida to Louisiana (USFWS 2003a), potentially including waters that have not been designated as critical habitat. Among all counties and parishes where infrastructure associated with the Bruinsburg site would be located (see table G.4.1-1), the Gulf sturgeon reportedly occurs in two Louisiana parishes, East Feliciana and East Baton Rouge, where no designated critical habitat exists (LNHP 2004). Available information sources do not identify specific Gulf sturgeon habitat areas in these parishes.

The pipeline ROW from Bruinsburg to Anchorage would cross two surface water bodies in Louisiana: Thompson Creek, which forms the border of East and West Feliciana Parishes; and the Mississippi River, which lies on the border of East and West Baton Rouge Parishes. Both of the surface water bodies are assumed to provide suitable habitat for the Gulf sturgeon. Impacts to the sturgeon and its habitat would be avoided by the use of directionally drilling.

G.4.1.2.3 Pallid Sturgeon

The pallid sturgeon inhabits larger channels of the Mississippi-Missouri River system. Five counties in Mississippi (Claiborne, Jefferson, Adams, Warren, and Wilkinson) and four parishes in Louisiana (East Baton Rouge, East Feliciana, West Baton Rouge, and West Feliciana) border the Mississippi River within the known range of the pallid sturgeon. Elements of the proposed action located on or adjacent to the

Mississippi River in these counties and parishes include the Bruinsburg RWI, the pipeline ROW from Bruinsburg to the Entergy power plant, the pipeline ROW from Bruinsburg to Anchorage, and the Anchorage marine terminal.

Construction Impacts

Construction of the RWI on the Mississippi would have no effect on the pallid sturgeon. 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. 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, postconstruction restoration, and other measures.

Portions of the pipeline and power line ROWs from Bruinsburg to Anchorage and to the Entergy power plant would pass near the Mississippi River. Construction of these two ROWs would not affect the pallid sturgeon. Construction-related soil runoff would not affect the Mississippi River habitat of the Gulf sturgeon because the pipeline ROWs would not pass sufficiently close to the river for construction activities to have an effect.

The pipeline crossing of the Mississippi River would be constructed using directional drilling. With this method, the pipeline would be placed beneath the river without excavation or any other instream activity; therefore, construction of the pipeline would not affect the pallid sturgeon.

Construction of the Anchorage terminal would have no effect on pallid sturgeon. Construction would be located more than 300 feet (100 meters) from the river and standard erosion and runoff control best management practices would be used during construction to mitigate these impacts. In addition, the Mississippi River at Baton Rouge is highly turbid and any increase in turbidity resulting from construction activities would not significantly affect water quality or the quality of the pallid sturgeon's habitat in the river.

Operation and Maintenance Impacts

Operation of the RWI would have the potential to entrain and impinge young sturgeon and their prey. If this alternative were selected, DOE would work with USFWS to design the raw water intake with appropriate mesh size, intake velocity, and other technologies to minimize or avoid adverse impacts. Because the planned 1.2 million barrels per day (MMBD) raw water withdrawal would be a small fraction of the total flow, there would be no significant changes in the sturgeon habitat due to operation of the RWI.

Operation and maintenance of the portion of the crude oil pipeline ROW beneath the Mississippi River would have no impact. Because directional drilling would be used to construct the pipeline below the riverbed, no instream maintenance activities would be required.

Operation and maintenance of the Anchorage terminal would cause potential instream noise and disturbance impacts (e.g., related to tanker loading and navigation) and present a risk of oil spills. The increase in tanker navigation to the existing docks at Anchorage resulting from SPR operations would be very small and infrequent; therefore, the operation and maintenance of the marine terminal would have no effect on the pallid sturgeon.

G.4.1.3 Invertebrates

G.4.1.3.1 Alabama Heelsplitter Mussel

The Alabama heelsplitter is found in the Amite River in Louisiana, including a portion of the river in East Baton Rouge Parish. Although the pipeline ROW from Bruinsburg to Anchorage would pass through East Baton Rouge Parish, it would not cross or pass near the Amite River; therefore, none of the proposed actions would affect the Alabama heelsplitter.

G.4.1.3.2 Fat Pocketbook Mussel

A population of the fat pocketbook mussel was recently discovered in the Mississippi River and associated tributaries in Jefferson County, MS (Aycock 2005; NatureServe 2005). As shown in table G.4.1-1, the proposed activity in Jefferson County associated with development of the Bruinsburg site is construction of the pipeline ROW from Bruinsburg to Anchorage. The pipeline ROW would not intersect the Mississippi River in Jefferson County, but it would cross two small tributaries, Coles Creek and Fairchilds Creek. Based on the information provided by MNHP (2006), this species is not present in the Mississippi River at the RWI location in Copiah County, which is roughly 15 miles (24.1 kilometers) upstream from the mouth of Coles Creek.

Construction Impacts

Fat pocketbooks in the Mississippi River adjacent to Jefferson County would not be affected by construction of the pipeline ROW from Bruinsburg to Anchorage because the pipeline would not cross the river in this area. The species might be affected in Coles Creek or Fairchilds Creek at the pipeline crossings; MNHP (2006) identified these water bodies as an area of concern. Because these tributaries are small, conventional construction methods (e.g., open-ditch excavation) would be used to bury the pipeline below the streambeds. During construction of the stream crossings at Coles and Fairchilds Creeks, excavation might directly affect fat pocketbooks, if 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 might drive away red drum or other fish hosts of its larval stage.

A small bridge would be built for the brine access road to Coles Creek. Construction of the bridge may have a temporary affect on the mussels because some instream disturbance would occur even with the best management practices to control siltation. The streambed would be restored after construction, and the bridge would be constructed of grates to allow sunlight to reach the stream surface. Operation and maintenance of the road would occur infrequently and would not affect the mussels.

DOE would have a qualified biologist survey the area of the two proposed crossings. If the mussels are identified in the area of the crossings, they would be relocated to suitable habitat upstream of the crossing or construction would be avoided during the reproductive season, or both. Relocation of freshwater mussels has been documented as a successful strategy to avoid impacts during instream construction disturbances (Reutter et al. 2001). Erosion barriers, silt curtains, and other best management practices would be used to limit downstream siltation. After construction, the streambeds would be restored to their original condition.

Operation and Maintenance Impacts

Operation and maintenance of the pipeline ROW from Bruinsburg to Anchorage would have no effect on the fat pocketbook. These activities would include periodic inspection and debris removal. These activities would be infrequent and cause minimal disturbance to the mussel and its habitat.

G.4.1.4 Mammals

G.4.1.4.1 Louisiana Black Bear

The range of the Louisiana black bear once included all of Louisiana and lower Mississippi where the Bruinsburg site and its associated infrastructure would be located. Today, the only known breeding populations are in Louisiana in the Tensas and Atchafalaya River basins (Bowker and Jacobson 1995). These areas have been designated as critical habitat. Other areas with suspected occurrences of Louisiana black bears include the Loess Bluffs portion of the Mississippi River corridor in southwestern Mississippi and the adjacent Tunica Hills of Louisiana, as well as smaller areas in the lower East Pearl River and lower Pascagoula River basins of southern Mississippi (Wooding et al. 1993).

The Bruinsburg site and its associated infrastructure are not located in the designated critical habitat of the Louisiana black bear; however, the pipeline ROW from Bruinsburg to Anchorage passes through southwest Mississippi and adjacent areas of Louisiana where a population of the bears is suspected. In addition, suitable habitat for the Louisiana black bear is present in every county in Mississippi, as well as East and West Feliciana Parishes in Louisiana, where infrastructure for the proposed Bruinsburg site would be located. The Louisiana black bear is not likely to occur in the populated areas of East and West Baton Rouge Parishes in Louisiana.

Construction Impacts

Development, operation, and maintenance of the Bruinsburg site and its associated infrastructure would have no effect on the Louisiana black bear. If any Louisiana black bears are present in areas of suitable habitat in the planned pipeline ROWs (e.g., in southwest Mississippi and adjacent areas of Louisiana), they could be expected to avoid construction and other temporary human activities.

Construction of the pipeline ROWs would contribute to habitat fragmentation, which has been cited as a concern for this species (James 2005). Pipelines would be buried and the ROW would not impose a barrier to the movement of this species, so it is expected there would be no effect on the species.

Operation and Maintenance Impacts

Operation and maintenance of the ROWs would include periodic inspection and clearing of excessive vegetation. These activities would be minimal and would not affect the Louisiana black bear, if present. The Louisiana black bear would be expected to avoid the Bruinsburg site and RWI; thus, operation and maintenance activities at these locations would not affect this species.

G.4.1.4.2 West Indian Manatee

Although the West Indian manatee along the Gulf of Mexico coast in the United States occurs primarily in Florida, individuals range as far west as Texas. Of the locations listed in table G.4.1-1, the West Indian manatee has been reported only in East Baton Rouge Parish in Louisiana. The pipeline ROW from Bruinsburg to Anchorage is the only element of the proposed action in table G.4.1-1 that would be located

in East Baton Rouge Parish. The Anchorage terminal would be located in West Baton Rouge Parish directly across the Mississippi River from East Baton Rouge Parish.

The pipeline ROW crossing of the Mississippi River from East Baton Rouge Parish to the Anchorage terminal is in a segment of the Mississippi River with significant navigational traffic and industrial activity. This segment of the river does not possess characteristics of the manatee's preferred habitat, which consists of shallow sheltered bays and coves without strong currents and with abundant aquatic vegetation. Further, the proposed crude oil pipeline would be directionally drilled under the river and would have no affect on the species.

Construction, operation, and maintenance activities associated with the Anchorage terminal would take place more than 300 feet (100 meters) from the river, and standard erosion and runoff control best management practices would be used during construction to mitigate these impacts. In addition, the Mississippi River at Baton Rouge is highly turbid and any increase in turbidity resulting from construction activities would not significantly affect water quality. Operation and maintenance of the marine terminal would cause potential instream noise and disturbance impacts (e.g., related to tanker loading and navigation) and would present a risk of oil spills. The increase in tanker navigation to the existing docks at Anchorage resulting from SPR operations would be very small; therefore, the routine operation and maintenance at the docks would have no effect on the manatee.

G.4.1.5 Marine Mammals

No offshore elements are associated with the proposed Bruisburg site; no marine mammals would be affected other than the West Indian manatee discussed above.

G.4.1.6 Reptiles

The ringed map turtle is present in the Pearl River in Mississippi, including the portion of the Pearl River that forms the eastern boundary of Copiah and Hinds Counties (Jones 1991). Two elements of the proposed action listed in table G.4.1-1 would be located in Copiah and Hinds Counties. The pipeline ROW from Bruinsburg to Peetsville would pass through the southwest corner of Copiah County, and the pipeline ROW from Bruinsburg to the Jackson terminal would end in central Hinds County. Neither of these elements of the proposed action would cross the Pearl River; therefore, the proposed action would not affect the ringed map turtle or its habitat in the Pearl River.

G.4.2 Richton, MS

The assessment for the proposed Richton candidate site evaluates the potential effects on threatened, endangered, and candidate species by each element of the proposed action listed in table G.4.2-1.

Table G.4.2-1: Elements of the Proposed Action and Location on the Richton Candidate Site

Element of Proposed Action	Location by County or Offshore Area
Richton site and associated access road	Perry
Pipeline ROW from Richton to Pascagoula	Perry, Greene, George, Jackson
Pipeline ROW from Richton to Liberty Station	Perry, Forrest, Lamar, Marion, Walthall, Pike, Amite
Raw water intake and associated access road, pipeline, and power lines	Perry
Power lines and associated ROW from utility lines south of Leaf River to RWI	Perry

Table G.4.2-1: Elements of the Proposed Action and Location on the Richton Candidate Site

Element of Proposed Action	Location by County or Offshore Area
Marine terminal in Pascagoula (docks and storage tanks)	Jackson
Storage tanks at Liberty Station	Amite
Offshore brine pipeline and diffuser	Gulf of Mexico

Assessment findings for these components of the proposed Richton site are presented for each species below.

G.4.2.1 Birds

G.4.2.1.1 Bald Eagle

Information submitted by USFWS (James 2005) identifies the bald eagle as potentially present statewide in Mississippi. Based on the online database provided by Mississippi Natural Heritage Program (MNHP) (MMNS 2002), the bald eagle has been confirmed in two counties, George and Jackson, where development of the pipeline ROW from Richton to Pascacoula and the Pascagoula terminal is proposed. Further analysis conducted by MNHP reports no known bald eagles within 2 miles (3 kilometers) of the proposed pipeline or terminal (MNHP 2006). The closest documented bald eagle nests are 5 to 6 miles (8 to 10 kilometers) away. Approximately 20 percent of the proposed pipeline ROW is composed of palustrine forested wetlands which are suitable habitat for nesting and foraging bald eagles. The proposed Pascagoula terminal would be built on emergent wetlands, which are rarely used by the bald eagle for nesting. Because the bald eagle may be present Statewide, potential impacts on this species have been evaluated for all elements of the proposed action in table G.4.2-1. Natural history data indicate that bald eagles occurring in Mississippi are likely to be nonbreeding seasonal migrants (NatureServe 2005).

Construction Impacts

Construction activities would not affect bald eagles because none are known to nest within 2 miles (3 kilometers) of the site or any of proposed ROWs or other infrastructure, and range data indicate that most bald eagles in Mississippi are likely nonbreeding. Because no nesting activity is anticipated, it is assumed that the construction activities would have no effect on the species.

Operation and Maintenance Impacts

Operation and maintenance activities would have no effect on the species. The proposed elements located near documented bald eagles are the proposed pipeline to Pascagoula and the Pascagoula terminal. The proposed pipeline to Pascagoula would be collocated along an existing ROW. Operation and maintenance activities would be the same as current activities along this ROW. The Pascaoula terminal would be located on disturbed land adjacent to a naval station. Operation and maintenance activities would be less than current human activity levels at the naval station. Bald eagles that would move to areas near these proposed elements would be tolerant of human activity and noise.

G.4.2.1.2 Brown Pelican

Of the locations listed in table G.4.2-1, the brown pelican has been recorded only in Jackson County, MS. (MMNS 2002). The proposed pipeline ROW from Richton to Pascagoula, the Pascagoula terminal, and the offshore brine pipeline in and adjacent to Jackson County includes habitat types potentially suitable

for the brown pelican. Records indicate one known occurrence of the brown pelican approximately 1,700 feet (500 meters) from the proposed pipeline to Pascagoula. The area of that section of the pipeline is in open water.

Construction Impacts

In Jackson County, MS, suitable habitat for brown pelicans is confined to the Gulf shore and associated barrier islands, sandbars, and wetlands. The terminus of the crude oil pipeline, along with the existing Plantation Pipeline, at Pascagoula, MS, is located in an industrially developed area of the Gulf Coast. Pipeline construction activities in this area would not affect undisturbed habitat and would have no effect on the brown pelican.

The offshore segments of the crude oil pipeline to Pascagoula and the brine disposal pipeline pass within 1,700 feet (500 meters) of one known brown pelican area and may pass through other areas inhabited by the brown pelican. No activity is permitted within 2,300 feet (700 meters) of nesting brown pelicans (USFWS 2005). If the Richton site is chosen for development, a biologist would accompany the alignment survey crew to identify brown pelican roosts along the proposed brine disposal pipeline ROW. If any brown pelican roosting sites are identified during the alignment survey, the construction would be scheduled to avoid roosting times (March through July). Assuming that construction activities can be avoided in or near rookeries, there would be no effect on brown pelicans.

Operation and Maintenance Impacts

Operation and maintenance of the crude oil distribution pipeline would be comparable to existing activities associated with the Plantation pipeline. The pipeline would be buried and human activity would be minimal; therefore, there would be no effect on the brown pelican.

The offshore segments of the crude oil pipeline to Pascagoula and the brine disposal pipeline would be buried, and minimal maintenance activity would be necessary; therefore, operation and maintenance of the pipeline would have no effect on the brown pelican.

G.4.2.1.3 Mississippi Sandhill Crane

The only wild population of the Mississippi sandhill crane is located at the Mississippi sandhill crane National Wildlife Refuge in western Jackson County, MS. The only elements of the proposed action in Jackson County are the pipeline ROW from the Richton to Pascagoula, the brine pipeline ROW to the Gulf of Mexico, and the Marine Terminal at Pascagoula. All of these elements would be located more than 5 miles to the east of the refuge. At this distance, no effect on the Mississippi sandhill crane or its habitat are expected to result from construction, operation, or maintenance of the crude oil distribution pipeline, brine disposal pipeline, or marine terminal.

G.4.2.1.4 Piping Plover

As shown in table G.4.2-1, the marine terminal at Pascagoula and the oil distribution and brine disposal pipeline ROWs would be the only elements of the proposed action in Jackson County, MS, where the piping plover is known to occur. Designated critical habitat is located on barrier islands and shores around the Gulf of Mexico. None of the proposed elements cross designated critical habitat of the piping plover. The brine disposal pipeline passes near designated critical habitat on Horn Island National Wildlife Reserve. The proposed alignment would be located 1,600 feet (480 meters) from the island. The proposed pipelines in Jackson County, MS, cross beaches, mudflats, or sandflats that may also be potential feeding habitat for the piping plover.

Construction Impacts

Construction of the proposed brine disposal pipeline would be away from designated critical habitat on Horn Island National Wildlife Refuge. The construction of this section of the pipeline would not impact the designated critical habitat or the piping plover because it is located in open water 1,600 feet (480 meters) away from the designation boundary. In other potential piping plover habitat areas, construction impacts would be avoided by use of directional drilling under beaches, mudflats, or sandflats. Using this construction method, construction would not affect the piping plover and its habitat. Because the pipeline would be buried, there would be no long-term construction effects.

Operation and Maintenance Impacts

Operation of the pipeline would not affect the species, its behavior, or the quality of its habitat. The pipeline would be a static structure buried under ground, and it would not produce noise or other effects that would disturb the plover. Maintenance activities would be minor, and they would not affect this species.

G.4.2.1.5 Red-Cockaded Woodpecker

National Forest lands in Mississippi are home to four primary and secondary core populations of the red-cockaded woodpecker. These and other core populations throughout the southeastern United States are monitored to assess recovery of the species. None of the core populations in Mississippi is located in areas that would be affected by development of the Richton site and associated infrastructure. Table G.4.2.1.5-1 shows that in all counties where elements of the proposed action for the Richton site would be located, all activities would occur outside of designated core population areas.

Elements of the proposed action, including the pipeline ROWs from Richton to Pascagoula and Richton to Liberty Station, would pass through areas with potential suitable habitat of low- to medium-density pine forests. Analysis provided by MNHP found no occurrences of the red-cockaded woodpecker within 2 miles (3 kilometers) of any proposed element (MNHP 2006). The proposed ROW to Pascagoula follows an existing pipeline ROW where mature stands suitable for the red-cockaded woodpecker are not likely to be found. The crude oil pipeline to Liberty largely does not follow an existing ROW. If mature pine stands of 60 years or more are identified in preconstruction ROW alignment surveys, DOE would use a biologist to survey the area for red-cockaded woodpecker nesting cavities and foraging activity. Nesting cavity trees would be marked and the ROW alignment would be adjusted to avoid impacts to stands more than 30 years old within 0.5 miles (0.8 kilometers) of the nesting cavity (Aycock 2005).

Table G.4.2.1.5-1: Proximity of Red-Cockaded Woodpecker Designated Core Populations to Elements of Proposed Action for the Richton Site

County	Elements of the Proposed Action for the Richton Site	Location of Designated Core Population	SPR Elements Located in Designated Core Population Areas
Amite	• Pipeline ROW from Richton to Liberty Station • Storage tanks at Liberty Station	Homochitto National Forest	None
Forrest	• Pipeline ROW from Richton to Liberty Station	De Soto National Forest	None
George	• Pipeline ROW from Richton to Pascagoula	De Soto National Forest	None

Table G.4.2.1.5-1: Proximity of Red-Cockaded Woodpecker Designated Core Populations to Elements of Proposed Action for the Richton Site

County	Elements of the Proposed Action for the Richton Site	Location of Designated Core Population	SPR Elements Located in Designated Core Population Areas
Greene	• Pipeline ROW from Richton to Pascagoula	De Soto National Forest	None
Jackson	• Pipeline ROW from Richton to Pascagoula • Marine terminal in Pascagoula • Brine disposal pipeline ROW to Gulf of Mexico	De Soto National Forest	None
Perry	• Richton candidate site • Pipeline and power line ROWs and raw water intake • Pipeline ROW from Richton to Pascagoula • Pipeline ROW from Richton to Liberty Station	De Soto National Forest	None

G.4.2.2 Fish

G.4.2.2.1 Gulf Sturgeon

Three proposed elements of the Richton site and its associated infrastructure may directly affect federally designated critical habitat of the Gulf sturgeon: (1) the raw water intake on the Leaf River in Perry County, (2) the pipeline ROW from Richton to Pascagoula in Greene County, and (3) the pipeline ROW from Richton to Liberty Station in Forrest and Marion Counties. The potentially impacted designated critical habitat areas are located in the Leaf, Chickasawhay, Pearl, Pascagoula, and Bogue Chitto Rivers. Spawning generally occurs in these water bodies where the streambed is hard clay, rubble, gravel, or shell (USFWS 2003a). After spawning, the adult Gulf sturgeon migrates downstream to specific areas in the lower Pascagoula River system and remains until November (Heise et al 2004). This anadromous species may be found in the designated critical habitat year-round because the young spend their first 2 years in the river where they were spawned (USFWS 2003a).

Construction Impacts

The raw water intake structure would be located on the Leaf River in Perry County and the power lines for the RWI structure and site would cross the Leaf River. Construction of the RWI would affect the designated critical habitat at this location and the area immediately downstream. For example, excavation would disturb the Leaf River streambed, remove vegetation, and temporarily raise turbidity and reduce dissolved oxygen levels. These potential effects would be mitigated with the use of onshore erosion barriers, instream silt curtains, 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 sturgeon.

Construction activities in the pipeline ROW from Richton to Pascagoula would have no effect on designated critical habitat of the Gulf sturgeon. The ROW would cross designated critical habitat in one location, the Chickasawhay River in Greene County. This crossing would be constructed using

directional drilling to avoid disturbing sensitive habitat. Because no direct impact on the river would take place, construction of the pipeline ROW from Richton to Pascagoula would have no effect on the Gulf sturgeon.

The pipeline ROW from Richton to Liberty Station would intersect designated critical habitat for the Gulf sturgeon in the Leaf River in Forrest County, the Pearl River in Marion County, and the Bogue Chitto River in Pike County. All of these crossings would be constructed with directional drilling, which would prevent any effect on designated critical habitat at these locations. Smaller upriver tributaries, such as Tallahala Creek, would be crossed using conventional methods. Sedimentation and turbidity would be minimized through best management practices, and they would be a temporary disturbance. DOE would avoid instream construction methods of pipeline ROWs near Gulf sturgeon designated critical habitat during spawning.

Operation and Maintenance Impacts

Operation and maintenance of the RWI may have a serious adverse affect on the Gulf sturgeon, especially during low flow periods. During periods of low flow, the RWI may divert up to 11 percent of the total flow of the Leaf River. 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 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 per second and that 30 percent of that flow was 1,131 cubic feet 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 would alter the designated critical habitat by reducing water depth and width, increasing pollutant concentrations, and altering water temperatures. These changes may expose breeding areas, limit adult migration movements, or increase mortality of larval and juvenile sturgeon, or all of these. Intake of water during low flow periods would affect water volumes 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 salt water (Heise et al 2004).

The raw water withdrawal may cause impingement of young Gulf sturgeon. The intake of the RWI would be designed for a maximum intake velocity of 0.5 feet (0.15 meters) per second. Moving vertical screens deposit impinged fish or materials into a chute that releases them downstream of the intake. Impingement of young Gulf sturgeon would cause bodily harm that may result in mortality.

Maintenance of the pipeline ROWs constructed with directional drilling would not affect the Gulf sturgeon or its designated critical habitat because no instream activities would take place. Maintenance of ROWs constructed in upstream tributaries by conventional methods also would not affect the Gulf sturgeon or its designated critical habitat because instream activities are minor and infrequent.

G.4.2.2.2 Pearl Darter

The pearl darter is believed to exist only in the Pascagoula River drainage system, which includes the Leaf River, Black Creek, and the Pascagoula River (NatureServe 2005). A 2005 study on the distribution of the pearl darter confirmed its presence throughout the Leaf River (Slack et al 2005). Elements of the

proposed action in this drainage system include the raw water system, the pipeline ROW from Richton to Pascagoula, and the pipeline ROW from Richton to Liberty Station.

Construction Impacts

The pearl darter has been documented throughout the Leaf River to the lower Pascagoula drainage, but little is known about its specific habitat requirements or spawning behavior (Slack et al. 2005). Construction of the RWI may temporarily increase water turbidity and temperature downstream. 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 2001a). These temporary impacts would be mitigated with erosion and sedimentation best management practices, as well as habitat restoration, but the construction of the RWI may affect the pearl darter.

The pipeline ROW from Richton to Liberty Station would cross the Leaf River in Forrest County in the general area where pearl darters are known to spawn. No construction effects would occur at this location because directional drilling would be used to place the pipeline beneath the riverbed without instream activity. The pipeline ROW from Richton to Liberty station would also cross Black Creek in Lamar County and Tallahala Creek in Perry County. These crossings would be constructed with either directional drilling or the conventional open-ditch excavation method. If directional drilling is used, the pipeline ROW would not affect pearl darters, because no activity would be required in the creek. Conventional construction methods might affect the pearl darter in the short-term. Excavation would temporarily remove vegetation and other beneficial characteristics of the streambed and streambanks. Water quality also might be impacted locally during construction. These impacts would be mitigated with erosion barriers and silt curtains that reduce downstream sediment transport. The affected streambed and streambanks would be restored to the extent practicable following construction; therefore, in the long term, the construction would have no effect on pearl darter habitat in Black Creek or Tallahala.

Where the pipeline ROW from Richton to Pascagoula would cross surface waters of the Pascagoula River drainage system (i.e., at the Chickasawhay River), directional drilling would be used to avoid impacts in the river. Because no excavation would take place in the river, no effects are expected.

Operation and Maintenance Impacts

Operation of the RWI may affect 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 per second (116 cubic meters per second). During periods of low flow, however, the withdrawal may constitute up to 11 percent of the river's flow. Changes in flow would alter water depth, channel width, water temperatures, and pollutant concentrations downstream. These types of alterations are identified as a major threat to pearl darter population (USFWS 2001a).

The water intake would also cause entrainment and impingement of pearl darters as well as their feeding resources. The RWI would have a maximum intake velocity 0.5 feet (0.15 meters) per second with traveling 0.5 inch (40mm) mesh screen. Standard length of the adult pearl darter ranged from 1 inch (30 mm) to 2 inches (50 mm) in sampling of the Leaf River in 2004 (Slack et al. 2005). An adult darter would be able to swim through the mesh screens. Due to its small size, the pearl darter might suffer impingement on the screens, which would cause bodily harm likely to lead to death.

Maintenance of the pipeline crossings constructed with directional drilling would not involve instream activities and no effects would be expected. Where the crossings are constructed using conventional methods, the crossings would be periodically inspected and maintained. For example, it may be

necessary to remove debris from the river channel in the ROW. These maintenance activities would be minimal and infrequent, and they would have no effect on the pearl darter.

G.4.2.3 Invertebrates

The only endangered, threatened, or candidate invertebrate species in counties where the proposed Richton site and its associated infrastructure would be located is the Camp Shelby burrowing crayfish. The only known population of this species is in Perry County, MS. As discussed in section G.2.3.2, no SPR development is proposed in this area of Perry County. The proposed action would not affect this species.

G.4.2.4 Mammals

G.4.2.4.1 Gray Myotis (Gray Bat)

The literature review identified some evidence that the gray bat may occur in Perry County, MS. Elements of the Richton alternative in Perry County include the proposed Richton site, the raw water intake and pipeline, power lines and associated ROWs, and the pipeline ROWs from Richton to Pascagoula and Liberty Station. Most information sources indicate that all proposed SPR construction and operation would occur well outside the species' current range. In addition, the proposed development locations do not include caves, which are the year-round roosting sites for this species. Therefore, construction, operation, and maintenance of the Richton site and associated pipelines and other structures would have no effect on the gray bat.

G.4.2.4.2 Louisiana Black Bear

All elements of the proposed action listed in table G.4.2-1 are located within the historical range of the Louisiana black bear. The literature review identified one source (Wooding et al. 1993) that named the lower East Pearl River and lower Pascagoula River basins of southern Mississippi as possible current range for the Louisiana black bear. An additional source (Gillette 2005) referred to recent sightings in Jackson County, MS, within the lower Pascagoula River basin. The crude oil pipeline to Pascagoula is the only proposed action in the lower Pascagoula River basin. Analysis provided by the Mississippi Natural Heritage Program did not identify any known occurrences of Louisiana black bear within 2 miles (3 kilometers) of any proposed element associated with the Richton site. This species is a highly mobile, habitat generalist that avoids humans, and the proposed crude oil pipeline to Pascagoula is co-located on an existing pipeline ROW. Therefore, any Louisiana black bears remaining in southeast Mississippi near the proposed action would be expected to avoid the temporary activities of constructing and maintaining the pipeline ROW, and there would be no effect on this species.

G.4.2.5 Marine Mammals

The operation of the brine disposal system would have no effect on the Gervais beaked whale, goose-beak whale, pygmy sperm whale, dwarf sperm whale, sperm whale, rough-toothed dolphin, killer whale, false killer whale, short-finned pilot whale, pygmy killer whale, West Indian manatee, and the bottlenose dolphin. These species are found in deeper waters than the brine diffuser contours (see Appendix B, Brine Discharge Modeling).

Potential impacts on the Atlantic spotted dolphin are presented below. The Atlantic spotted dolphin is a tropical species that can be found in a variety of areas through the Gulf of Mexico. The species ranges from coastal to pelagic environments, typically over the continental shelf and slope. The Atlantic spotted dolphin is usually associated with the Gulf Stream.

Construction Impacts

The Atlantic spotted dolphin species is usually found in deeper waters than the extent of the brine disposal system, but it is known to venture into shallower waters. The species would likely avoid or leave any areas of construction, and would return after construction had been completed. Due to the limited construction time and the relatively small area of the Gulf of Mexico that would be impacted, there would be no effect on the Atlantic spotted dolphin.

Operation Impacts

The Atlantic spotted dolphin may occur in the location of the brine diffuser; however, it is unlikely that the species would remain in the area for an extended period. Because the dissipation of the brine would occur in a relatively small area of the Gulf of Mexico and the species would not be restricted to such areas, there would be no effect on the Atlantic spotted dolphin.

G.4.2.6 Plants

As discussed in section G.2.6.1, the Louisiana quillwort recovery plan report stated that the only known reproducing populations of Louisiana quillwort in Mississippi are in the De Soto National Forest in Jackson and Perry Counties (Larke 1996). No elements of the proposed action are located in the specific areas of Jackson and Perry Counties identified in the recovery plan; therefore, construction, operation, and maintenance of the Richton site and associated infrastructure would not affect this species. However, results of an uncited species distribution summary presented by NatureServe (2005) indicated that Louisiana quillwort may be more widely distributed in Mississippi than reported by the recovery plan. If populations of Louisiana quillwort are identified (e.g., from interagency consultations or public participation) and verified in the areas affected by proposed activities, appropriate mitigation measures would be identified and implemented to ensure that there are no effects.

G.4.2.7 Reptiles

G.4.2.7.1 Alabama Red-Belly Turtle

Although the Alabama red-belly turtle is found primarily in Alabama, in 2005 it was identified in the lower Pascagoula River and two of its tributaries in Mississippi (James 2005). One of these tributaries, the Escatawpa River, would be crossed by the pipeline ROW from Richton to Pascagoula if the Richton candidate site is chosen for development. MNHP identified two known occurrences of Alabama red-belly turtle populations located within 1 mile (2 kilometers) from the proposed crude oil pipeline to Pascagoula crossing of the Escatawpa River.

Construction Impacts

Directional drilling would be used to construct the crossing of the Escatawpa River. Directional drilling would be set up away from the river and habitat of the Alabama red-belly turtle and, therefore, nearby populations of the Alabama red-belly turtle would not be affected.

Operation and Maintenance Impacts

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Because the Escatawpa River crossing would be constructed with directional drilling, maintenance would not involve instream activities, and no effects on the turtles would be expected.

G.4.2.7.2 Black Pine Snake

Of the counties listed in table G.4.2-1, the black pine snake reportedly occurs in Forrest, George, Marion, and Perry Counties in Mississippi. If the Richton candidate site is chosen for development, elements of the proposed action in these counties include the Richton candidate site, the RWI intake and pipeline ROW, power line ROWs, a portion of the pipeline ROW from Richton to Liberty Station, and a portion of the pipeline ROW from Richton to Pascagoula. The black pine snake has been documented within 2 miles (3 kilometers) of the proposed Richton site in Perry County (Clark 2005; MNHP 2006).

Construction Impacts

Each of these elements of the proposed action identified above would affect forest lands that would be suitable for the species. If the black pine snake is present in these locations, it generally would be expected to avoid human activity during construction; however, disturbance and direct mortality are possible consequences of excavation, earth moving, and other construction activities. Because this species has been confirmed within 2 miles (3 kilometers) of the site, DOE would survey the site for evidence of black pine snakes. Individuals would be relocated to nearby suitable habitat areas under supervision of USFWS. DOE would conduct habitat assessments of the proposed RWI and ROWs to determine if surveys for black pine snakes are necessary. Individuals would be relocated under supervision of USFWS.

Operation and Maintenance Impacts

Following construction, the black pine snake would be expected to favor adjacent habitat areas unaffected by SPR infrastructure and operations. The Richton site and ROWs would not be a barrier to the black pines snake or its prey; the snake could still use these areas for hunting, and it might continue to inhabit pipeline ROWs. Therefore, operation and maintenance of the Richton site and associated infrastructure would have no effect on the species.

G.4.2.7.3 Eastern Indigo Snake

As discussed in G.2.7.3, the eastern indigo snake is unlikely to be found in the proposed project area because records indicate the range in Mississippi is historical. Comments received from USFWS (2005) and MNHP (2006) do not mention the species as being potentially impacted by the proposed Richton project. Further analysis conducted by MNHP (2006) did not find any populations within 2 miles (3 kilometers) of the proposed project elements. It is unlikely that the eastern indigo snake would be found in the areas affected by the proposed Richton site, and so there would be no effect on this species.

G.4.2.7.4 Gopher Tortoise

Of the locations listed in table G.4.2-1, the gopher tortoise has been recorded in eight counties: Forrest, George, Greene, Jackson, Lamar, Marion, Perry, and Walthall. Elements of the proposed action in these counties include the proposed Richton site, the raw water intake and pipeline, power line ROWs, all of the pipeline ROW from Richton to Pascagoula, and a portion of the pipeline ROW from Richton to Liberty Station. Analysis provided by Mississippi Natural Heritage Program confirms 26 recorded occurrences of gopher tortoises within or with ranges intersecting a 2 mile (3 kilometer) buffer of the proposed elements in gopher tortoise range. Half of these records are associated with the ROW to Pascagoula. Habitat suitable for the gopher tortoise may be found at all elements within gopher tortoise range. As discussed in section G. 2.7.4, the gopher tortoise prefers locations with dry sandy soils, abundant ground cover, and a sparse canopy. Although seldom seen above ground, the presence of gopher tortoises is indicated by large conspicuous burrows.

Construction Impacts

Construction activities such as excavation and the operation of large earthmoving equipment have the potential to unearth, smother, or compact gopher tortoise burrows, and therefore, construction would affect this species.

All proposed elements within gopher tortoise range and on moderately well-drained to excessively well-drained sandy soils would be surveyed by a biologist for tortoise burrows. If the tortoise or its burrows are found, DOE would contact the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) and the USFWS to avoid harm to this federally threatened species. 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 crude oil pipeline to Liberty, RWI pipeline and power lines largely do not 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 MDWFP, and according to strict protocols and within seasonal windows specified by these agencies. During construction, special care should be taken to avoid cogon promulgation (MNHP 2006).

Operation and Maintenance Impacts

After development, the Richton site would be poor habitat for the gopher tortoise, and this species generally would not be expected onsite. The moderately to excessively well-drained sandy soils of the maintained pipeline and power line ROWs and cleared security area around the Richton site would provide preferred habitat for the gopher tortoise. These areas may attract more tortoise than its preconstruction condition. DOE would monitor these areas for the presence of gopher tortoise mounds and control the invasion and spread of cogon grass. Only herbicides approved for use around tortoises would be used in gopher tortoise habitat areas to avoid poisoning food resources (MNHP 2006). With proper monitoring and procedures, operation and maintenance activities may improve habitat quality for gopher tortoises.

G.4.2.7.5 Kemp's Ridley Sea Turtle

The Kemp's Ridley sea turtle inhabits estuarine waters of the Gulf coast, potentially including areas of Jackson County, MS. Nesting occurs on coastal beaches and dunes. The only component of the proposed Richton site development with a potential to affect these habitats is the brine disposal pipeline. Based on data provided by MNHP, the closest recorded nesting area is 7 miles (11 kilometers) from the Pascagoula terminal and brine disposal pipeline in the Grand Bay National Estuarine Research Reserve. Construction and operation of the brine disposal pipeline would not affect undocumented nesting areas because the pipeline would be directionally drilled from an inland area to open water to avoid excavations along the shoreline.

Offshore pipeline construction would temporarily disturb potential feeding habitat for the Kemp's Ridley sea turtle; however, the turtle could feed at the nearby Grand Bay National Estuarine Research Reserve during the temporarily disturbance.

G.4.2.7.6 Loggerhead Sea Turtle

The loggerhead sea turtle nests on Gulf Coast beaches, including those of Jackson County, MS, where the proposed Richton brine disposal pipeline would pass. Construction and operation of the brine disposal pipeline would not affect nesting because the pipeline would be directionally drilled from an inland area to open water to avoid excavations along the shoreline.

Construction of the offshore segment of the brine disposal pipeline would not directly affect the loggerhead sea turtle. Construction would potentially impact the loggerhead feeding habitat in near shore areas; however, the disturbance would be short term, and plentiful feeding habitat may be found at the nearby Grand Bay National Estuarine Research Reserve.

G.4.2.7.7 Ringed Map Turtle

The ringed map turtle is found in the Pearl River system of Mississippi and Louisiana. Of the elements of the proposed action listed in table G.4.2-1, only the pipeline ROW from Richton to Liberty station crosses the Pearl River system. Analysis by MNHP did not find any records of the turtle within 2 miles (3 kilometers) of the proposed crossing. Because directional drilling would be used to construct the Pearl River crossings, construction, operation, and maintenance of the pipeline ROW from Richton to Liberty Station would not affect the ringed map turtle.

G.4.2.7.8 Yellow-blotched Map Turtle

The range of the yellow-blotched map turtle includes river segments in five counties listed in table G.4.2-1: Forrest, George, Greene, Jackson, and, Perry Counties. Water bodies potentially affected by SPR activities within these counties include the Leaf, Chickasawhay, and Escatawpa Rivers and Tallahala Creek (see section G.2.7.8). Data provided by MNHP confirmed recent records of populations at all of these water bodies. Elements of the Richton site development in this species' range include the Richton site, the raw water intake and pipeline, power line ROW, all of the pipeline ROW from Richton to Pascagoula, and a portion of the pipeline ROW from Richton to Liberty Station. No yellow-blotched map turtle habitat occurs at the Richton site or in the raw water pipeline ROW.

Construction Impacts

Potential construction impacts on the yellow-blotched map turtle may occur during construction of pipeline crossings across rivers in the species' range and during construction of the raw water intake on the Leaf River. The pipeline ROW from Richton to Pascagoula would cross the Chickasawhay and Lower Escatawpa Rivers in areas known to be inhabited by the yellow-blotched map turtle. In addition, the pipeline ROW from Richton to Liberty Station would cross yellow-blotched map turtle habitat in Tallahala Creek in Perry County and in the Leaf River in Forrest County.

The Richton to Pascagoula pipeline crossings at the Chickasawhay River and the Escatawpa River would be constructed using directional drilling. This method would prevent construction from affecting the yellow-blotched map turtle in these locations because no activity would occur within the rivers.

Where the pipeline ROW from Richton to Liberty Station would cross Tallahala Creek in Perry County, conventional construction methods would be used, which may affect the turtle. Temporary habitat disturbance in the immediate work zone would be unavoidable. Instream excavation would resuspend sediment and temporarily degrade water quality and increase downstream sedimentation. These moderate short-term impacts would be minimized by the use of best management practices. For example, silt

curtains would be placed immediately downstream from the construction site. After construction, instream habitat would be restored, and there would be no long-term effect on the turtle.

Directional drilling would be used where the pipeline ROW from Richton to Liberty Station would cross the Leaf River in Forrest County. Because this construction method does not involve instream activity, no effect on the yellow-blotched map turtle would occur in this location.

Construction of the RWI on the Leaf River may affect the yellow-blotched map turtle. 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 used instream and stream side to minimize water quality and sedimentation impacts. After completion of the raw water intake 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 affect the turtle.

Operation and Maintenance Impacts

Where pipelines are constructed using conventional methods, maintenance activities would include periodic inspection and potential clearing of obstacles. These infrequent and minor activities would have no effect on the yellow-blotched map turtle.

Operation of the raw water intake during cavern development would withdraw about 1.2 MMBD (50.4 million gallons per day) for the 4-year period of solution mining. This 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 is attributed to the decline of the yellow-blotched map turtle through adverse effects to its food resources. In addition, withdrawal of water may affect the species by entraining or impinging small turtles or their invertebrate prey. Impinged turtles would be returned to the water downstream of the intake by traveling screens, which would not harm the turtles. During normal to above average flows, the entrainment or impingement of yellow-blotched map turtle prey food resources would be a small portion of the available resources. During extreme low flow periods, entrainment or impingement of prey may stress the species, but such periods are expected to be temporary.

G.4.3 Assessment Summary

Tables G.4.3-1 and G.4.3-2 identify the threatened, endangered, and candidate species that may be affected by each element of the proposal to develop the Bruinsburg site. The potential for effects for each element was estimated based on information about the presence or absence of the species or suitable habitat in areas that would be affected. The evaluation also considered the potential mitigation factors. Table G.4.3-1 identifies whether construction activities may affect species. Table G.4.3-2 summarizes whether operation and maintenance activities may affect species. Similar potential effect summaries for the Richton site are presented in tables G.4.3-3 and G.4.3-4.

Table G.4.3-5 summarizes the number of species that may be affected by construction and operations and maintenance for both of the proposed sites in Mississippi. This summary shows that the fat pocketbook mussel may be affected by construction activities for the Bruinsburg site and associated infrastructure. This assessment is uncertain because the presence of the fat pocketbook at the potentially affected location has not been confirmed, and it is uncertain whether directional drilling would be used to completely avoid the potential impacts. The summary shows no effects are expected to the least interior tern and red-cockaded woodpecker based on current available data on population locations. DOE would survey for these species if potential habitat areas are identified during preconstruction alignment surveys.

Table G.4.3-1: Summary of Potential Construction-Related Impacts to Threatened, Endangered, and Candidate Species from Development of the Bruinsburg Candidate Site

Species	Site	Bruinsburg to Peetsville ROW	Bruinsburg to Anchorage ROW	Bruinsburg to Jackson Terminal ROW	Bruinsburg to Entergy Power Plant ROW	RWI and ROW	Brine Disposal ROW	Anchorage Marine Terminal
Birds								
Bald Eagle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Interior Least Tern	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Red-Cockaded Woodpecker	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Fish								
Bayou Darter	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Gulf Sturgeon	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Pallid Sturgeon	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Invertebrates								
Alabama Heelsplitter	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Fat Pocketbook	No effect	No effect	May affect	No effect	No effect	No effect	No effect	No effect
Mammals								
Louisiana Black Bear	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
West Indian Manatee	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Reptiles								
Ringed Map Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect

Table G.4.3-2: Summary of Potential Operation and Maintenance Impacts to Threatened, Endangered, and Candidate Species from Development of the Bruinsburg Candidate Site

Species	Site	Bruinsburg to Peetsville ROW	Bruinsburg to Anchorage ROW	Bruinsburg to Jackson Terminal ROW	Bruinsburg to Entergy Power Plant ROW	RWI and ROW	Brine Disposal ROW	Anchorage Terminal
Birds								
Bald Eagle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Interior Least Tern	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Red-Cockaded Woodpecker	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Fish								
Bayou Darter	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Gulf Sturgeon	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Pallid Sturgeon	No effect	No effect	No effect	No effect	No effect	May affect	No effect	No effect
Invertebrates								
Alabama Heelsplitter	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Fat Pocketbook	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Mammals								
Louisiana Black Bear	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
West Indian Manatee	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Reptiles								
Ringed Map Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect

Table G.4.3-3: Summary of Potential Construction-Related Impacts to Threatened, Endangered, and Candidate Species from Development of the Richton Candidate Site

Species	Site	Richton to Pascagoula ROW	Richton to Liberty Terminal ROW	RWI and ROW	Power lines ROW	Liberty Terminal	Pascagoula Terminal	Brine Diffuser and ROW[a]
Birds								
Bald Eagle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Brown Pelican	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Mississippi Sandhill Crane	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Piping Plover	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Red-Cockaded Woodpecker	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Fish								
Gulf Sturgeon	No effect	No effect	No effect	May affect	No effect	No effect	No effect	No effect
Pearl Darter	No effect	No effect	May affect	May affect	No effect	No effect	No effect	No effect
Invertebrates								
Camp Shelby Burrowing Crayfish	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Mammals								
Gray Myotis (Gray Bat)	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Louisiana Black Bear	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Marine Mammals								
Atlantic Spotted Dolphin	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Plants								
Louisiana Quillwort	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Reptiles								
Alabama Red-Belly Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Black Pine Snake	May affect	May affect	May affect	May affect	May affect	No effect	No effect	No effect
Eastern Indigo Snake	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Gopher Tortoise	May affect	May affect	May affect	May affect	May affect	No effect	No effect	No effect

Table G.4.3-3: Summary of Potential Construction-Related Impacts to Threatened, Endangered, and Candidate Species from Development of the Richton Candidate Site

Species	Site	Richton to Pascagoula ROW	Richton to Liberty Terminal ROW	RWI and ROW	Power lines ROW	Liberty Terminal	Pascagoula Terminal	Brine Diffuser and ROW[a]
Kemp's Ridley Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Loggerhead Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Ringed Map Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Yellow-Blotched Map Turtle	No effect	No effect	May affect	May affect	No effect	No effect	No effect	No effect

Table G.4.3-4: Summary of Potential Operation and Maintenance Impacts to Threatened, Endangered, and Candidate Species from Development of the Richton Candidate Site

Species	Site	Richton to Pascagoula ROW	Richton to Liberty Terminal ROW	RWI and ROW	Power Lines ROW	Liberty Terminal	Pascagoula Terminal	Brine Diffuser and ROW
Birds								
Bald Eagle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Brown Pelican	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Mississippi Sandhill Crane	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Piping Plover	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Red-Cockaded Woodpecker	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Fish								
Gulf Sturgeon	No effect	No effect	No effect	May affect	No effect	No effect	No effect	No effect
Pearl Darter	No effect	No effect	No effect	May affect	No effect	No effect	No effect	No effect
Invertebrates								
Camp Shelby Burrowing Crayfish	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Mammals								
Gray Myotis (Gray Bat)	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Louisiana Black Bear	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect

Table G.4.3-4: Summary of Potential Operation and Maintenance Impacts to Threatened, Endangered, and Candidate Species from Development of the Richton Candidate Site

Species	Site	Richton to Pascagoula ROW	Richton to Liberty Terminal ROW	RWI and ROW	Power Lines ROW	Liberty Terminal	Pascagoula Terminal	Brine Diffuser and ROW
Marine Mammals								
Atlantic Spotted Dolphin	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Plants								
Louisiana Quillwort	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Reptiles								
Alabama Red-Belly Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Black Pine Snake	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Eastern Indigo Snake	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Gopher Tortoise	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Kemp's Ridley Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Loggerhead Sea Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Ringed Map Turtle	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect

Table G.4.3-4: Summary of Potential Operation and Maintenance Impacts to Threatened, Endangered, and Candidate Species from Development of the Richton Candidate Site

Species	Site	Richton to Pascagoula ROW	Richton to Liberty Terminal ROW	RWI and ROW	Power Lines ROW	Liberty Terminal	Pascagoula Terminal	Brine Diffuser and ROW
Yellow-Blotched Map Turtle	No effect	No effect	No effect	May affect	No effect	No effect	No effect	No effect

Table G.4.3-5: Summary of the Number of Species Potentially Affected

Potential for Effect	Number of Species			
	Bruinsburg, MS		Richton, MS	
	Construction	Operation and Maintenance	Construction	Operation and Maintenance
No effect	10	10	15	17
May affect	1	1	5	3

Operation and maintenance of the Bruinsburg site may affect the pallid sturgeon during raw water withdrawals, which could entrain or impinge larval or juvenile sturgeon.

The development of the Richton site may affect five species during construction and three species during operation and maintenance. The gopher tortoise and black pine snake may be affected during construction of the site and certain pipeline ROWs. These impacts would be short term and operation and maintenance of the site or ROWs are not expected to affect these species. Maintained pipeline ROWs may improve and expand preferred habitat for the gopher tortoise. The Gulf sturgeon, pearl darter, and yellow-blotched map turtle may be affected by the construction of the RWI structure and certain pipeline water body crossings. The operation of the RWI structure would cause alterations to the Leaf River flow, which may seriously affect these species dependent on the Leaf River.

Overall, selection of the Richton site may affect a greater number of federally listed threatened, endangered, and candidate species than selection of the Bruinsburg site. Consideration of potential threatened and endangered species effects during selection of SPR development alternatives would not be based only on the number of species affected. Additional factors considered would include the likelihood of affecting the species, the availability and feasibility of mitigation measures, the duration of effects, the likelihood of recovery, and other considerations.

G.5 RECOMMENDATIONS

The evaluation summarized in section G.4 considered how some potential effects would be minimized, avoided, or, more accurately, forecasted by the use of preconstruction field investigations, mitigation measures, and other precautionary measures. The recommendations below summarize the types of measures identified in section G.4 that would lessen the potential for effects due to the development of the SPR candidate sites in Mississippi. Additional measures may be identified during detailed planning if either of the candidate sites is selected for development.

G.5.1 Bruinsburg, MS

- Conduct preconstruction habitat assessments of proposed elements to determine if surveys are needed for the bald eagle, interior least tern, and red-cockaded woodpecker.

- Conduct field survey to determine whether the fat pocketbook mussel is present in Coles Creek or Fairchilds Creek at the locations of proposed crossings of the pipeline ROW from Bruinsburg to Anchorage. If present, identify suitable habitat upstream where the mussel could be relocated if directional drilling is not a feasible construction method.

- Notify the USFWS and the appropriate state wildlife officials if any protected species are observed either during preconstruction field surveys or during construction.

- Where a proposed pipeline ROW would intersect a surface water body where one or more endangered, threatened, or candidate species has been confirmed, use directional drilling to construct the pipeline crossing, if possible. The feasibility of directional drilling should be evaluated for the following crossings:

  - The crossings of Coles Creek and Fairchilds Creek by the pipeline ROW from Bruinsburg to Anchorage if the fat pocketbook mussel is found to be present in these creeks.

  - The crossing of Thompson Creek by the pipeline ROW from Bruinsburg to Anchorage if the Gulf sturgeon is confirmed to be present.

- When directional drilling is not used to construct a pipeline crossing of a surface water where an endangered, threatened, or candidate species may be present, use best available methods to minimize water quality impacts and downstream siltation.

- When construction, operation, or maintenance activities would occur in areas identified as habitat for a threatened, endangered, or candidate species, schedule activities, to the extent practicable, to avoid sensitive life-cycle stages (e.g., spawning, nesting) identified in section G.2.

G.5.2 Richton, MS

- Complete formal consultation with the USFWS or NOAA Fisheries, or both, as mandated under Section 7 of the Endangered Species Act for any potential adverse effects to the Gulf sturgeon, pearl darter, and yellow-blotched map turtle from water withdrawal on the Leaf River. DOE would prepare a biological assessment and implement any requirements prepared during formal consultation by the USFWS or NOAA Fisheries, or both. DOE would coordinate these specific mitigation measures during the application process for a Surface Water Diversion Permit Application to the MDEQ, a Section 404 permit from the USACE, and a formal Section 7 Consultation with the USFWS and NMFS. Mitigation measures might include water conservation, water re-use, and use of a supplemental water source during low flow periods.

- Conduct a preconstruction habitat assessment on proposed elements and survey on moderately well-drained to excessively well-drained sandy soils for the gopher tortoise burrows. Relocate wildlife within the burrows before construction under supervision of USFWS. Where possible, adjust pipeline ROW alignments to avoid large clusters of burrows. Control invasion and spread of cogon grass. Use only herbicides safe for use around tortoises in preferred habitat areas.

- Conduct preconstruction habitat assessment and survey for the black pine snake at the proposed Richton storage site. If found, relocate individuals to nearby suitable habitat areas during construction, as recommended by USFWS.

- Conduct habitat assessments along proposed pipeline ROWs to determine if surveys are needed for the black pine snake, red-cockaded woodpecker, piping plover, brown pelican, or Louisiana quillwort.

- Notify USFWS and the appropriate State wildlife officials if any protected species are observed either during preconstruction field surveys or during construction.

- Where a proposed pipeline ROW would intersect a surface water body where one or more endangered, threatened, or candidate species has been confirmed, use directional drilling to construct the pipeline crossing, if possible. The feasibility of directional drilling should be evaluated for the following crossings:

- Black Creek in Lamar County by the pipeline ROW from Richton to Liberty Station; and
- Tallahala Creek in Perry County by the pipeline from Richton to Liberty Station.

- When directional drilling is not used to construct a pipeline crossing of a surface water where an endangered, threatened, or candidate species may be present, use best available methods to minimize water quality impacts and downstream siltation.

- When construction, operation, or maintenance activities would occur in areas identified as habitat for a threatened, endangered, or candidate species, schedule activities, to the extent practicable, to avoid sensitive life-cycle stages (e.g., spawning, nesting) identified in section G.2.

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Appendix H
Evaluation of Federally Listed Species in Texas

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H.1 INTRODUCTION

This evaluation of federally listed species was prepared in conjunction with the draft environmental impact statement (EIS) for expansion of the Strategic Petroleum Reserve (SPR). The draft EIS evaluates the expansion of the SPR by developing additional storage capacity at up to three existing sites (West Hackberry and Bayou Choctaw in Louisiana and Big Hill in Texas) or developing one of five new sites (Chacahoula and Clovelly in Louisiana; Richton and Bruinsburg in Mississippi; and Stratton Ridge in Texas), or a combination of the Clovelly and Bruinsburg sites.

This appendix analyzes potential effects on federally listed endangered and threatened species, and marine mammals protected under the Endangered Species Act (ESA) and Marine Mammal Protection Act (special status species), respectively, from the development of the proposed new and expansion sites in Texas. Potential effects on endangered and threatened species and marine mammals from development of the proposed new and expansion sites in Louisiana and Mississippi are analyzed in appendices F and G, respectively.

The Department of Energy (DOE) prepared this evaluation of federally listed species to review and document its findings of "no effect" and "may affect" in accordance with the definitions found in the Final ESA Section 7 Consultation Handbook dated March 1998 (Consultation Handbook), a letter from U.S. Fish and Wildlife Service (USFWS) dated September 29, 2005, and consultations with the USFWS field offices. The evaluation was based on the definitions of the effects to endangered or threatened species in the Handbook and letter, as provided in the following list:

- **No effect.** The proposed action would not affect federally listed species or critical habitat (i.e., suitable habitat for the species occurring in the project county is not present in or adjacent to the action area).

- **Is not likely to adversely affect.** The project may affect listed species or critical habitat, or both; however, the effects would be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented to reach this level of effects.

- **Is likely to adversely affect.** Adverse effects to listed species 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 it also would be likely to cause some adverse effects to individuals of that species, then the proposed action "is likely to adversely affect" the listed species.

DOE is evaluating the impacts associated with five proposed new sites and three proposed expansion sites, some of which would have more than 100 miles (160 kilometers) of new pipelines, new tank farms, and brine disposal systems (offshore diffuser or injection wells) associated with them. When DOE issues a record of decision, it will select either one new site (or a combination of the Clovelly and Bruinsburg sites) and either two or three expansion sites for future development, or the no-action alternative. For these reasons, DOE has not conducted comprehensive field surveys and can reach only "no effect" or "may affect" conclusions for this evaluation of special status species instead of using all of the classifications described earlier. For the finding of "may affect," DOE has not completed onsite surveys

to support a finding of "is not likely to adversely affect" or "is likely to adversely affect"; therefore, a finding of "no effect" or "may affect" is the conclusion that DOE can reach at this time.

After the record of decision is issued that specifies the new site or sites and the expansion sites that would be developed, DOE would perform site- and species-specific surveys for all the federally listed species that received a finding of "may affect." DOE would perform the evaluation of the federally listed species in consultation with USFWS and section 7 of the ESA and the Final ESA section 7 Consultation Handbook dated March 1998.

H.1.1 Purpose

This evaluation analyzes the potential effects on federally listed threatened and endangered species of construction, operation, and maintenance of additional SPR storage capacity. In Texas, this additional capacity could be added by developing one new site (Stratton Ridge) and expanding capacity at one existing site (Big Hill). For the proposed new Stratton Ridge site, the proposed activities would include: construction of underground storage caverns and surface facilities at the storage site; construction of pipelines for crude oil distribution, raw water supply, and brine disposal; surface water withdrawal to support solution mining of new caverns; discharge of brine in the Gulf of Mexico; and construction of the Texas City terminal. The proposed Big Hill expansion would use the existing raw water intake (RWI) system, brine disposal pipeline and Gulf of Mexico brine discharge, and existing crude oil distribution system; in addition to cavern construction, a new 21-mile (34-kilometer) crude oil pipeline to the Sun Terminal in Nederland would be constructed.

H.1.2 Threatened and Endangered Species Terminology

The USFWS lists a species on the Federal Endangered Species List as "threatened" when it is likely to become endangered throughout all or a significant portion of its range in the foreseeable future, and lists a species as "endangered" when it is in danger of extinction throughout all or a significant portion of its range. In addition, the USFWS maintains a list of what are called "candidate species" that are being considered for listing under the Endangered Species Act. A candidate species is a species that the USFWS has on file sufficient information to support a proposal to list as endangered or threatened, but for which preparation and publication of a proposal is precluded by higher-priority listing actions. Federal agencies are encouraged to consider these species in preparing environmental impact analysis done under NEPA in order to alleviate threats to them and thereby possibly eliminate the need to list the species as endangered or threatened.

To define all the species that are required to be addressed in the biological assessment, DOE contacted and obtained information from the USFWS and the Texas Parks and Wildlife Department (TPWD). Appendix K contains the consultation letters and lists the consultation meetings held.

H.1.3 Organization

This appendix includes the following information: a brief literature review for each of the species addressed (section H.2); observations made during site visits (section H.3); an assessment of the potential effects of the proposed action on the threatened, endangered, and candidate species (section H.4); and recommendations for minimizing potential adverse effects on the subject species and on other biological resources (section H.5). References cited in this appendix are identified in section H.6.

H.2 LITERATURE REVIEW

The literature review describes the natural histories of all species federally listed as threatened or endangered *and* identified as present or potentially present (e.g., based on historical records) by the USFWS (2006) in at least one county where proposed new and expanded SPR facilities and associated infrastructure would be located. Although candidate species (i.e., those listed as candidates for Federal listing as threatened or endangered) are within the scope of this assessment, there were no candidate species identified in the literature review for the Texas counties with proposed SPR facilities. Table H.2-1 lists the species evaluated in this appendix.

Table H.2-1: Federally Listed Threatened or Endangered Species in Texas Counties Where SPR Development is Proposed

Common Name	Scientific Name	Federal Status	Texas Status	County Where Species May Exist[a]
Birds				
Attwater's Greater Prairie Chicken	*Tympanuchus cupido attwateri*	Endangered	Endangered	Galveston
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	Threatened	Brazoria
Brown Pelican	*Pelecanus occidentalis*	Endangered	Endangered	Brazoria, Galveston
Eskimo Curlew	*Numenius borealis*	Endangered	Endangered	Galveston (P)[b]
Piping Plover	*Charadrius melodus*	Threatened	Threatened	Brazoria, Galveston, Jefferson
Whooping Crane	*Grus americana*	Endangered	Endangered	Brazoria (P)
Marine Mammals				
Gervais Beaked Whale	*Mesoplodon europaeus*	Protected	Threatened	Brazoria, Galveston, Jefferson
Goose-Beaked Whale	*Ziphius cavirostris*	Protected	Threatened	Brazoria, Galveston, Jefferson
Pygmy Sperm Whale	*Kogia breviceps*	Protected	Threatened	Brazoria, Galveston, Jefferson
Dwarf Sperm Whale	*Kogia simus*	Protected	Threatened	Brazoria, Galveston, Jefferson
Sperm Whale	*Physeter macrophalus*	Endangered	Endangered	Brazoria, Galveston, Jefferson
Atlantic Spotted Dolphin	*Stenella frontalis*	Protected	Threatened	Brazoria, Galveston, Jefferson
Rough-Toothed Dolphin	*Steno bredanensis*	Protected	Threatened	Brazoria, Galveston, Jefferson
Killer Whale	*Orcinus orca*	Protected	Threatened	Brazoria, Galveston, Jefferson
False Killer Whale	*Pseudorca crassidens*	Protected	Threatened	Brazoria, Galveston, Jefferson
Short-Finned Pilot Whale	*Globicephala macrorhynchus*	Protected	Threatened	Brazoria, Galveston, Jefferson
Pygmy Killer Whale	*Feresa attenuata*	Protected	Threatened	Brazoria, Galveston, Jefferson
West Indian Manatee	*Trichechus manatus*	Endangered	Endangered	Brazoria, Galveston, Jefferson

Table H.2-1: Federally Listed Threatened or Endangered Species in Texas Counties Where SPR Development is Proposed

Common Name	Scientific Name	Federal Status	Texas Status	County Where Species May Exist[a]
Bottlenose Dolphin	(*Tursiops truncatus*)	Protected	Not Listed	All Coastal Counties
Reptiles				
Atlantic Hawksbill Sea Turtle	*Eretmochelys imbricate*	Endangered	Endangered	Brazoria, Galveston, Jefferson
Green Sea Turtle	*Chelonia mydas*	Threatened	Threatened	Brazoria, Galveston, Jefferson
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	Endangered	Brazoria, Galveston, Jefferson
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Endangered	Brazoria, Galveston, Jefferson
Loggerhead Sea Turtle	*Caretta caretta*	Threatened	Threatened	Brazoria, Galveston, Jefferson

[a] Includes only counties in Texas where SPR facilities are proposed for development or expansion.
[b] Potentially or historically present in the county.

H.2.1 Birds

H.2.1.1 Attwater's Greater Prairie Chicken

Attwater's greater prairie chicken (*Tympanuchus cupido attwateri*) is a heavily barred, chunky, chicken-sized bird with dark brown, cinnamon, and pale buff feathers (NGS 1983). The average weight for males and females is 35.8 and 25.6 ounces (1,014 grams and 730 grams), respectively (Dunning 1993). Their diet consists primarily of insects, particularly grasshoppers, during the summer and fruit, leaves, flowers, shoots, seeds, and grain during other times of the year (NatureServe 2005).

The historical range of these birds was in the Gulf Coast prairies of southwestern Texas and Louisiana, south of the Rio Grande (NatureServe 2005). Currently, Attwater's greater prairie chicken is found only in a narrow band of coastal prairie along the Texas coast, including some offshore islands, and as of 1991, several remnant inland populations existed in Goliad, Refugio, Austin, Colorado, Fort Bend, and Victoria Counties (Matthews and Moseley 1990). Beginning in early April, males gather for communal courtship (10 to 30 birds). Incubation lasts 23 or 24 days, after which the hatchlings leave the nest within a few hours of hatching (NatureServe 2005). Home ranges can vary widely, but they are smallest in summer and largest in winter (Horkel 1979).

H.2.1.2 Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is a large bird of prey with an average wingspan of 7 feet (2 meters). Adult males and females are similar in appearance, with a dark brown body and wings, and a distinctive white head and tail. This species is listed as a federally threatened species, although delisting has been proposed.

Bald eagles may be found throughout the continental United States and Alaska. They are most likely found in areas with large expanses of aquatic habitat with forested shorelines or cliffs where they select supercanopy roost trees. Bald eagles are opportunistic foragers. Although they prefer fish, they eat a great variety of mammals, amphibians, crustaceans, and birds, including many species of waterfowl (Buehler 2000).

Bald eagles nest almost exclusively at the edges of lakes, rivers, or seacoasts. They generally nest in tall trees or cliffs near the water's edge, although they occasionally nest on the ground. Nests are often reused in successive years. The breeding season begins in the spring (earlier in southern states), with the young fledging after about 6 months (USFWS 1983; USFWS 1995). According to comments submitted to DOE by the USFWS (James 2005), nesting activity occurs from September to January with young fledged usually by midsummer. Nonbreeding populations occur throughout Texas; breeding populations are found primarily in eastern Texas along the Gulf Coast (NatureServe 2005; TPWD 2005).

Bald eagles are highly sensitive to human noise and interference (USFWS 1983; USFWS 1995). They are most sensitive during the first 12 weeks of the nesting cycle. Disturbance during nesting may lead to nest abandonment or reduced hatching and survival rates. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest, lessening their likelihood of survival (Watson 2005).

H.2.1.3 Brown Pelican

The brown pelican (*Pelecanus occidentalis*) is a large water bird with a massive bill and throat pouch. Its wings and body are grayish-brown. Nonbreeding adults have a whitish head and neck often with some yellow. The hindnecks of breeding adults are dark chestnut (NGS 1983; Palmer 1962). Larger individuals have a wingspread of more than 7 feet (2 meters) (USFWS 2005).

The brown pelican is a fish eater. It is found almost exclusively in coastal areas along the southern east coast, the Gulf of Mexico, and throughout the west coast. It prefers to feed in shallow estuarine waters and use sand spits, offshore sand bars, and islets for nocturnal roosting. Dry roosting sites are essential to suitable habitat (NatureServe 2005). Nests usually are built on coastal islands, on the ground, or in small bushes and trees (Palmer 1962).

The brown pelican is federally listed as endangered. Populations in California, Texas, and Louisiana were devastated by pesticide poisoning from dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethylene (DDE), and other compounds throughout the 1950s and 1960s. Now eastern and Gulf Coast populations of the brown pelican appear to be stable and possibly increasing in recent years. Contaminant levels in both populations are below the threshold for reproductive failure, but the populations are still very vulnerable to pesticide pollution (Anderson and Hickey 1970). Other threats include the disturbance of nesting birds by humans, declining fish populations, increased water turbidity caused by dredging, oil and chemicals spills, entanglement in fishing gear, and extreme weather conditions. Recently, habitat degradation has affected both roosting and nesting. For example, nesting efforts have failed in the Gulf Coast because of erosion at the nesting sites (NatureServe 2005).

The brown pelican is classified as vulnerable in Texas and imperiled in Louisiana. In Texas, brown pelicans can be found along the entire coast; most of the breeding brown pelicans in Texas nest in counties near Corpus Christi (TPWD 2005).

H.2.1.4 Eskimo Curlew

The Eskimo curlew (*Numenius borealis*) is a very rare, 12- to 14-inch (30- to 36-centimeter), long-legged shorebird with a gray-brown upper body with dark eyelines, a slightly downward-curved bill, cinnamon wing linings, and white streaks on the lower body. Female Eskimo curlews are generally larger than males (NYDEC 2003). Their diet consists of grasshoppers and grasshopper eggs, crickets, grubs, ants, moths, spiders, snails, earthworms, freshwater insects, seeds, and berries (Gollop et al. 1986).

A possible sighting of four Eskimo curlews was reported in Texas in 1987 (Gollop 1988), but no recent reliable sightings have been reported for Texas, and the global population is believed to be less than 50 and possibly extinct (NatureServe 2005). Historically, Eskimo curlews arrived in Texas in early March and migrated through the Great Plains from late March to mid-May (Gollop et al. 1986; Johnson and Herter 1989) to their breeding areas further north (e.g., Alaska). Their nonbreeding habitat consists of tidal flats, herbaceous grasslands, pastures, and plowed fields within a few miles (kilometers) of the sea (AOU 1983). Preferred nesting habitat includes open artic tundra, uplands grassy tundra, and tundra and tidal marshes near the Arctic Ocean (Harrison 1978; Johnson and Herter 1989; Matthews and Moseley 1990). Female Eskimo curlews lay a clutch of four eggs between late May and early July (NatureServe 2005).

H.2.1.5 Piping Plover

The piping plover (*Charadrius melodus*) is a small, sandy-colored shorebird similar in appearance to a sandpiper. Distinguishing field marks of this species include yellow-orange legs, a black band across the forehead from eye to eye, and a black ring around the base of its neck (USFWS 2005). The piping plover is federally listed as threatened in Texas.

A migratory species, the piping plover overwinters on beaches, mudflats, and sandflats along the Atlantic Coast and the Gulf of Mexico including barrier island beaches and spoil islands on the Gulf Intracoastal Waterway (ICW) (USFWS 2005). In Texas, piping plovers have been observed in most of the counties bordering the Gulf of Mexico (NatureServe 2005). Critical habitat for wintering piping plovers has been established for several specific locations in Brazoria and Galveston Counties in Texas (USFWS 2001):

- **Unit TX–31:** San Bernard National Wildlife Refuge Beach, 410 acres (166 hectares) in Matagorda and Brazoria Counties. This is a unit composed of Gulf beach, 5 miles (8 kilometers), and extends from the mouth of the San Bernard River to a point along the beach 8.7 miles (14 kilometers) to the southwest.

- **Unit TX–32:** Gulf Beach, 269 acres (109 hectares) of shoreline in Brazoria County. This unit is a segment of Gulf beach between the Brazos River and the San Bernard River and borders an area known as Wolf Island.

- **Unit TX–33:** Bryan Beach and adjacent beach, 388 acres (157 hectares) in Brazoria County. The boundaries enclose a length of Gulf beach between the mouth of the Brazos River and the Farm-to-Market 1495 road. A portion of this area is owned and managed by the TPWD.

- **Unit TX–34:** San Luis Pass, 272 acres (110 hectares) near the Brazoria-Galveston county line. This unit extends along the Gulf side of Galveston Island from San Luis Pass to the site of the former town of Red Fish Cove. Approximately 57 percent of the unit includes flats in the floodtide delta that are state-owned and managed by the Texas General Lands Office (TGLO).

- **Unit TX–35:** Big Reef, 117 acres (47 hectares) in Galveston County. This unit consists of beach and sandflats on the north, west, and east shore of Big Reef, down to mean lower low water (MLLW) level. South Jetty is not included. The area is managed by the City of Galveston.

- **Unit TX–36:** Bolivar Flats, 395 acres (160 hectares) in Galveston County. This unit extends from the jetties on the southwest end of the Bolivar Peninsula to a point on the Gulf beach 0.6 miles (1 kilometer) north of Beacon Bayou. It includes 3 miles (4.8 kilometers) of Gulf shoreline. The area is leased from the TGLO by Houston Audubon Society, and it is managed for its important avian resources. The uplands areas are used for roosting by the piping plover.

- **Unit TX–37:** Rollover Pass, 16 acres (6.5 hectares) in Galveston County. This unit consists of Rollover Bay on the bayside of Bolivar Peninsula. It includes tidal flats on state-owned land managed by the TGLO. This unit captures the intertidal complex of the bay, and it is bounded by the towns of Gilchrist to the east and the Gulf beach of the Bolivar Peninsula to the south.

For all of these units, the landward boundary of the critical habitat is defined as the line indicating the beginning of dense vegetation (which is not used by piping plovers as habitat) and the gulfside (or bayside) boundary is the MLLW, defined as the annual average of the lower low-water height of each tidal day. All of the units listed here include lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Piping plovers begin their fall migration to wintering habitats along the Gulf Coast and elsewhere in mid to late summer, where they remain until around March when they migrate northward to breeding grounds (NatureServe 2005). Although a few plovers remain throughout the year, sightings in winter habitats are rare in late May, June, and early July (USFWS 2001).

H.2.1.6 Whooping Crane

The whooping crane (*Grus americana*) is a very tall, mostly white bird with long legs and neck, red facial skin, and a straight bill. It averages 52 inches (132 centimeters) in length (NatureServe 2005). Its summer diet consists of insects, crustaceans, and berries; its winter diet is supplemented with grains, acorns, wolfberry fruit, insects, crustaceans, mollusks, fishes, reptiles, amphibians, and marine worms (USFWS 1980; Hunt and Slack 1989).

The whooping crane's preferred habitat is typically herbaceous wetlands, lagoons, and tidal flats. It typically nests in dense emergent vegetation found in shallow ponds, fresh-water marshes, wet prairies, and lake margins in large tracts of undisturbed wilderness (NatureServe 2005). Breeding begins in early May, and pairs of whooping cranes mate for life. The crane also establishes and defends winter territories on coastal marshes in parts of Texas. Breeding territories are large, averaging 1,900 acres (769 hectares) (Johnsgard 1991). Nestlings fledge after mid-August, and they mature sexually at 4 to 6 years (NatureServe 2005).

H.2.2 Marine Mammals

At the proposed Stratton Ridge site, the onshore portion of the brine disposal pipeline construction would not affect marine mammals. That construction would include directional drilling from onshore to open water in the Gulf of Mexico. The construction and operation of the offshore brine disposal pipeline and brine diffusion system for the Stratton Ridge site may affect the marine mammal species; likewise, operation of the brine diffusion systems for both the Big Hill and Stratton Ridge sites may affect the marine mammal species. The locations of the offshore pipelines and the diffuser system would not reach the depths of the Gulf of Mexico where the majority of these species are found because the locations of the diffuser systems are at a depth of approximately 30 feet (9 meters). In addition, the dispersion of the brine discharge into the Gulf of Mexico would dissipate before reaching these depths.

H.2.2.1 Gervais Beaked Whale

The Gervais beaked whale (*Ziphius cavirostris*) is a pelagic species associated with the continental shelf and deep oceanic waters, and, in addition, it is closely associated with the Gulf Stream waters. Its diet consists mainly of squid and deepwater fishes. Little is known about this species, but it is believed sexual

maturity occurs when it measures 15 feet (4.5 meters). The Gervais beaked whale lives about 27 years (Wynne et al. 1999).

H.2.2.2 Goose-Beaked Whale

The goose-beaked whale (*Ziphius cavirostris*), also known as Cuvier's beaked whale, typically is found in waters that are greater than 3,280 feet (1,000 meters). The goose-beaked is a pelagic species associated with the continental shelf and deep oceanic waters, but it is also closely associated with the Gulf Stream waters. Little is known about the goose-beaked whale. It is believed to travel in pods of 2 to 25 animals, and it typically avoids vessels. Sexual maturity is believed to occur at 7 to 11 years, with breeding occurring in the spring. Females give birth to a calf every 2 to 3 years after a 12-month gestation. The goose-beaked whale is believed to lactate for 12 months and live more than 35 years. Its diet consists mainly of deepwater fish and squid (Wynne et al. 1999).

H.2.2.3 Pygmy Sperm Whale

The pygmy sperm whale (*Kogia breviceps*) is a pelagic, deep-water species that inhabits the areas near the continental shelf edge, slope, and deep oceanic waters. It is found throughout the Gulf of Mexico in these waters. The pygmy sperm whale is not as social as other species, and it is typically found alone or in small groups. The male reaches sexual maturity when it measures 8.9 to 9.8 feet (2.7 to 3.0 meters). The female reaches sexual maturity when it measures 8.5 to 9.1 feet (2.6 to 2.8 meters) in length. A single calf is born after an 11-month gestation period, and lactation lasts about 12 months. The pygmy sperm whale's diet consists mainly of squid, fish, and crustaceans (Wynne et al. 1999).

H.2.2.4 Dwarf Sperm Whale

The dwarf sperm whale (*Kogia simus*) is a pelagic, deep-water species that inhabits the areas near the continental shelf edge, slope, and deep oceanic waters. It is found throughout the Gulf of Mexico in these waters. The dwarf sperm whale is not as social as other species, and it typically is found alone or in small groups. It reaches sexual maturity when it measures between 6.9 and 7.2 feet (2.1 and 2.2 meters) in length. A single calf is born after a 9.5-month gestation period, and lactation lasts about 12 months. The dwarf sperm whale's diet consists mainly of squid, fish, and crustaceans (Wynne et al. 1999).

H.2.2.5 Sperm Whale

The sperm whale (*Physeter macrophalus*) is a pelagic, deep-water species that inhabits areas near the continental slope. It is found throughout the Gulf of Mexico along the continental slope and along the Atlantic seaboard associated with Gulf Stream features. Female and young sperm whales form breeding schools of 10 to 80 animals. Sexually inactive males form bachelor schools, and older males are typically solitary. Females reach sexual maturity between 7 to 11 years; males reach sexual maturity at 19 years. A single calf is born every 3 to 6 years after a 14-month gestation period, and lactation lasts 12 to 24 months. The sperm whale's diet consists mainly of squid, but the species also will eat fish (Wynne et al. 1999).

H.2.2.6 Atlantic Spotted Dolphin

The Atlantic spotted dolphin (*Stenella frontalis*) is a tropical species that can be found in a variety of areas throughout the Gulf of Mexico. It ranges from coastal to pelagic environments, typically near the continental shelf and slope, and it usually is associated with the Gulf Stream. The Atlantic spotted dolphin reaches sexual maturity at 8 to 15 years. It breeds during the fall and spring and produces one calf every 1 to 2 years after a 12-month gestation period. Lactation typically lasts 3 to 5 years. The

Atlantic spotted dolphin can live 25 to 30 years. It is a gregarious species found in groups of less than 20 other dolphins and small whales along the coast and in larger groups of less than 100 individuals offshore. The Atlantic spotted dolphin's diet consists of squid and a variety of fish (Wynne et al. 1999).

H.2.2.7 Rough-Toothed Dolphin

The rough-toothed dolphin (*Steno bredanensis*) is a tropical, pelagic species found seaward of the continental slope. Little is known about the rough-toothed dolphin, but it is thought to be sexually mature at 10 to 14 years and to live as long as 32 years. It is believed to travel in pods of 10 to more than 100 individuals and associated other species such as spinner dolphins, bottlenose dolphins, and pilot whales. Sometimes the rough-toothed dolphin can be found associated with large mats of Sargassum. The rough-toothed dolphin's diet consists of deepwater octopus, squid, and fish (Wynne et al. 1999).

H.2.2.8 Killer Whale

The killer whale (*Orcinus orca*) can be found in both coastal and oceanic waters ranging from tropical to polar. The killer whale is a highly social species that travels in a pod of 3 to 55 animals, and the pod often cooperates in hunting and feeding efforts. The whale is sexually mature at 10 to 15 years and mates year round. A single calf is born every 3 to 8 years after a 17-month gestation period. Lactation typically lasts about 12 months. The killer whale may live more than 50 years. It has a diverse diet that includes fish, birds, squid, turtle, and other marine mammals (Wynne et al. 1999).

H.2.2.9 False Killer Whale

The false killer whale (*Pseudorca crassidens*) is a pelagic species found in the deeper waters of the Gulf of Mexico, seaward of the continental shelf. The false killer whale is a social species that can be found in groups of 10 to more than 100 individuals with the same species or with other dolphin species. It is sexually mature at 8 to 14 years, and it has a single calf every 3 to 4 years after a 16-month gestation period. This species has been known to be aggressive toward smaller dolphins. The false killer whale's diet consists mainly of squid and fish (Wynne et al. 1999).

H.2.2.10 Short-Finned Pilot Whale

The short-finned pilot whale (*Globicephala macrorhynchus*) can be found in a variety of water depths. Typically it is associated with squid, its main prey. The short-finned pilot whale is a tropical species usually associated with the Gulf Stream, and it can be found in pelagic or coastal environments. It may move inshore during the summer months. The short-finned pilot whale is a social species that can be found in groups of 10 to more than 100 individuals, and it is often associated with bottlenose dolphins. It is believed to be sexually mature at 6 to 12 years and thought to breed every 3 years. A single calf is born after a 15- or 16-month gestation period. Lactation for calves lasts about 20 months. An individual short-finned pilot whale can live between 50 and 70 years. Its diet consists primarily of squid, but it also has been known to prey on fish (Wynne et al. 1999).

H.2.2.11 Pygmy Killer Whale

The pygmy killer whale (*Feresa attenuata*) is a pelagic species found in the deeper waters of the Gulf of Mexico, seaward of the continental shelf. Little is known about the life history of this whale. Its diet is believed to consist mostly of fish, but it has been observed preying on squid. The pygmy killer whale is a gregarious species that typically associates in groups of 10 to 50 individuals. The pygmy killer whale has shown aggressive tendencies, but typically it is wary of boats (Wynne et al. 1999).

H.2.2.12 West Indian Manatee

The West Indian manatee (*Trichechus manatua*), also known as the Florida manatee, is an herbivore found in the warm coastal and inland waters. This manatee has a low tolerance for cold waters below 68 ºFahrenheit (20 ºCelsius), and it is typically found in warm springs and rivers. The manatee does not typically extend beyond the Florida–Alabama border, but sometimes it is found along the entire Gulf Coast. This slow swimming mammal spends its days feeding on submerged aquatic vegetation, floating vegetation, and emergent vegetation. The manatee is sexually mature at 3 to 5 years and produces a single calf every 2 to 5 years after a 12-month gestation period (Wynne et al. 1999).

H.2.2.13 Bottlenose Dolphin

The bottlenose dolphin (*Tursiops truncatus*) typically is found in coastal or offshore waters. In a coastal environment, the bottlenose dolphin can be found in warm, sallow inshore waters of bays and rivers. When offshore, it usually is in deep waters over the continental shelf and slope. The female bottlenose dolphin reaches sexual maturity at 5 to 10 years, while the male reaches maturity at 8 to 12 years. It breeds during fall and spring, and it produces one calf every 3 to 6 years after a 12-month gestation period. Lactation typically lasts 12 to 18 months. The bottlenose dolphin may live more than 50 years. It is a social species; it can be found along the coast in small groups of less than 10 individuals and offshore in larger groups of 10 to more than 100 individuals. This species usually can be found in mixed groups with pilot whales and right whales. The bottlenose dolphin's diet consists of fish, invertebrates, and squid (Wynne et al. 1999).

H.2.3 Reptiles

H.2.3.1 Atlantic Hawksbill Sea Turtle

The Atlantic hawksbill sea turtle (*Eretmochelys imbricata*) has a large brown carapace with overlapping scutes and two claws on each flipper. Some individuals have a tortoiseshell pattern of radiating streaks. The young are all black or dark brown except for raised ridges, shell edges, and areas on the neck and flippers. Mature adults usually measure 30 to 35 inches (76 to 89 centimeters) in length (Conant and Collins 1991). It feeds on the ocean bottom and reef faces close to shore on a diet consisting primarily of crab, sea urchin, shellfish, and jellyfish, and also some plant material and fish.

The Atlantic hawksbill is a local- and long-distance migrant that prefers shallow coastal waters with rocky bottoms, coral reefs, mangrove-bordered bays, and estuaries (CSTC 1990). This turtle prefers to nest on undisturbed, deep-sand beaches on the Gulf Coast of Mexico, the West Indies, the Bahamas, and the Americas (Meylan 1992; Lund 1985). The age of sexual maturity is unknown. Adult females nest only once every 2 to 3 years between May and November, laying 4 to 6 clutches of 50 to more than 200 eggs at 14- to 18.5-day intervals (NatureServe 2005). Incubation lasts approximately 2 months (CSTC 1990).

H.2.3.2 Green Sea Turtle

The green sea turtle (*Chelonia mydas*) turtle has a brown carapace covered in dark, wavy markings, radiating mottled markings, or large dark brown blotches; young are black or dark brown with white undersides. Mature adults are usually 35 to 48 inches (90 to 122 centimeters), but they can reach more than 60 inches (153 centimeters) in length. The length of a hatchling carapace is usually between 1.6 and 2.4 inches (4.1 and 6.1 centimeters) (Conant and Collins 1991). This turtle most commonly feeds in shallow, low-energy waters containing abundant submerged vegetation. Adults are primarily herbivores, while juveniles are more invertivorous.

The green sea turtle is a long-distance migrant preferring tidal flats, pelagic zones, and isolated sand dunes. It prefers to nest on high-energy beaches with deep sand (NatureServe 2005). Every 2 to 4 years, the female lays between 1 and 8 clutches, each averaging 90 to 140 eggs, at approximately 2-week intervals. Nesting occurs between March and October in the Caribbean–Gulf of Mexico region, with a peak nesting rate during May and June (Ehrhart and Witherington 1992).

H.2.3.3 Kemp's Ridley Sea Turtle

Kemp's Ridley sea turtle (*Lepidochelys kempii*) is a small endangered sea turtle found in shallow coastal and estuarine waters including those of the Gulf of Mexico. The adult is olive green above and yellow below, and young are gray above and yellow below. The shell is nearly round, and its limbs are flattened flippers. The shell length is usually between 23 and 28 inches (58 and 70 centimeters) for adults and 1.5 to 1.7 inches (3.8 to 4.4 centimeters) for hatchlings (Conant and Collins 1991).

In coastal waters, the Kemp's Ridley sea turtle is usually found over sand or mud bottoms where it feeds on crabs. Nests are built on elevated dunes, especially on beaches backed up by large swamps or bodies of open water having seasonal, narrow ocean connections (NatureServe 2005).

During the nesting season from April to July, the female lays 1 to 4 clutches of about 100 eggs at intervals of 10 to 28 days. Eggs hatch after an average of 50 to 55 days (CSTC 1990).

H.2.3.4 Leatherback Sea Turtle

The leatherback sea turtle (*Dermochelys coricea*) has a black or dark blue carapace, often with irregular white or pink blotches, and seven prominent longitudinal ridges. The adult is usually 53 to 70 inches (135 to 178 centimeters) in length. Leatherback hatchlings are about 2.4 to 3 inches (6 to 7.5 centimeters) long, and they are black and white and covered with small beady scales that are later shed (Conant and Collins 1991). The leatherback sea turtle feeds primarily on jellyfish.

Mainly pelagic, the leatherback tends to approach land exclusively for nesting (Eckert 1992). This long-distance migrant prefers the open ocean, particularly along the edge of continental shelves, but it is also found in seas, gulfs, bays, and estuaries. When nesting, the leatherback seeks moist sand on sloping sandy beaches backed by vegetation near deep water and rough seas (CSTC 1990). Every 2 to 3 years, the female leatherback lays 10 or possibly more clutches of 50 to 170 eggs at intervals of about 1 to 2 weeks. Nesting occurs between March and August in the Western hemisphere. Eggs hatch in 8 to 10 weeks (Eckert 1992).

H.2.3.5 Loggerhead Sea Turtle

The loggerhead (*Caretta caretta*) is a reddish-brown sea turtle found in a variety of habitats including open seas more than 500 miles (805 kilometers) from shores, bays, estuaries, lagoons, creeks, and mouths of rivers in warm, temperate, and subtropical regions (NatureServe 2005). Adults have a carapace length typically between 28 and 49 inches (70 and 125 centimeters). Hatchlings have a shell length of 1.5 to 2 inches (4 to 5 centimeters) (Dodd 1988, 1992; Conant and Collins 1991).

The female loggerhead sea turtle nests on open sandy beaches above the high-tide mark, seaward of well-developed dunes. High-energy and steeply sloped beaches with gradually sloped offshore approaches are favored (CSTC 1990). In southeastern states, females deposit between 50,000 to 70,000 clutches each year (Meylan et al. 1995). Despite some natural fluctuation in the size of the loggerhead population, numbers appear to be declining in some areas largely due to habitat destruction and incidental take by

shrimp trawlers. The nesting population in the southeastern United States is believed to be declining (CSTC 1990; Taylor 1992).

Every 2 to 3 years, a mature female lays between 1 and 9 clutches of around 120 eggs at intervals of 2 weeks. Nesting occurs mainly at night, often at high tide, from April to early September. In the southeastern states, eggs hatch in 8 to 9 weeks. The sex of the hatchlings is determined by incubation temperatures, with the ratio strongly biased toward females in Atlantic coastal waters. Hatchlings emerge from the nest a few days after hatching, typically during darkness (Wibbels et al. 1991; Mrosovsky and Provancha 1992).

H.3 FIELD OBSERVATIONS

This section reports the observations made during field visits to the proposed Stratton Ridge SPR site.

On October 6 and 7, 2005, four biologists from ICF Consulting conducted pedestrian surveys of the proposed Stratton Ridge SPR site. The inspectors walked over the proposed site and RWI structure. The survey included limited portions of the proposed pipeline right-of-way (ROW).

H.3.1 Stratton Ridge Storage Site

The proposed Stratton Ridge storage site encompasses 273 acres (102 hectares) west of Highway 523. Cattle and feral pigs roam and graze throughout the site, influencing the vegetative communities. The biologists observed perennial streambeds in the northeastern portion of the site and culverts along the pipeline that bisects the site from east to west. They observed no permanent streams in the site, but they did see three areas of standing water and emergent and potentially submergent vegetation.

The study area includes the following principal habitat types:
- Evergreen forest (primarily forested wetlands),
- Deciduous forest,
- Emergent wetlands, and
- Open and old fields.

A description of each principal habitat type in the study area follows. Plant species observed on the site are identified in table H.3.1-1.

Table H.3.1-1: Plant Species Observed at the Stratton Ridge Site

Common name	Scientific Name	Vegetative Layer
Evergreen Forest		
Live Oak	*Quercus virginiana*	Canopy
Water Oak	*Q. phellos*	Canopy
Holly	*Ilex* spp.	Understory
Yaupon	*Ilex vomitoria*	Understory
Dahoon	*Ilex cornuta*	Understory
Devil's Walking Stick	Aralia spinosa	Understory
Chinese Tallow Tree	*Sapium sebiferum*	Canopy/Understory (invasive)
Vibernum	*Viburnum* spp.	Understory/Ground cover
Rattlebush	*Symplocos tinctoria*	Understory/Ground cover
Saw Palmetto	*Serenoa repens*	Understory/Ground cover
Greenbriar	*Smilax* spp.	Understory/Ground cover

Table H.3.1-1: Plant Species Observed at the Stratton Ridge Site

Common name	Scientific Name	Vegetative Layer
Blackberry	*Rubus argutus*	Understory/Ground cover
Butterweed	*Packera glabella*	Understory/Ground cover
Pigweed	*Amaranthus* spp.	Understory/Ground cover
Trumpet Creeper	*Campsis radicans*	Understory/Ground cover
Deciduous Forest		
Winged Elm	*Ulmus alata*	Canopy
Chinese Tallow Tree	*Sapium sebiferum*	Canopy
Pigweed	*Amaranthus* spp.	Understory/Ground cover
Rattlebush	*Symplocos tinctoria*	Understory/Ground cover
Saw Palmetto	*Serenoa repens*	Understory/Ground cover
Viburnum	*Viburnum* spp.	Understory/Ground cover
Emergent Wetlands		
Sedge	*Carex* spp.	Ground cover
Soft Rush	*Juncus marginatus*	Ground cover
Legume	*Fabaceae*	Ground cover
Bulrush	*Scirpus* spp.	Ground cover
Spike Rush	*Eleocharis quadrangulata*	Ground cover

Evergreen Forest: Approximately 85 percent of the evergreen forest is forested wetlands with upland portions consisting of scattered isolated islands and berms. The evergreen forest is dominated by live oak and an understory that includes holly, yaupon holly, devil's walking stick, and vibernum. The ground cover varies based on the amount of sunlight reaching the forest floor and the level of grazing.

Deciduous Forest: Deciduous hardwood forests are present in higher elevation areas at the southern portion of the site. The dominant species are winged elm and Chinese tallow tree.

Emergent Wetlands: The largest emergent wetland area is in the central-eastern area of the site. Standing water was present at all of the emergent wetlands observed during the site visit. The biologists observed a variety of sedge, rush, and bulrush, along with legumes, rattlebush, and Chinese tallow tree along the edges of the wetlands.

Open and Old Fields: The observed open fields are associated with power line and pipeline ROWs. The old fields adjacent to the proposed site were for cattle grazing. The entire site is now grazed by cattle.

H.3.2 Stratton Ridge RWI Structure

The proposed RWI structure for the Stratton Ridge site is on the ICW. The surrounding area is flat brackish to saltwater marshland with some tidal influence.

H.4 HABITAT ASSESSMENT AND POTENTIAL IMPACTS

This section evaluates whether the proposed SPR development activities would take place in areas where threatened, endangered, and candidate species are known to exist or where they may exist based on the natural history information reported in chapter 2 of the draft EIS. For any element of the proposed new Stratton Ridge site or proposed Big Hill expansion site located in known or potential threatened,

endangered, or candidate species habitat, the nature and potential for effects on that species are described. The assessment considers potential avoidance and minimization measures that DOE would implement for each element of the proposed action.

In the following sections, a separate assessment is provided for the proposed new Stratton Ridge site and the Big Hill proposed expansion site.

H.4.1 Stratton Ridge

This assessment for the proposed Stratton Ridge site evaluates the potential effects on threatened, endangered, and candidate species by each of the elements of the proposed new site listed in Table H.4.1-1.

Table H.4.1-1: Elements of the Proposed Action and Location on Stratton Ridge Candidate Site

Element of Proposed Action	Location by County or Offshore Area
Stratton Ridge site	Brazoria
Oil distribution pipeline ROW from Stratton Ridge to the Texas City terminal	Brazoria and Galveston
RWI structure, RWI pipeline ROW, brine disposal pipeline ROW, and RWI power line ROW to the ICW	Brazoria
Brine disposal ROW from ICW to Gulf of Mexico	Brazoria
Offshore brine pipeline and diffuser	Gulf of Mexico

The following paragraphs describe the evaluation findings for each species that could result from the elements of the proposed action at the Stratton Ridge candidate site.

H.4.1.1 Birds

H.4.1.1.1 Attwater's Greater Prairie Chicken

Attwater's greater prairie chickens are recorded in Galveston County, where part of the crude oil distribution pipeline for the Stratton Ridge site would be located. Woodrow (2005) listed the species as a species of concern for the proposed new Stratton Ridge site. As of 2003, two fragments of habitat were recorded for Attwater's greater prairie chicken in Texas, including one in Galveston County at the Texas City Prairie Preserve and the other in Colorado County (TPWD 2005; Nature Conservancy 2005). The element of the proposed action in Galveston County associated with the proposed new Stratton Ridge site is construction of the crude oil distribution pipeline along the existing ROW to the Texas City terminal. The existing ROW where the new pipeline would be built passes through the southern part of Texas City; the Prairie Reserve is to the north of Texas City, at least 4 miles (6.4 kilometers) away. Because this is an existing ROW that does not pass through the Prairie Reserve, the construction of the pipeline and the subsequent operation and maintenance activities would have no effect on the existing population of Attwater's greater prairie chickens.

H.4.1.1.2 Bald Eagle

Eastern Texas including Brazoria County has breeding and wintering-over populations of bald eagles (TWPD 2005). Construction on the proposed Stratton Ridge site; the ROW for the RWI pipeline, brine disposal pipeline, and power lines to the RWI structure; and the crude oil distribution pipeline ROW

would occur in or near areas with potentially suitable habitat for the bald eagle. These suitable habitats include open water or wetlands adjacent to forested area.

Construction Impacts

A pair of bald eagles is known to nest northwest of the proposed Stratton Ridge site near Ash Lake, approximately 2 miles (3.2 kilometers) from the Stratton Ridge site. 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 further than 0.25 miles (0.4 kilometers) from the proposed site, these bald eagles may be affected by the Stratton Ridge site development because the habitat at the site may provide suitable foraging area. Tree removal onsite and in the 300-foot (91-meter) security area around the site, construction noise, and human activity may affect bald eagles foraging in the area, although the construction would be a temporary impact. There are no known bald eagle nests at the proposed Stratton Ridge site, but the bottomland hardwood forest (palustrine forested wetlands) and emergent wetlands habitat at the site may be suitable for nesting and foraging or roosting habitat. If the proposed Stratton Ridge site is selected for development, a biologist would survey the site for bald eagle nests. If a nest is identified, DOE would consult with USFWS and TPWD. DOE would implement appropriate mitigation strategies. For example, construction of the pipeline would be completed to avoid the time when nesting bald eagles are particularly sensitive to human activity. Bald eagles are particularly sensitive to human activity during the period when they nest in Texas from October to July, with peak egg-laying in December and hatching in January (Watson 2005).

The construction of the proposed 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 these ROWs. If the Stratton Ridge site is selected for development, a biologist would survey the area for nests and suitable habitat along the ROWs and RWI construction site. If a nest is identified, DOE would consult with USFWS and TPWD, as described earlier. If no nests are identified, construction still may have an effect on bald eagles because the suitable foraging area would be disrupted. It is also possible that habitats may exist for bald eagle nesting and foraging along the existing pipeline ROW to the Texas City terminal. The new construction would have no effect on bald eagles because the area currently is disturbed by the existing ROW from ongoing maintenance activities (mowing and tree trimming). As a result, eagles that would frequent the area would be tolerant of human disturbances.

Operation and Maintenance Impacts

Operation and maintenance activities at the site and at the RWI may affect foraging bald eagles because they are sensitive to human noise and interference (USFWS 1983; USFWS 1995). At the RWI, DOE would downshield lights to minimize the impacts of artificial lighting and use noise attenuation barriers to minimize the impact to wildlife, including bald eagles. But for the pipeline ROW, the pipelines would be a static structure and would not produce noise that would disturb the eagles. Maintenance activities along the ROW and at the RWI structure would be infrequent and minor. In addition, the crude oil pipeline would be constructed in an existing pipeline ROW; therefore, operation and maintenance activities for this element of the proposed action would closely resemble existing conditions, and would have no effect on foraging or nesting bald eagles.

H.4.1.1.3 Brown Pelican

The brown pelican has been recorded in both Brazoria and Galveston Counties in Texas (TPWD 2005). Brown pelicans are found almost exclusively in coastal areas where they feed in shallow estuarine waters; thus, the elements most likely to affect brown pelicans are the RWI structure, the brine disposal pipeline

ROW to the Gulf of Mexico, and brine discharge. Most of the known breeding nests for brown pelicans in Texas are south of Brazoria County in Corpus Christi Bay, Sundown Island, Matagorda Bay, and Aransas Bay (TPWD 2005). There are no known nesting sites for brown pelicans in the proposed Stratton Ridge site development areas; however, the habitat near the RWI structure and along the proposed brine pipeline ROW is suitable, particularly because the ROW crosses the Brazoria National Wildlife Refuge that provides isolated coastal wetlands habitat for many birds. Part of the brown pelican population spends the nonbreeding and breeding seasons along the Texas coast.

Construction Impacts

No known brown pelican nests are located near the proposed location for the RWI structure or the brine disposal pipeline ROW. In addition, the brine disposal pipeline would be directionally drilled under the beach into the Gulf of Mexico, and total area of construction would be relatively small compared to the entire area available for feeding brown pelicans. Therefore, it is expected that the proposed Stratton Ridge site development would have no effect on the brown pelican species.

Operation and Maintenance Impacts

Operation and maintenance of the proposed Stratton Ridge site would have no effect on brown pelicans because there are no known nests nearby. For the pipeline ROW, the pipeline would be a static structure and would not produce noise that would disturb the pelicans. Maintenance activities along the ROW and at the RWI structure would be infrequent and minor.

H.4.1.1.4 Eskimo Curlew

In the past, the Eskimo curlew has been recorded in Galveston County where the crude oil distribution pipeline would be built along an existing ROW to the Texas City terminal. Historically, the Eskimo curlew migrated through Texas in early March, but it did not breed there. The species is thought to be extinct, and the last sightings in Texas occurred in 1987 (Gollop 1988). Because this species is not known to currently inhabit the area, construction, operation, and maintenance of the crude oil distribution pipeline for the Stratton Ridge development would have no effect on Eskimo curlew.

H.4.1.1.5 Piping Plover

The piping plover has been recorded in both Brazoria and Galveston Counties. All of the proposed development for the Stratton Ridge site would take place within these counties; however, only the brine disposal pipeline ROW and the RWI structure potentially would affect habitat suitable for the piping plover. The ROW for the brine and RWI pipelines would be directionally drilled under the ICW and the brine pipeline would be directionally drilled under the beach into the Gulf of Mexico.

Construction Impacts

More than 35 percent of the known piping plover population winters along the Texas coast from mid-July until early May, and some birds can be found in Texas year round (TPWD 2005). Several areas along the coast in Brazoria and Galveston Counties have been designated as critical habitat (see section H.2.1.5); however, the proposed route of the brine pipeline ROW does not intersect with any of these areas. The brine pipeline ROW would be located more than 6 miles (10 kilometers) northeast of critical habitat Unit TX–33 and more than 11 miles (18 kilometers) southwest of critical habitat Unit TX–34. Because the ROW falls between these two habitats and the brine pipeline would be directionally drilled under the beach to the Gulf of Mexico, there would be no effect on the piping plover from construction of the brine

disposal pipeline and RWI structure. The RWI structure would be located adjacent to the ICW, which is not considered suitable habitat for the piping plover.

Operation and Maintenance Impacts

If any piping plovers feed in the area, the pipeline operation would have no affect on the birds, their behavior, or the quality of their habitat. The pipeline would be a static structure, and it would not produce noise that would disturb the plovers. Maintenance activities along the ROW and at the RWI structure would be infrequent and minor. Overall, operations and maintenance would have no effect on piping plovers.

H.4.1.1.6 Whooping Crane

The whooping crane migratory population winters on the Gulf Coast of Texas, but it does not breed there. Suitable habitats for nonbreeding whooping cranes include herbaceous wetlands, lagoons, and tidal flats. The only wild self-sustaining population of the whooping crane in Texas is known to winter in and around the Aransas National Wildlife Refuge, which is in Aransas County more than 100 miles (160 kilometers) southwest of the proposed Stratton Ridge site (TPWD 2005). However, it is possible that some whooping cranes could potentially winter in Brazoria County and other counties nearby. Woodrow (2005) of TPWD noted that there are occurrences of whooping cranes within 1.5 miles (2.4 kilometers) of the proposed Stratton Ridge pipeline ROWs.

Construction Impacts

The RWI structure, the RWI and brine disposal pipelines ROW, the power line ROW to the RWI structure, and the crude oil distribution pipeline ROW all would be located within Brazoria County and could be sited in areas amenable to whooping crane habitat. Whooping cranes often occupy and defend discrete territories, so it would be possible to identify whether whooping crane winter habitats are near construction sites for the proposed Stratton Ridge project. Because the cranes do not nest in Texas, construction would disrupt only a small portion of feeding area at a time. Because power lines would be buried through the Brazoria National Wildlife Refuge, construction would have no effect on the species.

Operation and Maintenance Impacts

Because whooping cranes do not nest in Texas and may only infrequently use the surrounding habitat, the operation and maintenance of the site, RWI structure, and pipeline ROWs would have no effect on the birds, their behavior, or the quality of their habitat. The pipelines would be static structures and would not produce noise that would disturb the cranes. Maintenance activities would be infrequent and minor.

H.4.1.2 Marine Mammals

The construction of the brine disposal pipeline and the operation of the brine disposal system would have no effect on the Gervais beaked whale, goose-beaked whale, pygmy sperm whale, dwarf sperm whale, sperm whale, rough-toothed dolphin, killer whale, false killer whale, short-finned pilot whale, and the pygmy killer whale. These species are found in deeper waters than the terminus of the offshore pipelines and brine diffuser contours (see Appendix C, Brine Plume Modeling). The brine diffuser for the Stratton Ridge site would be located at a depth of 30 feet (9 meters).

Discussion follows on potential impacts on the Atlantic spotted dolphin, the West Indian manatee, and the bottlenose dolphin.

H.4.1.2.1 Atlantic Spotted Dolphin

The Atlantic spotted dolphin is a tropical species that can be found in a variety of areas through the Gulf of Mexico. It ranges from coastal to pelagic environments, typically over the continental shelf and slope. The Atlantic spotted dolphin is usually associated with the Gulf Stream.

Construction Impacts

The Atlantic spotted dolphin species is usually found in deeper waters than the extent of the brine disposal system and brine diffuser, but it is known to venture into shallower waters. The species would likely avoid or leave any areas of construction, and return after construction was complete. There would be no effect on the Atlantic spotted dolphin because of the limited construction time and the relatively small area of the Gulf of Mexico that would be impacted.

Operation Impacts

The Atlantic spotted dolphin may occur in the location of the brine diffuser; however, it is unlikely that the species would remain in the area for an extended period. Because the dissipation of the brine would occur in a relatively small area of the Gulf of Mexico (see Appendix C, Brine Plume Modeling) and the species would not be restricted to such areas, there would be no effect on the Atlantic spotted dolphin.

H.4.1.2.2 West Indian Manatee

The West Indian manatee, also known as the Florida manatee, is found in the warm, coastal and inland waters where it feeds. The manatee typically does not extend beyond the borders of Florida and Alabama, but sometimes it can be found along the entire Gulf of Mexico coastline.

Construction Impacts

The West Indian manatee rarely is found off the coast of Texas or in coastal inland water including the ICW. The species likely would avoid or leave any areas of construction, and return after construction was complete. There would be no effect on the West Indian manatee because it is rarely off the coast of Texas, the limited construction time, and the relatively small area of the Gulf of Mexico that would be impacted.

Operation Impacts

The West Indian manatee is rarely found off the coast of Texas or in coastal inland water including the ICW. The operation of the RWI would not affect the West Indian manatee. There would be no effect on the West Indian manatee because it is rarely off the coast of Texas, the dissipation of the brine would occur in a relatively small area of the Gulf of Mexico, and the species would not be restricted to such areas.

H.4.1.2.3 Bottlenose Dolphin

The bottlenose dolphin (*Tursiops truncatus*) typically can be found in coastal or offshore waters. In the coastal environment, the bottlenose dolphin can be found in warm, sallow inshore waters of bays and rivers. When offshore, it is usually in deep waters over the continental shelf and slope.

Construction Impacts

The bottlenose dolphin may be affected by the construction of the RWI and the brine disposal pipelines for the proposed Stratton Ridge site because it can be found in both onshore and offshore environments. The disturbance created by the construction of the RWI likely would keep the bottlenose dolphin from the immediate area, but it could return after construction was complete. The construction of the brine disposal pipeline and diffuser would create a disturbance that would keep the dolphin from the immediate area, but it would not harm the dolphin.

Operation Impacts

The bottlenose dolphin would not be adversely affected by the operation of the RWI or the brine disposal system. The intake for the raw water would create a slight current (less than 0.5 feet [0.15 meters] per second) that the dolphin could easily avoid. The operation of the brine diffusers offshore for the Stratton Ridge site would not affect the bottlenose dolphin. The dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance. The bottlenose dolphin most likely would avoid the area directly adjacent to the diffuser ports, but this area would be limited in size compared to the area of the Gulf where they would feed.

H.4.1.3 Reptiles

H.4.1.3.1 Atlantic Hawksbill Sea Turtle

The Atlantic hawksbill sea turtle nests from May to November on sandy beaches, often in the proximity of coral reefs. The turtle is seen occasionally in Texas, including coastal areas of Brazoria and Galveston Counties, but more commonly in more tropical waters. The brine disposal pipeline would be the only element of the proposed Stratton Ridge site development with a potential to affect this species.

Construction Impacts

Construction of the brine disposal pipeline onshore would have no effect on this species because directional drilling would be used for the pipeline in the area where it would pass under the beach to the Gulf of Mexico. Offshore pipeline construction temporarily would disturb potential feeding habitat for the Atlantic hawksbill sea turtle; however, the total area affected would be a small portion of the total available area of suitable habitat, and there would be no effect.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would not affect the Atlantic hawksbill sea turtle because the pipeline would be buried. Operation of the offshore component of the brine disposal system would have no effect on the sea turtle's feeding and habitat because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat). Maintenance of the pipeline offshore would be infrequent, and it would not affect the Atlantic hawksbill sea turtle.

H.4.1.3.2 Green Sea Turtle

The green sea turtle nest from March to October in tidal flats, pelagic zones, and isolated sand dunes. The turtle is seen occasionally in Texas, including coastal areas of Brazoria and Galveston Counties, but more commonly in more tropical waters. The brine disposal pipeline would be the only element of the proposed Stratton Ridge development with a potential to affect this species.

Construction Impacts

Construction of the brine disposal pipeline onshore would have no effect on this species because directional drilling would be used for the pipeline in the area where it would pass under the beach to the Gulf of Mexico. Offshore pipeline construction temporarily would disturb potential feeding habitat for the green sea turtle; however, the total area affected would be a small portion of the total available area of suitable habitat, and there would be no effect on the species.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would not affect the green sea turtle because the pipeline would be buried. Operation of the offshore component of the brine disposal system would have no effect on the sea turtle's feeding and habitat because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat). Maintenance of the pipeline offshore would be infrequent, and it would not affect the green sea turtle.

H.4.1.3.3 Kemp's Ridley Sea Turtle

The Kemp's Ridley sea turtle inhabits estuarine waters of the Gulf, including coastal areas of Brazoria and Galveston Counties, with nesting occurring on coastal beaches and dunes. Woodrow (2005) of TPWD noted that the Kemp's Ridley sea turtle potentially could inhabit areas near portions of the Stratton Ridge development. The brine disposal pipeline would be the only element of the proposed Stratton Ridge site development with a potential to affect this species.

Construction Impacts

Construction of the brine disposal pipeline onshore would not affect this species because directional drilling would be used for the pipeline, and it would pass under the beach to the Gulf of Mexico. Offshore pipeline construction temporarily would disturb potential feeding habitat for the Kemp's Ridley sea turtle; however, the total area affected would be a small portion of the total available area of suitable habitat, and there would be no effect.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would not affect the Kemp's Ridley sea turtle because the pipeline would be buried. Operation of the offshore component of the brine disposal system would have no effect on the sea turtle's feeding and habitat because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat). Maintenance of the pipeline offshore would be infrequent, and it would not affect the Kemp's Ridley sea turtle.

H.4.1.3.4 Leatherback Sea Turtle

The leatherback sea turtle inhabits open ocean waters and seeks moist sand on sloping sandy beaches backed by vegetation for nesting between March and August, and it has been recorded in Brazoria and Galveston Counties. The brine disposal pipeline would be the only element of the proposed Stratton Ridge development with a potential to affect this species.

Construction Impacts

Construction of the brine disposal pipeline onshore would not affect the leatherback sea turtle because directional drilling would be used for the pipeline, and it would pass under the beach to the Gulf of Mexico. Offshore pipeline construction temporarily would disturb potential feeding habitat for the leatherback sea turtle; however, the total area affected would be a small portion of the total available area of suitable habitat, and there would be no effect.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would not affect the leatherback sea turtle because the pipeline would be buried. Operation of the offshore component of the brine disposal system would have no effect on the sea turtle's feeding and habitat because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat). Maintenance of the pipeline offshore would be infrequent, and it would not affect the leatherback sea turtle.

H.4.1.3.5 Loggerhead Sea Turtle

The loggerhead sea turtle can be found in both open ocean waters and along the coast and in near-shore waters (such as river mouths), and it nests on Gulf Coast beaches, including those of Brazoria and Galveston Counties. The brine disposal pipeline would be the only element of the proposed Stratton Ridge site development with a potential to affect this species.

Construction Impacts

Construction of the brine disposal pipeline onshore would not affect the loggerhead sea turtle because directional drilling would be used for the pipeline and it would pass under the beach to the Gulf of Mexico. Offshore pipeline construction would temporarily disturb potential feeding habitat for the loggerhead sea turtle. However, the total area affected would be a small portion of the total available area of suitable habitat, and there would be no effect.

Operation and Maintenance Impacts

Operation and maintenance of the onshore portion of the brine disposal pipeline would not affect the loggerhead sea turtle because the pipeline would be buried. Operation of the offshore component of the brine disposal system would have negligible impact on the sea turtle's feeding and habitat because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat). Maintenance of the pipeline offshore would be infrequent and would not affect the loggerhead sea turtle.

H.4.2 Big Hill, Texas

This assessment for the proposed Big Hill expansion site evaluates the potential effects on threatened, endangered, and candidate species by each of the elements of the proposed site expansion listed in table H.4.2-1.

The following paragraphs describe the evaluation findings for each species that could result from the elements of the proposed action at the Big Hill site expansion.

Table H.4.2-1: Elements of the Proposed Action and Location at the Proposed Big Hill Expansion Site

Element of Proposed Action	Location by County or Offshore Area
Big Hill candidate site	Jefferson
Oil distribution pipeline ROW from Big Hill to the Sun Terminal in Nederland	Jefferson
Brine disposal pipeline[a] ROW	Jefferson
Offshore brine pipeline and diffuser	Gulf of Mexico

[a] Only 7,000 feet (2,130 meters) of the brine disposal pipeline, starting from where it leaves the site, would be replaced.

H.4.2.1 Bird

The piping plover is known to inhabit Jefferson County, and the species uses beaches, mudflats, and sandflats on the Gulf of Mexico and the ICW for feeding but not nesting. The proposed expansion development would not be located in this type of habitat; therefore, construction, operation, and maintenance activities associated with the Big Hill expansion would have no effect on the piping plover.

H.4.2.2 Marine Mammals

The operation of the brine disposal system would have no effect on the Gervais beaked whale, goose-beaked whale, pygmy sperm whale, dwarf sperm whale, sperm whale, rough-toothed dolphin, killer whale, false killer whale, short-finned pilot whale, or the pygmy killer whale. These species are found in deeper waters than the brine diffuser contours (see Appendix C, Brine Plume Modeling).

The next paragraphs describe potential impacts on the Atlantic spotted dolphin and the West Indian manatee.

H.4.2.2.1 Atlantic Spotted Dolphin

The Atlantic spotted dolphin is a tropical species that can be found in a variety of areas through the Gulf of Mexico. This dolphin ranges from coastal to pelagic environments, typically over the continental shelf and slope. The Atlantic spotted dolphin is usually associated with the Gulf Stream.

Construction Impacts

No offshore construction is associated with the proposed Big Hill expansion; therefore, there would be no effect to the Atlantic spotted dolphin.

Operation Impacts

The Atlantic spotted dolphin may occur in the location of the brine diffusion; however, it is unlikely that the species would remain in the area for an extended period. Because the dissipation of the brine would occur in a relatively small area of the Gulf of Mexico and the species would not be restricted to such areas, there would be no effect on the Atlantic spotted dolphin.

H.4.2.2.2 West Indian Manatee

The West Indian manatee, also known as the Florida manatee, is found in the warm, coastal and inland waters where it feeds. The manatee typically does not extend beyond the borders of Florida and Alabama, but sometimes it is found along the entire coast of the Gulf of Mexico.

Construction Impacts

No offshore construction is associated with the proposed Big Hill expansion; therefore, there would be no effect to the West Indian manatee.

Operation Impacts

The West Indian manatee is rarely found off the coast of Texas or in coastal inland water including the ICW. The operation of the RWI would not affect the West Indian manatee. There would be no effect on the West Indian manatee because it rarely occurs off the coast of Texas, the dissipation of the brine would occur in a relatively small area of the Gulf of Mexico, and the species would not be restricted to such areas.

H.4.2.2.3 Bottlenose Dolphin

The bottlenose dolphin (*Tursiops truncatus*) typically can be found in coastal or offshore waters. In the coastal environment, the bottlenose dolphin can be found in warm, sallow inshore waters of bays and rivers. When offshore, it is usually in deep waters over the continental shelf and slope.

Construction Impacts

No offshore construction is associated with the proposed Big Hill expansion; therefore, there would be no effect to the bottlenose dolphin.

Operation Impacts

The operation of the brine diffusers offshore for the Big Hill site would not impact the bottlenose dolphin. The dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance. The bottlenose dolphin most likely would avoid the area directly adjacent to the diffuser ports, but this area would be limited in size compared to the area of the Gulf where the species would feed.

H.4.2.3 Reptiles

H.4.2.3.1 Atlantic Hawksbill Sea Turtle

The Atlantic hawksbill turtle nests from May to November on sandy beaches, often in the proximity of coral reefs. The turtle is occasionally seen in Texas, including Jefferson County, but more commonly it is found in more tropical waters. None of the new development for the expansion of the Big Hill site would be located in this type of habitat; therefore, construction of the Big Hill expansion would have no effect on the Atlantic hawksbill sea turtle. Operation of the offshore component of the brine disposal system would result in a brine plume; however, the plume would have no effect on the sea turtle's feeding and habitat because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat).

H.4.2.3.2 Green Sea Turtle

The green sea turtle nests from March to October in tidal flats, pelagic zones, and isolated sand dunes. The turtle is occasionally seen in Texas, including Jefferson County, but more commonly it is found in more tropical waters. No new development would be required for the expansion of the Big Hill site in this type of habitat; therefore, construction of the Big Hill expansion would have no effect on the green sea turtle. Operation of the offshore component of the brine disposal system would result in a brine plume; however, the plume would have no effect on the sea turtle's feeding and habitat because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat).

H.4.2.3.3 Kemp's Ridley Sea Turtle

The Kemp's Ridley sea turtle inhabits estuarine waters of the Gulf Coast, including coastal areas of Jefferson County, with nesting occurring on coastal beaches and dunes. No new development for the expansion of the Big Hill site would be located in this type of habitat; therefore, construction of the Big Hill expansion would have no effect on the Kemp's Ridley sea turtle. Operation of the offshore component of the brine disposal system would result in a brine plume; however, the plume would have no effect on the sea turtle's feeding and habitat because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat).

H.4.2.3.4 Leatherback Sea Turtle

The leatherback sea turtle inhabits open ocean waters and seeks moist sand on sloping sandy beaches backed by vegetation for nesting between March and August. The turtle is found along the Gulf, including coastal areas of Jefferson County. No new development for the expansion of the Big Hill site would be located in this type of habitat; therefore, construction of the Big Hill expansion would have no effect on the leatherback sea turtle. Operation of the offshore component of the brine disposal system would result in a brine plume; however, the plume would have no effect on the sea turtle's feeding and habitat because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat).

H.4.2.3.5 Loggerhead Sea Turtle

The loggerhead sea turtle may nest Gulf Coast beaches, including those of Jefferson County. No new development for the expansion of the Big Hill site would be located in this type of habitat; therefore, construction of the Big Hill expansion would have no effect on the loggerhead sea turtle. Operation of the offshore component of the brine disposal system would result in a brine plume; however, the plume would have no effect on the sea turtle's feeding and habitat because the dissipation of the concentrated brine would allow for ambient or near-ambient conditions to exist in a short distance (see Appendix E, Essential Fish Habitat).

H.4.3 Assessment Summary for the Stratton Ridge and Big Hill Sites

Tables H.4.3-1 through H.4.3-4 identify the threatened, endangered, and candidate species that may be affected by each element the proposed new Stratton Ridge site and proposed expansion of the Big Hill site. DOE estimated the potential for effects based on information about the presence or absence of the species and suitable habitat in areas that would be affected by development. The evaluation also considered the potential mitigation factors. Tables H.4.3-1 and H.4.3-3 identify whether construction

Table H.4.3-1: Summary of Potential Construction-Related Impacts on Threatened and Endangered Species at the Proposed Stratton Ridge Site

Species	SPR Storage Site	Stratton Ridge to Texas City ROW	RWI and ROW to ICW	Brine Disposal Pipeline ROW to Gulf of Mexico	Offshore Brine Diffuser Discharge
Birds					
Attwater's Greater Prairie Chicken	No effect	No effect	No effect	No effect	No effect
Bald Eagle	May affect	No effect	May affect	No effect	No effect
Brown Pelican	No effect	No effect	No effect	No effect	No effect
Eskimo Curlew	No effect	No effect	No effect	No effect	No effect
Piping Plover	No effect	No effect	No effect	No effect	No effect
Whooping Crane	No effect	No effect	No effect	No effect	No effect
Marine Mammals					
Gervais Beaked Whale	No effect	No effect	No effect	No effect	No effect
Goose-Beaked Whale	No effect	No effect	No effect	No effect	No effect
Pygmy Sperm Whale	No effect	No effect	No effect	No effect	No effect
Dwarf Sperm Whale	No effect	No effect	No effect	No effect	No effect
Sperm Whale	No effect	No effect	No effect	No effect	No effect
Atlantic Spotted Dolphin	No effect	No effect	No effect	No effect	No effect
Rough-Toothed Dolphin	No effect	No effect	No effect	No effect	No effect
Killer Whale	No effect	No effect	No effect	No effect	No effect
False Killer Whale	No effect	No effect	No effect	No effect	No effect
Short-Finned Pilot Whale	No effect	No effect	No effect	No effect	No effect
Pygmy Killer Whale	No effect	No effect	No effect	No effect	No effect
West Indian Manatee	No effect	No effect	No effect	No effect	No effect
Bottlenose Dolphin	No effect	No effect	No effect	No effect	No effect
Reptiles					
Atlantic Hawksbill Sea Turtle	No effect	No effect	No effect	No effect	No effect
Green Sea Turtle	No effect	No effect	No effect	No effect	No effect
Kemps Ridley Sea Turtle	No effect	No effect	No effect	No effect	No effect
Leatherback Sea Turtle	No effect	No effect	No effect	No effect	No effect
Loggerhead Sea Turtle	No effect	No effect	No effect	No effect	No effect

Table H.4.3-2: Summary of Potential Operation and Maintenance Impacts to Affect Threatened and Endangered Species at the Proposed Stratton Ridge Site

Species	SPR Storage Site	Stratton Ridge to Texas City ROW	RWI and ROW to ICW	Brine Disposal Pipeline ROW to Gulf of Mexico	Offshore Brine Diffuser Discharge
Birds					
Attwater's Greater Prairie Chicken	No effect	No effect	No effect	No effect	No effect
Bald Eagle	May affect	No effect	May affect	No effect	No effect
Brown Pelican	No effect	No effect	No effect	No effect	No effect
Eskimo Curlew	No effect	No effect	No effect	No effect	No effect
Piping Plover	No effect	No effect	No effect	No effect	No effect
Whooping Crane	No effect	No effect	No effect	No effect	No effect
Marine Mammals					
Gervais Beaked Whale	No effect	No effect	No effect	No effect	No effect
Goose-Beaked Whale	No effect	No effect	No effect	No effect	No effect
Pygmy Sperm Whale	No effect	No effect	No effect	No effect	No effect
Dwarf Sperm Whale	No effect	No effect	No effect	No effect	No effect
Sperm Whale	No effect	No effect	No effect	No effect	No effect
Atlantic Spotted Dolphin	No effect	No effect	No effect	No effect	No effect
Rough-Toothed Dolphin	No effect	No effect	No effect	No effect	No effect
Killer Whale	No effect	No effect	No effect	No effect	No effect
False Killer Whale	No effect	No effect	No effect	No effect	No effect
Short-Finned Pilot Whale	No effect	No effect	No effect	No effect	No effect
Pygmy Killer Whale	No effect	No effect	No effect	No effect	No effect
West Indian Manatee	No effect	No effect	No effect	No effect	No effect
Bottlenose Dolphin	No effect	No effect	No effect	No effect	No effect
Reptiles					
Atlantic Hawksbill Sea Turtle	No effect	No effect	No effect	No effect	No effect
Green Sea Turtle	No effect	No effect	No effect	No effect	No effect
Kemps Ridley Sea Turtle	No effect	No effect	No effect	No effect	No effect
Leatherback Sea Turtle	No effect	No effect	No effect	No effect	No effect
Loggerhead Sea Turtle	No effect	No effect	No effect	No effect	No effect

Table H.4.3-3: Summary of Potential of Construction-Related Impacts on Threatened and Endangered Species at Proposed Big Hill Expansion Site

Species	SPR Storage Site	Big Hill Site to Shell Crude Oil Pipeline ROW	Brine Disposal Pipeline ROW	Brine Diffuser Discharge
Bird				
Piping Plover	No effect	No effect	No effect	No effect
Marine Mammals				
Gervais Beaked Whale	No effect	No effect	No effect	No effect
Goose-Beaked Whale	No effect	No effect	No effect	No effect
Pygmy Sperm Whale	No effect	No effect	No effect	No effect
Dwarf Sperm Whale	No effect	No effect	No effect	No effect
Sperm Whale	No effect	No effect	No effect	No effect
Atlantic Spotted Dolphin	No effect	No effect	No effect	No effect
Rough-Toothed Dolphin	No effect	No effect	No effect	No effect
Killer Whale	No effect	No effect	No effect	No effect
False Killer Whale	No effect	No effect	No effect	No effect
Short-Finned Pilot Whale	No effect	No effect	No effect	No effect
Pygmy Killer Whale	No effect	No effect	No effect	No effect
West Indian Manatee	No effect	No effect	No effect	No effect
Bottlenose Dolphin	No effect	No effect	No effect	No effect
Reptiles				
Atlantic Hawksbill Sea Turtle	No effect	No effect	No effect	No effect
Green Sea Turtle	No effect	No effect	No effect	No effect
Kemps Ridley Sea Turtle	No effect	No effect	No effect	No effect
Leatherback Sea Turtle	No effect	No effect	No effect	No effect
Loggerhead Sea Turtle	No effect	No effect	No effect	No effect

Table H.4.3-4: Summary of Potential Operation and Maintenance Impacts to Threatened and Endangered Species from Proposed Big Hill Site Expansion

Species	SPR Storage Site	Big Hill Site to Shell Crude Oil Pipeline ROW	Brine Disposal Pipeline ROW	Brine Diffuser Discharge
Bird				
Piping Plover	No effect	No effect	No effect	No effect
Marine Mammals				
Gervais Beaked Whale	No effect	No effect	No effect	No effect
Goose-Beaked Whale	No effect	No effect	No effect	No effect
Pygmy Sperm Whale	No effect	No effect	No effect	No effect
Dwarf Sperm Whale	No effect	No effect	No effect	No effect
Sperm Whale	No effect	No effect	No effect	No effect
Atlantic Spotted Dolphin	No effect	No effect	No effect	No effect
Rough-Toothed Dolphin	No effect	No effect	No effect	No effect
Killer Whale	No effect	No effect	No effect	No effect
False Killer Whale	No effect	No effect	No effect	No effect
Short-Finned Pilot Whale	No effect	No effect	No effect	No effect
Pygmy Killer Whale	No effect	No effect	No effect	No effect
West Indian Manatee	No effect	No effect	No effect	No effect
Bottlenose Dolphin	No effect	No effect	No effect	No effect
Reptiles				
Atlantic Hawksbill Sea Turtle	No effect	No effect	No effect	No effect
Green Sea Turtle	No effect	No effect	No effect	No effect
Kemps Ridley Sea Turtle	No effect	No effect	No effect	No effect
Leatherback Sea Turtle	No effect	No effect	No effect	No effect
Loggerhead Sea Turtle	No effect	No effect	No effect	No effect

activities for each site may affect species. Tables H.4.3-2 and H.4.3-4 summarize whether operation and maintenance activities for each site may affect species.

Table H.4.3-5 summarizes the number of species that would be affected by construction or operations and maintenance for both of the sites in Texas. This summary shows that with the current information, only one species (the bald eagle) may be affected by the construction and operation of the proposed new Stratton Ridge site, and no species would be affected by the proposed expansion of the Big Hill site.

Table H.4.3-5: Summary of the Number of Species Potentially Affected

Potential for Effect	Number of Species			
	Stratton Ridge, Texas		Big Hill, Texas	
	Construction	Operation and Maintenance	Construction	Operation and Maintenance
No effect	23	23	19	19
May affect	1	1	0	0

H.5 RECOMMENDATIONS

The evaluation of potential impacts described in section H.4 considered how some potential impacts could be minimized, avoided, or more accurately forecasted by the use of preconstruction field investigations, mitigation measures, and other precautionary measures. The following recommendations summarize the types of measures identified in section H.4 that would lessen the potential for effects caused by the development of the proposed new and expansion SPR sites in Texas. Additional measures may be identified during detailed planning if DOE were to select both the Stratton Ridge site and the Big Hill site for development or only the expansion of the Big Hill site.

H.5.1 Recommendations for Stratton Ridge, Texas

- Conduct a preconstruction survey to identify bald eagle nests within 0.25 miles (0.4 kilometers) of the proposed Stratton Ridge site and the proposed ROW from the site to the Gulf of Mexico for the RWI and brine disposal pipelines and power lines in Brazoria County, Texas. If any nests are found, consult with the USFWS and TPWD and implement appropriate mitigation strategies. For example, construction of the pipeline could be completed to avoid the time when nesting bald eagles are particularly sensitive to human activity. If nests or active foraging are identified near the proposed RWI structure, DOE would use noise attenuation measures such as concrete enclosures for the pumps and installation of quieter pump equipment.

- Coordinate with USFWS and TPWD if any protected species are observed or suitable habitat is determined to be present onsite.

- Use directional drilling in all beach crossings to avoid affecting sea turtles and sea birds that use the beaches.

H.5.2 Recommendations for Big Hill, Texas

Coordinate with USFWS and TPWD if any protected species are observed or suitable habitat is determined to be present onsite.

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Appendix I
State Listed Species Screening Evaluation

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Appendix I
State Listed Species Screening Evaluation

I.1 INTRODUCTION

This appendix to the draft environmental impact statement (DEIS) analyzes potential effects of the expansion of the Strategic Petroleum Reserve (SPR) on endangered and threatened species protected under State laws in Louisiana, Mississippi, and Texas. The potential impacts to species that are afforded protection under both Federal and state laws are described in appendices F, G, and H respectively. The potential expansion would involve developing additional storage capacity at up to three existing sites (West Hackberry and Bayou Choctaw in Louisiana and Big Hill in Texas) or developing one of five new sites (Chacahoula and Clovelly in Louisiana, Richton and Bruinsburg in Mississippi, and Stratton Ridge in Texas), or a combination of the sites at Clovelly and Bruinsburg. In addition, this appendix includes an analysis of species listed as regional forest service sensitive species in the Homochitto National Forest (USDA 2000). Part of the proposed pipelines associated with the Bruinsburg site would include land in the National forest. No screening table was prepared for Louisiana because species on the State list could be affected by proposed action concerning threatened and endangered species on the Federal list. Appendix F contains an evaluation of those species.

I.2 SCREENING EVALUATION TABLES

The following screening evaluation tables indicate threatened or endangered species on the State list and forest service sensitive species that may have a habitat in a proposed new or expansion SPR site or its associated infrastructure (e.g. terminals, pipeline and power line rights-of-way). To collect information for this screening evaluation, the Department of Energy (DOE) consulted state-based land cover data, U.S. Fish and Wildlife Wetland inventory data, state data from fish and wildlife agencies and natural heritage programs (LNHP 2004; MMNS 2002; TPWD 2005), and literature reviews covering threatened and endangered species in each state to define preferred habitats and life cycles. Results of this screening evaluation of all the state-listed species that may be affected by construction and operation of any of the proposed new or expansion sites and its associated elements appears in corresponding chapter sections of the DEIS.

Following is a list of screening evaluation tables that appear in this appendix:

Table I.2-1 State Threatened or Endangered Species and Forest Service Sensitive Species in Area of Proposed Bruinsburg, MS, Site;

Table I.2-2 State Threatened or Endangered Species in Area of Proposed Richton, MS, Site;

Table I.2-3 State Threatened or Endangered Species in Area of Proposed Stratton Ridge, TX, Site; and

Table I.2-4 State Threatened or Endangered Species in Area of Proposed Big Hill, TX, Expansion Site.

Table I.2-1: State Threatened or Endangered Species and Forest Service Sensitive Species in Area of Proposed Bruinsburg, MS, Site[a]

Species Information					Potential Presence of Species Based on Preferred Habitat of the Species and the Existing Habitat							References
Common Name	Latin Name	County or Parish	State Status[b]	Habitat Description	Candidate Site	Bruinsburg to Peetsville ROW and Terminal	Bruinsburg to Anchorage ROW and Terminal	Bruinsburg to Vicksburg ROW	Bruinsburg to Jackson ROW and Terminal	RWI and ROW	Brine Disposal ROW	
Birds												
Arctic Peregrine Falcon[c]	*Falco peregrinus tundrius*	*Louisiana:* East and West Feliciana, East and West Baton Rouge	T/E	Occurs in the barrier islands along the Gulf Coast, which are important feeding areas for long-distance migrants.								24
Bewick's Wren	*Thryomanes bewickii*	*Mississippi:* Warren	E	Occurs in old fields, chaparral, coniferous and hardwood forests, and suburban areas and orchards.				X	X			24
Fish												
Crystal Darter[d]	*Crystallaria asprella*	*Mississippi:* Copiah, Claiborne	E	Occurs in small- to medium-sized freshwater rivers, and prefers water more than 2-feet (60-centimeters) deep with a strong current and a clean sand and/or gravel bottom.		X		X	X	X		24
Frecklebelly Madtom[e]	*Noturus munitus*	*Mississippi:* Copiah	E	Thrives in large- to medium-sized rivers with a high to moderate gradient.		X		X	X	X		24
Southern Redbelly Dace[f]	*Phoxinus erythrogaster*	*Mississippi:* Wilkinson, Warren	E	Occurs in small creeks and prefers headwaters and upland creeks with clear water. Spawning takes place from April to June in the south, most often in shallow water near riffles among gravel, and occasionally in nests of other species.			X	X	X			24

Table I.2-1: State Threatened or Endangered Species and Forest Service Sensitive Species in Area of Proposed Bruinsburg, MS, Site[a]

Species Information					Potential Presence of Species Based on Preferred Habitat of the Species and the Existing Habitat							References
Common Name	Latin Name	County or Parish	State Status[b]	Habitat Description	Candidate Site	Bruinsburg to Peetsville ROW and Terminal	Bruinsburg to Anchorage ROW and Terminal	Bruinsburg to Vicksburg ROW	Bruinsburg to Jackson ROW and Terminal	RWI and ROW	Brine Disposal ROW	
Invertebrates												
Pearl Blackwater Crayfish	*Procambarus penni*	*Mississippi:* Copiah	NA[g]	Burrows in streambeds, banks, and dry water bodies, including areas in Homochitto National Forest.		X						16. 33
Sheepnose	*Plethobasus Cyphyus*	*Mississippi:* Hinds and Warren	E	Occurs mainly in large rivers (but also medium-sized rivers) where it is usually found in water more than 6.6 feet (2 meters) deep with a slight to swift current and a mud, sand, or gravel bottom.				X	X			12, 27
Rabbitsfoot	*Quadrula cylindrica cylindrical*	*Mississippi:* Hinds	E	Occurs in small- and medium-sized rivers with moderate to swift currents, in sand and gravel in medium- to large-sized rivers, and in bars or gravel close to a fast current in smaller streams. Generally inhabits water up to 9.8 feet (3 meters) deep.				X	X			8, 12, 26
Mammals												
Southeastern Shrew	*Sorex longirostris*	*Mississippi*[h]	NA[g]	Occurs in various habitats ranging from bogs to damp woods to uplands shrub and scrub or wooded areas; however, prefers moist to wet areas, often associated with heavy ground cover, including areas in Homochitto National Forest.		X						24, 33

Table I.2-1: State Threatened or Endangered Species and Forest Service Sensitive Species in Area of Proposed Bruinsburg, MS, Site[a]

Species Information					Potential Presence of Species Based on Preferred Habitat of the Species and the Existing Habitat							References
Common Name	Latin Name	County or Parish	State Status[b]	Habitat Description	Candidate Site	Bruinsburg to Peetsville ROW and Terminal	Bruinsburg to Anchorage ROW and Terminal	Bruinsburg to Vicksburg ROW	Bruinsburg to Jackson ROW and Terminal	RWI and ROW	Brine Disposal ROW	
Plants												
Trillium	*Trillium foetidissimum*	*Mississippi:* Adams, Claiborne, Copiah, Jefferson, Lincoln, Wilkinson	NA[g]	Occurs in moderately moist deciduous woodlands with rich soil usually including loess (an unstratified loamy deposit chiefly deposited by the wind), on moderate to steep slopes, sides of ravines, and knolls within floodplain forests, including areas in Homochitto National Forest.		X						24, 33
Reptiles												
Rainbow Snake	*Farancia erytrogramma*	*Mississippi:* Copiah	E	Usually found in or near streams, marshes, springs, and sandy fields.	X	X	X	X	X	X	X	11

RWI = raw water intake; ROW = right-of-way

Notes:

[a] Species on State lists that are also on Federal lists as endangered, threatened, or candidate species are not included in this table because they are evaluated in detail in Appendix G Evaluations of Special Status Species in Mississippi. Excluded species are:

Birds: Bald eagle, interior least tern, red-cockaded woodpecker;
Fish: Bayou darter, Gulf sturgeon, pallid sturgeon;
Invertebrates: Alabama heelsplitter mussel, fat pocketbook mussel;
Mammals: Louisiana black bear, West Indian manatee; and
Reptiles: Ringed map turtle.

[b] **State Status:** T=threatened; E=endangered.

[c] **Arctic peregrine falcon:** Preferred habitat is not present at the proposed Bruinsburg site.

[d] **Crystal darter:** DOE is consulting with the U.S. Fish and Wildlife Service, the Mississippi Department of Wildlife, Fisheries, and Parks, and the Mississippi Museum of Natural Science about specific water bodies in Copiah and Claiborne Counties where this species is found. Impacts associated with the Peetsville ROW would be possible if the species is found in Clarks Creek (a tributary to Bayou Pierre) or the Homochitto River. Impacts associated with the raw water intake could occur if the species is in the Mississippi River. No impacts would occur if the species is found in Bayou Pierre.

[e] **Frecklebelly madtom**: DOE is consulting with the U.S. Fish and Wildlife Service, the Mississippi Department of Wildlife, Fisheries, and Parks, and the Mississippi Museum of Natural Science about specific water bodies in Copiah County where this species is found. Impacts associated with the Peetsville ROW would be possible if the species is found in Clarks Creek (a tributary to Bayou Pierre). Impacts associated with the raw water intake could occur if the species is found in the Mississippi River. No impacts would occur if the species is found in Bayou Pierre.

[f] **Southern redbelly dace**: DOE is consulting with the U.S. Fish and Wildlife Service, the Mississippi Department of Wildlife, Fisheries, and Parks, and the Mississippi Museum of Natural Science about specific water bodies in Wilkinson County. The only pipeline proposed to cross this county is at the Buffalo River. Potential impacts would not be expected if the species is not in the Buffalo River. If it is found in the river, directional drilling may be a construction consideration.

[g] Pearl blackwater crayfish, southeastern shrew, and trillium do not have a State status of threatened or endangered in Mississippi; however, these species are listed as regional forest service sensitive species in the Homochitto National Forest according to the National Forests in Mississippi Forest Plan (USDA 2000).

[h] The southeastern shrew is found throughout Mississippi, but it is not specifically listed in any of the counties associated with the proposed Bruinsburg candidate site. The U.S. Forest Service lists the southeastern shrew as a regional forest service sensitive species in the Homochitto National Forest (USDA 2000); therefore, it is included in this list.

Table I.2-2: State Threatened or Endangered Species in Area of Proposed Richton, MS, Site[a]

Species Information					Potential Presence of Species Based on Preferred Habitat of the Species and the Existing Habitat					References
Common Name	**Latin Name**	**County**	**State Status[b]**	**Habitat Description**	**Candidate Site**	**Richton to Pascagoula ROW and Terminal**	**Richton to Liberty Station ROW and Terminal**	**RWI and ROW**	**Brine Diffuser and ROW**	
Amphibians										
Dark Gopher Frog	*Rana sevosa*	*Mississippi:* Forrest, Jackson	E	Occurs in upland evergreen forested areas and prefers upland sandy areas historically forested with longleaf pine with isolated temporary wetland breeding sites nearby.		X	X			1
One-Toed Amphiuma	*Amphiuma pholeter*	*Mississippi:* Jackson	E	Occurs in swamps and slow-moving streams and prefers deep, organic, liquid muck in swamps, spring runs, and occasionally floodplain swampy streams.		X			X	24
Birds										
Bewick's Wren	*Thryomanes bewickii*	*Mississippi:* Jackson	E	Occurs in old fields, chaparral, coniferous and hardwood forests, and suburban areas and orchards.		X				24
Fish										
Crystal Darter[c]	*Crystallaria asparella*	*Mississippi:* Marion	E	Occurs in small- to medium-sized freshwater rivers, and prefers water more than 2-feet (60-centimeters) deep with a strong current on a clean sand and/or gravel bottom.			X			24
Frecklebelly Madtom[d]	*Noturus munitus*	*Mississippi:* Marion, Pike, Walthall	E	Thrives in large- to medium-sized rivers with a high to moderate gradient.			X			24
Ironcolor Shiner[e]	*Notropis chalybaeus*	*Mississippi:* Marion	E	Occurs in pools and slow runs of streams with a low gradient, small acidic creeks, and rivers with a sandy substrate and clear, well-vegetated water.			X			24
Invertebrates										
Delicate Spike[f]	*Elliptio arctata*	*Mississippi:* George	E	Found in rivers along the shoreline and among rocks, sand, and gravel.						5, 17

Table I.2-2: State Threatened or Endangered Species in Area of Proposed Richton, MS, Site[a]

Species Information					Potential Presence of Species Based on Preferred Habitat of the Species and the Existing Habitat					References
Common Name	**Latin Name**	**County**	**State Status[b]**	**Habitat Description**	**Candidate Site**	**Richton to Pascagoula ROW and Terminal**	**Richton to Liberty Station ROW and Terminal**	**RWI and ROW**	**Brine Diffuser and ROW**	
Reptiles										
Rainbow Snake	*Farancia erytrogramma*	*Mississippi:* Forrest, Jackson, Lamar	E	Usually found in or near streams, marshes, springs, and sandy fields.		X	X			11
Southern Hognose Snake	*Heterodon simus*	*Mississippi:* Forrest	E	Thrives in open, well-drained, sandy soil habitats in the southeastern United States.			X			7

RWI = raw water intake; ROW = right-of-way.

Notes:

[a] Species on State lists that are also on Federal lists as endangered, threatened, or candidate species are not included in this table because they are evaluated in detail in Appendix G Evaluations of Special Status Species in Mississippi. Excluded species are:

Birds: Bald eagle, brown pelican, Mississippi sandhill crane, piping plover, red-cockaded woodpecker;
Fish: Gulf sturgeon, pearl darter;
Invertebrates: Camp Shelby burrowing crayfish;
Mammals: Gray myotis, Louisiana black bear;
Plants: Louisiana quillwort; and
Reptiles: Alabama red-belly turtle, black pine snake, eastern indigo snake, gopher tortoise, Kemps Ridley sea turtle, loggerhead sea turtle, ringed map turtle, yellow-blotched map turtle.

[b] State Status T=threatened; E=endangered.

[c] Crystal darter: Species is in the Pearl River. No impact is expected because directional drilling would be used for the crossing.

[d] Frecklebelly madtom: Species is in the Pearl River and the Bogue Chitto River. No impact is expected at the Pearl River and Bogue Chitto River, because directional drilling would be used for the crossing.

[e] Ironcolor shiner: Species is in the Pearl River. No impact is expected because directional drilling would be used for the crossing.

[f] Delicate spike: Pascagoula ROW does not cross Pascagoula River where this species is found in George County.

Table I.2-3: State Threatened or Endangered Species in Area of Proposed Stratton Ridge, TX, Site[a]

Species Information					Potential Presence of Species Based on Preferred Habitat of the Species and the Existing Habitat					
Common Name	**Latin Name**	**County**	**State Status[b]**	**Habitat Description**	**Candidate Site**	**Stratton Ridge to Texas City ROW and Terminal**	**RWI and ROW to Intracoastal Waterway**	**ROW to Gulf of Mexico**	**Offshore Brine Diffuser**	**References**
Birds										
Arctic Peregrine Falcon	*Falco peregrinus tundrus*	Brazoria, Galveston	T	Occurs in the barrier islands along the Gulf coast, which are important feeding areas for long-distance migrants.				X		24
Eastern Brown Pelican	*Pelecanus occidentalis*	Brazoria, Galveston	E	Nests on small, isolated coastal islands where it is safe from predators.			X	X		32
Reddish Egret	*Egretta rufescens*	Brazoria, Galveston	T	Found in estuarine habitats where it forages in shallow water. Nests typically are located on natural or manmade dredge spoil islands, or occasionally on the mainland in mangrove swamps and terrestrial vegetation.			X	X		24, 28
Sooty Tern	*Sterna fuscata*	Brazoria, Galveston	T	Typically nests on remote outlying islets and rocks, sandy beaches, bare ground, or coral, most often with scattered grasses present or among bushes, occasionally on rocky ledges. Nonbreeding habitat is primarily pelagic.			X	X		24
Swallow-Tailed Kite	*Elanoides forficatus*	Brazoria, Galveston	T	Found in diverse vegetation types, including pine forests, savannas, cypress and cypress-hardwood swamps, mangrove swamps, hardwood hammocks, riparian forests, prairies, and freshwater and brackish marshes.	X	X	X			21. 31
White-Faced Ibis	*Plegadis chihi*	Brazoria, Galveston	T	Occurs in freshwater habitats, including marshes, swamps, ponds, and rivers in tropical to temperate zones.	X	X	X			2
White-Tailed Hawk	*Buteo albicaudatus*	Brazoria, Galveston	T	Thrives in prairies near the coastline, cordgrass flats, scrub-live oak, mesquite and oak savannas, and mixed savanna-chaparral.			X	X		18
Wood Stork	*Mycteria Americana*	Brazoria, Galveston	T	Found in freshwater marshes, swamps, lagoons, and ponds; forages in shallow freshwater wetlands, and has also been reported in brackish wetlands.	X	X	X	X		25

Table I.2-3: State Threatened or Endangered Species in Area of Proposed Stratton Ridge, TX, Site[a]

Species Information					Potential Presence of Species Based on Preferred Habitat of the Species and the Existing Habitat					
Common Name	Latin Name	County	State Status[b]	Habitat Description	Candidate Site	Stratton Ridge to Texas City ROW and Terminal	RWI and ROW to Intracoastal Waterway	ROW to Gulf of Mexico	Offshore Brine Diffuser	References
Fish										
Paddlefish[c]	*Polyodon spathula*	Brazoria, Galveston	T	Occurs in medium- and large-sized rivers and seeks slow-flowing segments with depths greater than 5 feet (1.5 meters). During winter, moves to deeper water, and in the summer is often found in areas downstream from submerged sandbars.						6, 29
Mammals										
Black Bear	*Ursus americanus*	Brazoria, Galveston	T	Occurs in mixed deciduous-coniferous forests and prefers areas with a thick understory.	X					15
Reptiles										
Alligator Snapping Turtle	*Macrochelys temminckii*	Galveston	T	Occurs in deep rivers, canals, and lakes associated with rivers, swamps, bayous, ponds near rivers, shallow tributaries to rivers, and sometimes the brackish waters near river mouths. Seeks segments with slow-moving currents.			X			24
Smooth Green Snake	*Liochlorphis vernalis*	Brazoria, Galveston	T	Occurs in grassland and forest and often can be found in burrows, fallen logs, and debris.	X	X	X			24
Texas Horned Lizard[c]	*Phrynosoma cornutum*	Brazoria, Galveston	T	Thrives in arid and semi-arid regions of sparse vegetation, including deserts, prairies, bajadas, dunes, and foothills.						4, 9, 13, 30
Timber Rattlesnake[c]	*Crotalus horridus*	Brazoria, Galveston	T	Seeks high, dry ridges with oak-hickory forest interspersed with open areas and deciduous forests with rock outcrops.						10, 22

RWI = raw water intake; ROW = right-of-way

NOTES:

[a] Species on State lists that are also on Federal lists as endangered, threatened, or candidate species are not included in this table because they are evaluated in detail in Appendix H Evaluations of Special Status Species in Texas. Excluded species are:

Birds: Attwater's greater prairie chicken, bald eagle, brown pelican, Eskimo curlew, least tern, piping plover, whooping crane;
Mammals: Jaguarundi, red wolf, West Indian manatee; and
Reptiles: Atlantic hawksbill sea turtle, green sea turtle, Kemp's Ridley sea turtle, leatherback sea turtle, loggerhead sea turtle.

[b] **State Status** T=threatened; E=endangered.

[c] **Paddlefish, Texas horned lizard, and timber rattlesnake:** Habitats for these species are not found on the proposed Stratton Ridge site.

Table I.2-4: State Threatened or Endangered Species in Area of Proposed Big Hill, TX, Expansion Site[a]

Species Information					Potential Presence of Species Based on Preferred Habitat of the Species and the Existing Habitat				
Common Name	**Latin Name**	**County**	**State Status[b]**	**Preferred Habitat Description**	**Expansion Site**	**Big Hill to Shell ROW**	**Brine Disposal ROW Upgrade Near Site**	**Brine Diffuser**	**References**
Birds									
Arctic peregrine Falcon	*Falco peregrinus tundrus*	Jefferson	T	Occurs in the barrier islands along the Gulf Coast, which are important feeding areas for long-distance migrants.					24
Bachman's Sparrow	*Aimophila aestivalis*	Jefferson	T	Occurs in mature or old-growth southern pine woodlands subject to growing-season fires; breeds wherever fires have created ideal conditions, including dry, open pine in southern states and oak woods with an undercover of grasses and shrubs.	X	X			24
Eastern Brown Pelican	*Pelecanus occidentalis*	Jefferson	E	Nests on small, isolated coastal islands where it is safe from predators.					32
Reddish Egret	*Egretta rufescens*	Jefferson	T	Found in estuarine habitats, where it forages in shallow water. Nests typically are located on natural or manmade dredge spoil islands, or occasionally on the mainland in mangrove swamps and terrestrial vegetation.		X	X		24, 28
Sooty Tern	*Sterna fuscata*	Jefferson	T	Typically nests on remote outlying islets and rocks, sandy beaches, bare ground, or coral, most often with scattered grasses present or among bushes, occasionally on rocky ledges. Nonbreeding habitat is primarily pelagic.					24
Swallow-Tailed Kite	*Elanoides forficatus*	Jefferson	T	Found in diverse vegetation types, including pine forests, savannas, cypress and cypress-hardwood swamps, mangrove swamps, hardwood hammocks, riparian forests, prairies, and freshwater and brackish marshes.	X	X	X		21. 31
White-Faced Ibis	*Plegadis chihi*	Jefferson	T	Occurs in freshwater habitats, including marshes, swamps, ponds, and rivers in tropical to temperate zones.	X	X	X		2
Wood Stork	*Mycteria Americana*	Jefferson	T	Found in freshwater marshes, swamps, lagoons, and ponds; forages in shallow freshwater wetlands, and has also been reported in brackish wetlands.	X	X	X		25
Fish									
Paddlefish	*Polyodon spathula*	Jefferson	T	Occurs in medium- and large-sized rivers and seeks slow-flowing segments with depths greater than 5 feet (1.5 meters). During winter, moves to deeper water, and in the summer is often found in areas downstream from submerged sandbars.					6, 29
Mammals									
Black Bear	*Ursus americanus*	Jefferson	T	Occurs in mixed deciduous-coniferous forests and prefers areas with a thick understory.	X				15

Table I.2-4: State Threatened or Endangered Species in Area of Proposed Big Hill, TX, Expansion Site[a]

Species Information					Potential Presence of Species Based on Preferred Habitat of the Species and the Existing Habitat				References
Common Name	**Latin Name**	**County**	**State Status[b]**	**Preferred Habitat Description**	**Expansion Site**	**Big Hill to Shell ROW**	**Brine Disposal ROW Upgrade Near Site**	**Brine Diffuser**	
Rafinesque's Big-Eared Bat	*Corynorhinus rafinesquii*	Jefferson	T	Inhabits forested regions; summer roosts often are in hollow trees, occasionally under loose bark, or in abandoned buildings in or near wooded areas. Bridges, especially girder bridges, are important day-roost sites. Hibernates in caves in northern and mountainous regions.	X	X			3, 14, 19, 24
Reptiles									
Alligator Snapping Turtle	*Macrochelys temminckii*	Jefferson	T	Occurs in deep rivers, canals, and lakes associated with rivers, swamps, bayous, ponds near rivers, shallow tributaries to rivers and sometimes the brackish waters near river mouths. Seeks segments with slow-moving currents.					24
Scarlet Snake	*Cemophora coccinea copei*	Jefferson	T	Occurs in hardwood, pine, or mixed forest and woodland habitats and burrows, fallen logs, and debris.	X	X			24
Texas Horned Lizard	*Phrynosoma cornutum*	Jefferson	T	Thrives in arid and semi-arid regions of sparse vegetation, including deserts, prairies, bajadas, dunes, and foothills.					4, 9, 13, 30
Timber rattlesnake	*Crotalus horridus*	Jefferson	T	Seeks high, dry ridges with oak-hickory forest interspersed with open areas and deciduous forests with rock outcrops.					10. 22

ROW = right-of-way

NOTES:

[a] Species on State lists that are also on Federal lists as endangered, threatened, or candidate species are not included in this table because they are evaluated in detail in Appendix H Evaluations of Special Status Species in Texas. Excluded species are:

Birds: Attwater's greater prairie chicken, brown pelican, least tern, piping plover;
Mammals: Red wolf, West Indian manatee; and
Reptiles: Atlantic hawksbill sea turtle, green sea turtle, Kemp's Ridley sea turtle, leatherback sea turtle, loggerhead sea turtle.

[b] **State Status** T=threatened; E=endangered.

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