Chapter 2. Proposed Action and Alternatives

2.1 INTRODUCTION

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

2.2 PROPOSED ACTION

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

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

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

2.2.1 Potential New Sites

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

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

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

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

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

2.2.2 Potential Expansion Sites

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

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

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

2.2.3 Alternatives

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

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

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

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

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

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

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

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

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

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

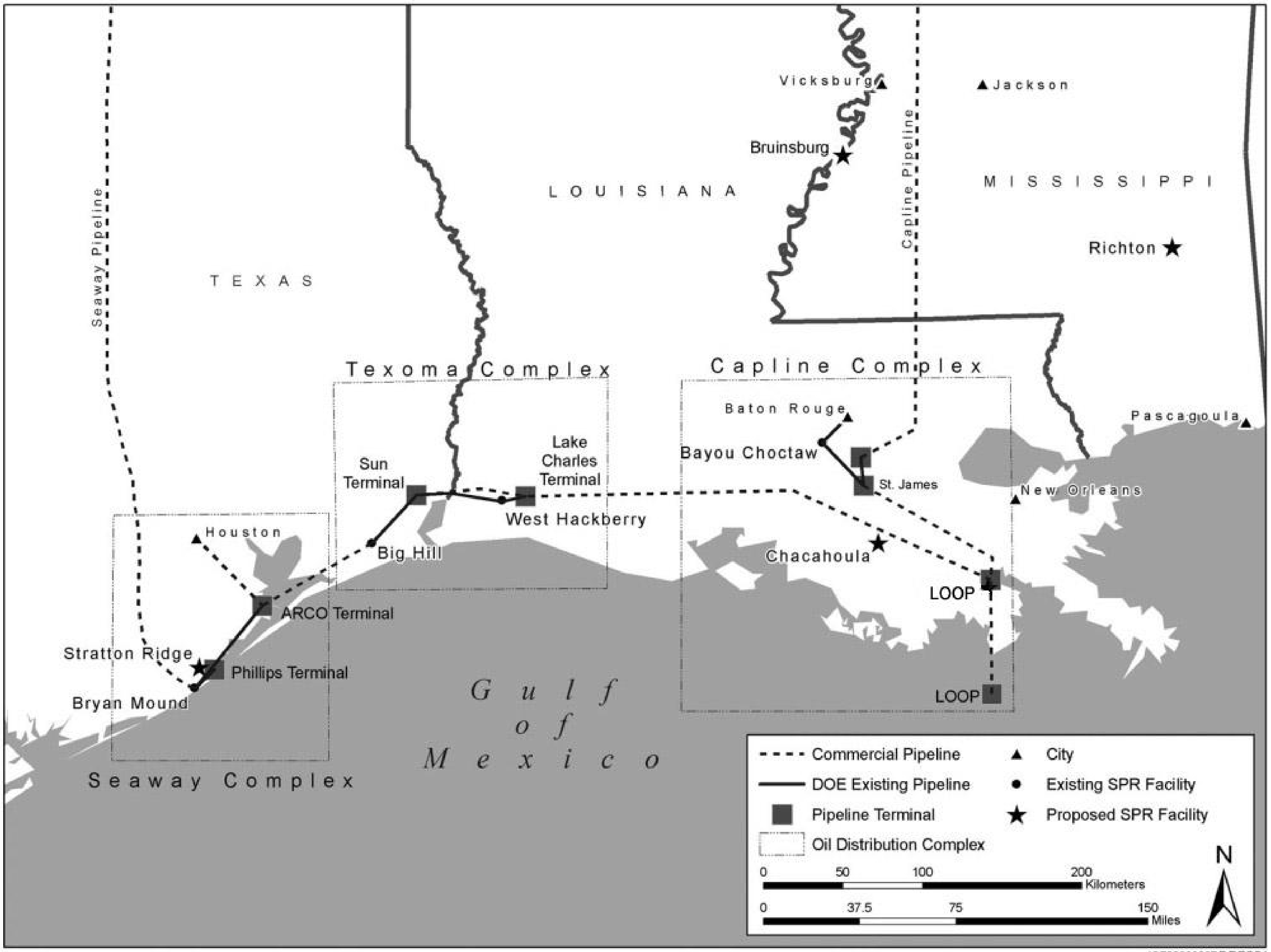
Table 2.2.3-1: Alternatives

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

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

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

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



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2.3 BACKGROUND ON CONSTRUCTION AND OPERATION OF SPR STORAGE SITES

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

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

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

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

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

2.3.1 Cavern Creation, Fill, and Drawdown System

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

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

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

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

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

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

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

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

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

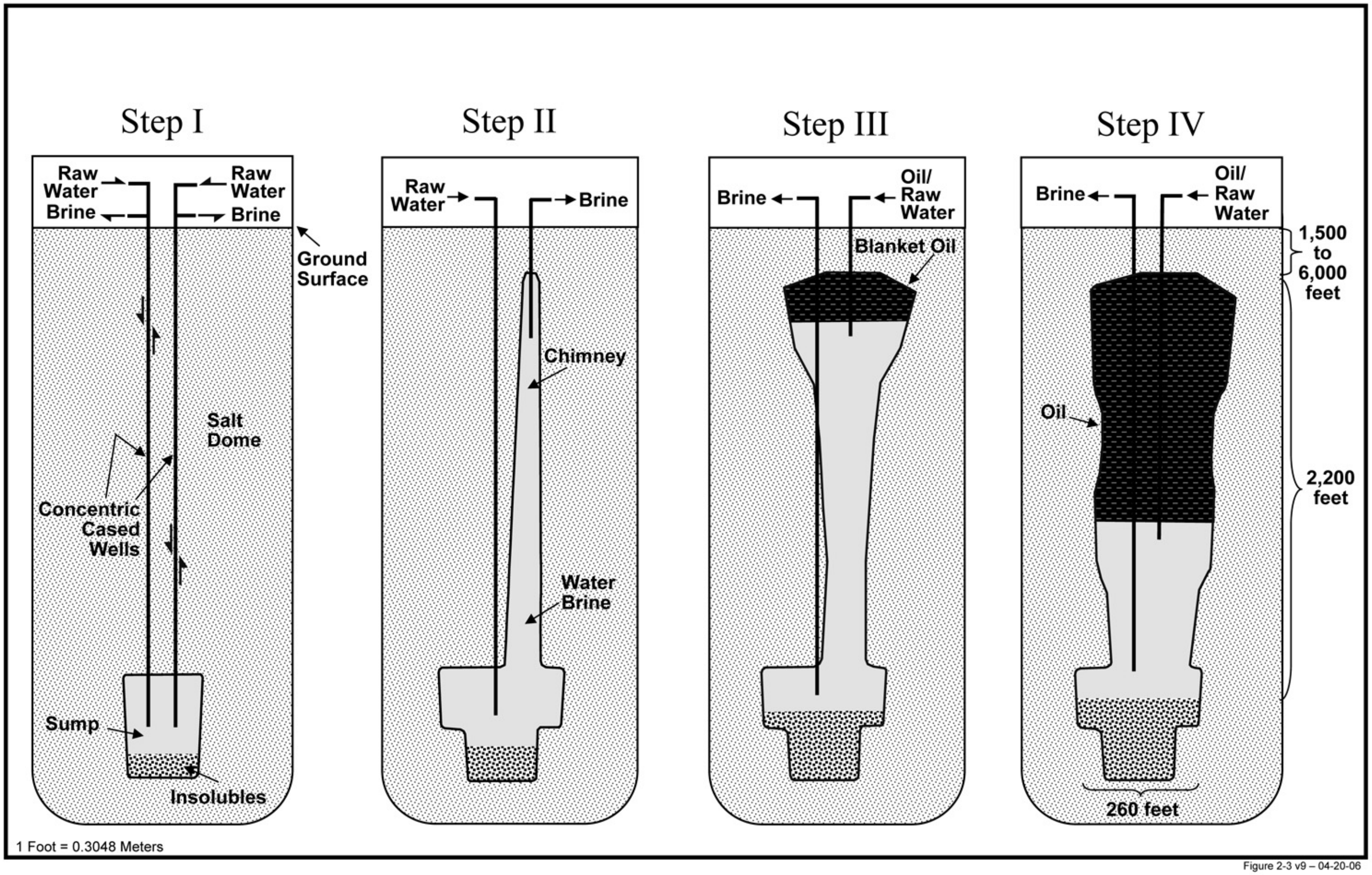
DOE would monitor the cavern development process using computer and sonar instruments. After the initial cavity is created, a sonar **caliper** survey would verify that the cavern is developing as planned. During solution mining, DOE would use computer modeling to predict the size and shape of the cavern.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

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

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

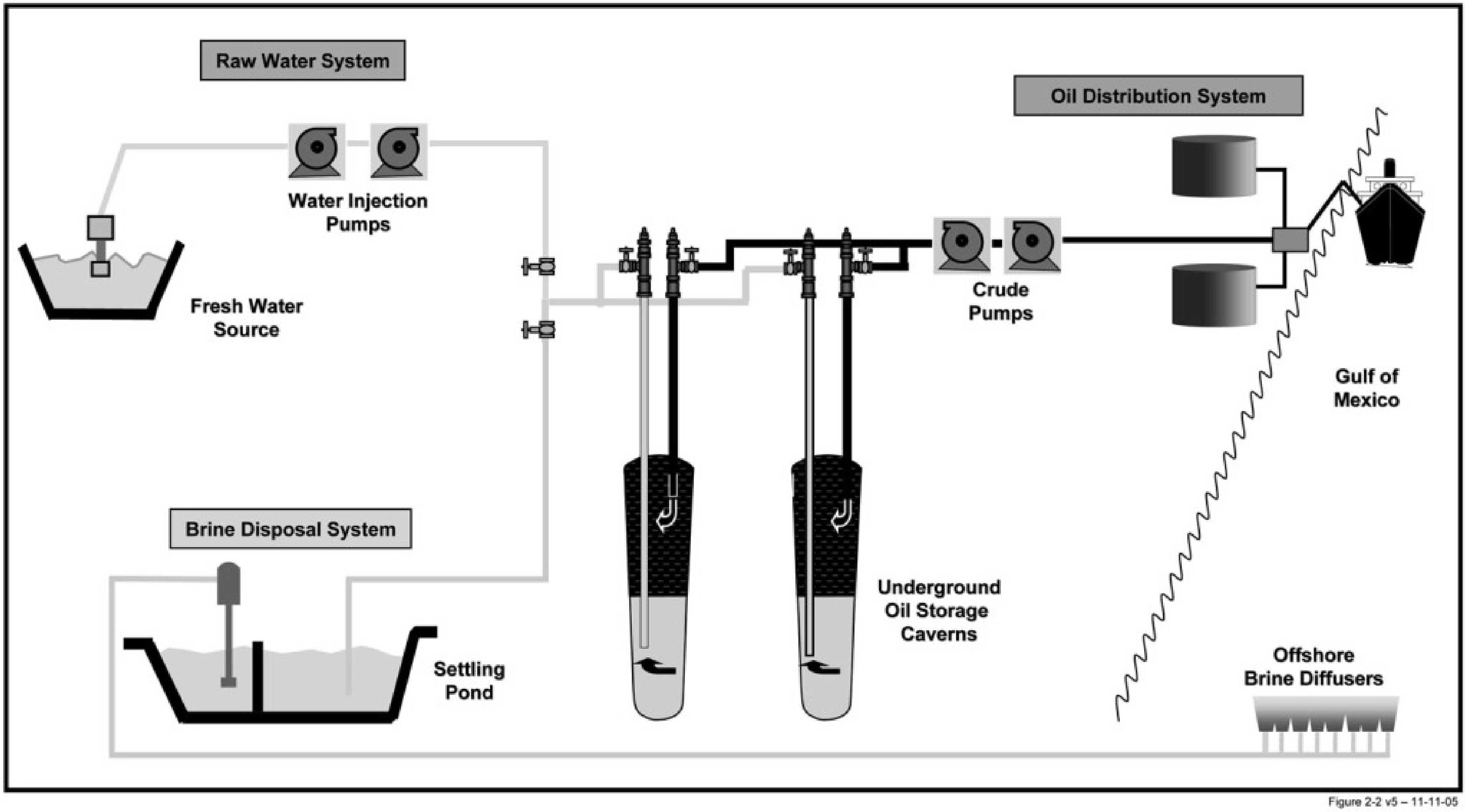
> Besides being the most economical way to store oil for long periods of time, the use of salt caverns is also one of the most environmentally secure. The salt walls of the storage caverns are “self-healing.” Extreme geologic pressures make the salt walls rock hard. If any cracks were to develop, they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

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



1 foot = 0.3048 Meters

Figure 2.3-2: Filling a Typical SPR Storage Site



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

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

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

2.3.2 Raw Water Intake System

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

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

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

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

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

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

2.3.3 Brine Disposal System

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

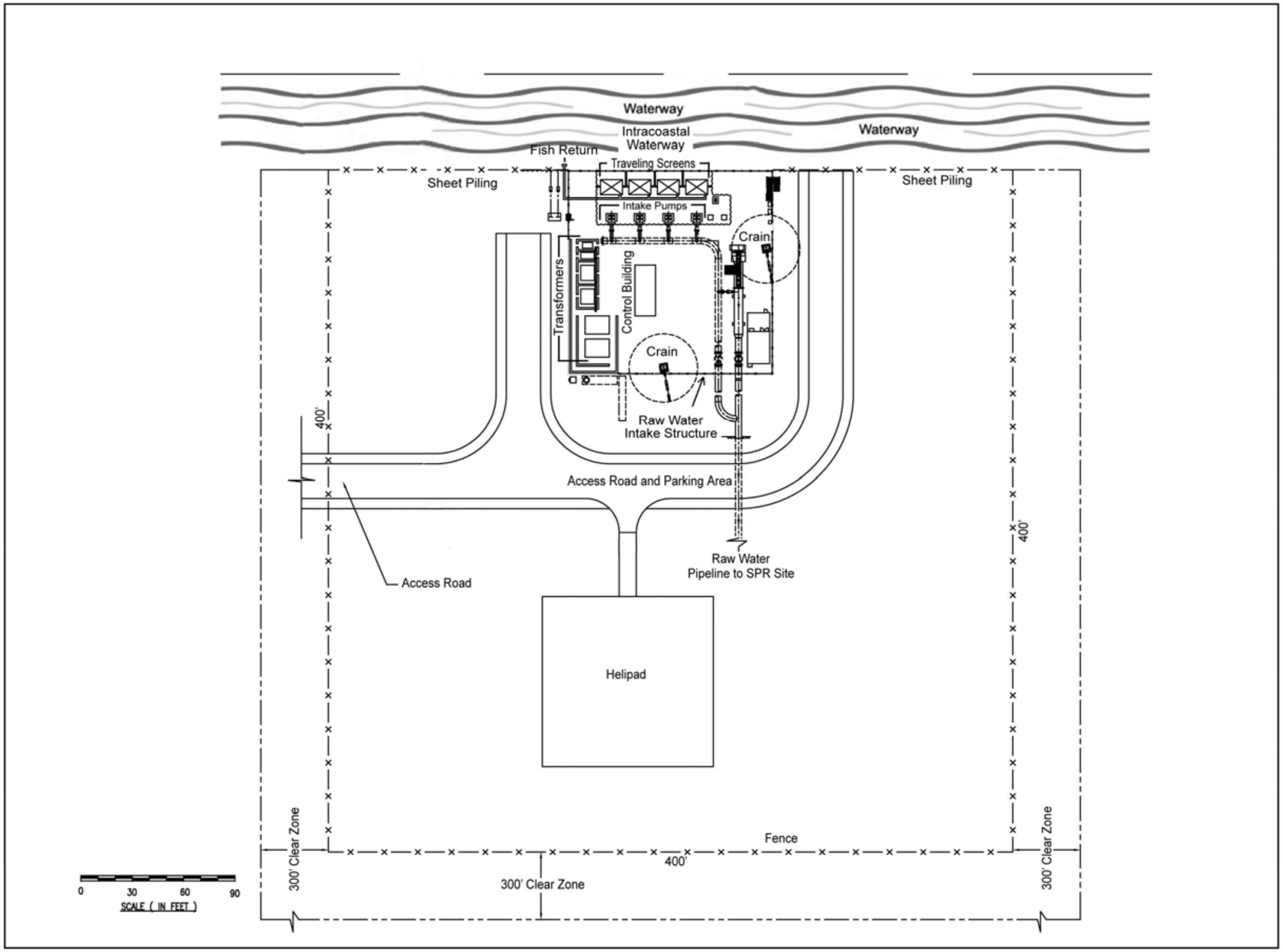
DOE would use two methods of disposing of brine produced during cavern solution mining: ocean disposal or injection wells. At Big Hill and each of the proposed new sites except Bruinsburg, the brine would be directly discharged into the Gulf of Mexico through a brine **diffuser** system. Brine would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

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

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

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

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



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

2.3.4 Crude Oil Distribution System

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

2.3.5 Site Support Structure and Equipment

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

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

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

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

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

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

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

2.3.6 Storm Protection Measures

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

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

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

2.3.7 Construction in Uplands

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

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

Clearing and Grubbing

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

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

Grading and Stabilization

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

2.3.8 Construction in Wetlands

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

2.3.9 Pipeline Construction

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

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

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

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

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

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

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

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

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

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

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

Table 2.3.9-1: Typical Widths of Pipeline Easements

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

2.3.10   Operations and Maintenance

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

Site Operations and Maintenance

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

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

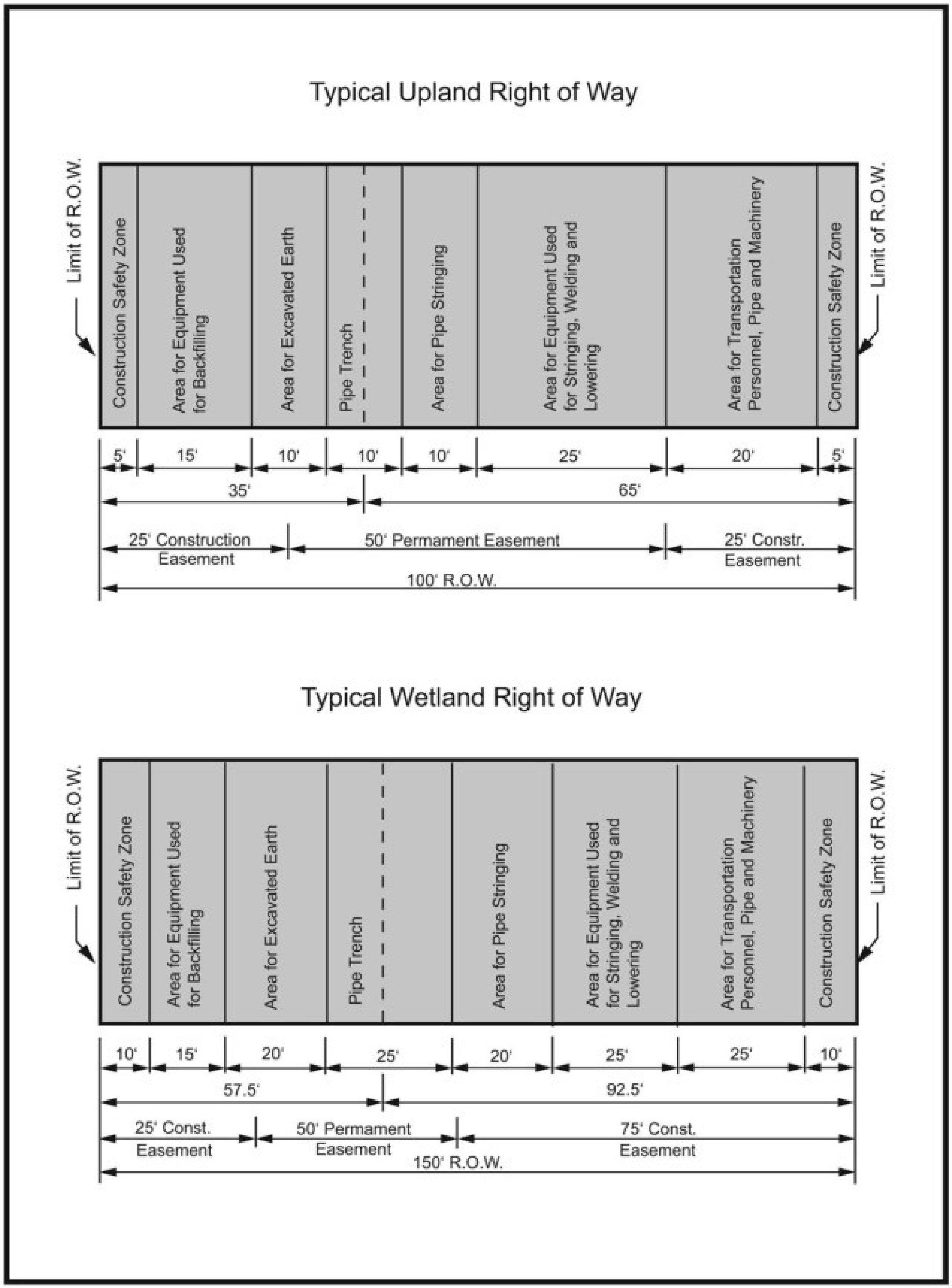


Figure 2-6 v2
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DOE would monitor cavern structural integrity daily by measuring pressure trends. DOE would test completed caverns for structural stability at least once every 5 years by using nitrogen well-leak tests as prescribed by methods acceptable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

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

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

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

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

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

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

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

To convert pounds to kilograms, multiply by 0.4536

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

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

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

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

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

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

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

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

Pipeline Operations and Maintenance

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

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

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

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

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

2.3.11 Decommissioning

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

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

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

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

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

2.4 POTENTIAL NEW SITES AND ASSOCIATED INFRASTRUCTURE

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

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

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

2.4.1 Bruinsburg Storage Site

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

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

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

Table 2.4-1: Key Details of the Alternatives

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

Table 2.4-1: Key Details of the Alternatives

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

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

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

IW = injection wells; T = terminal(s)

Figure 2.4.1-1: Location of Proposed Bruinsburg Storage Site

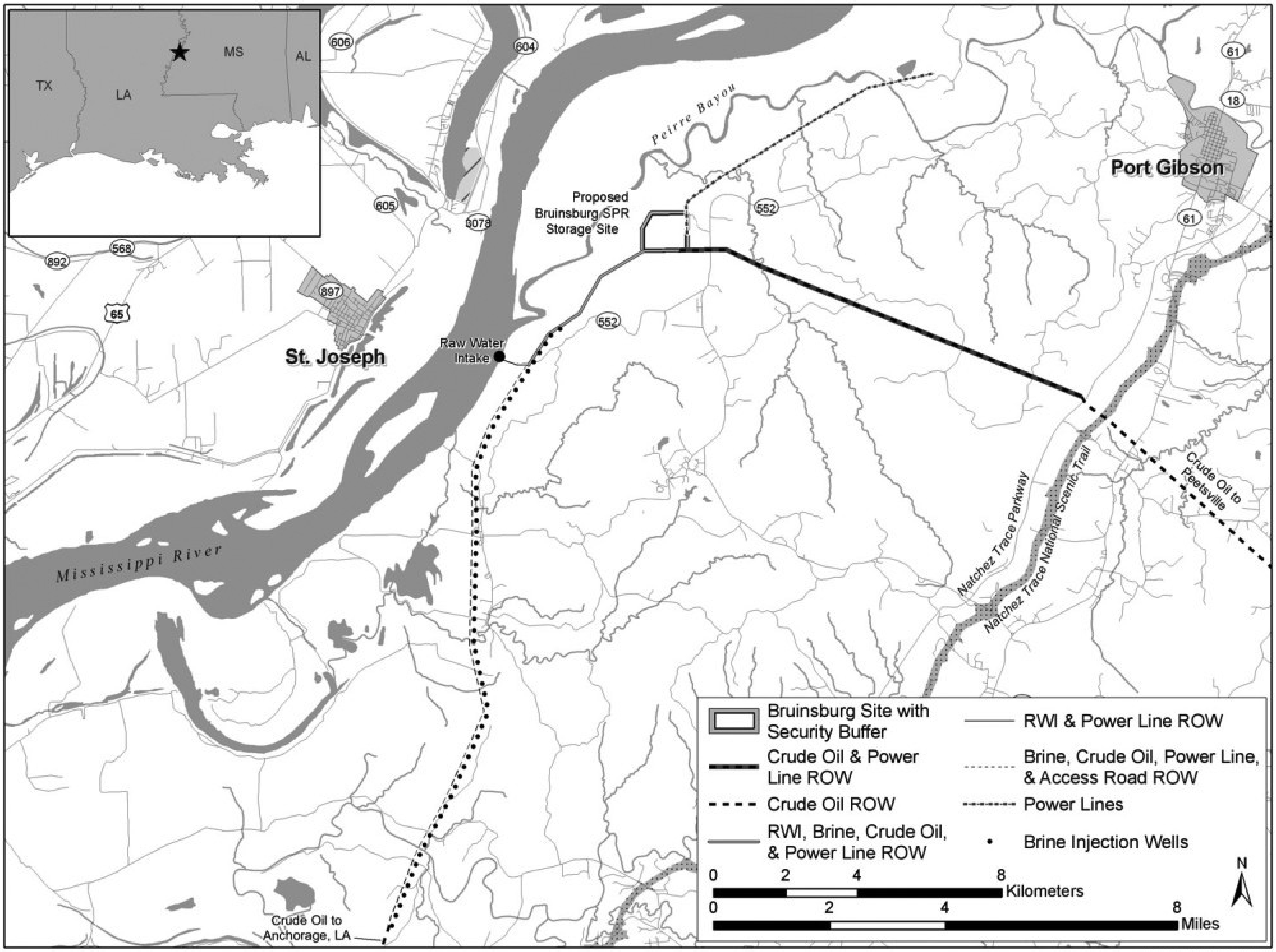

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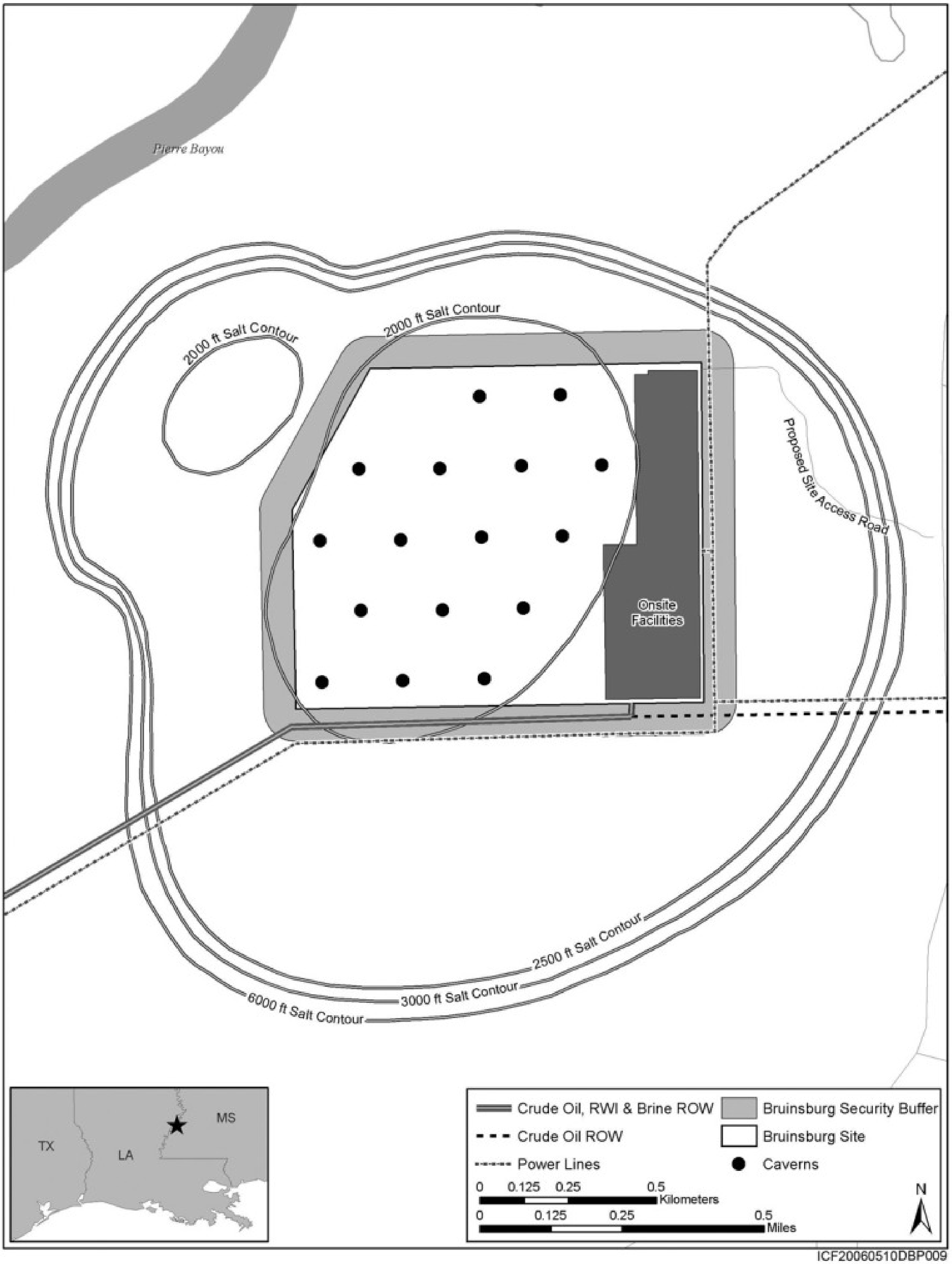
Figure 2.4.1-2: Proposed Layout of Bruinsburg Storage Site



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

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

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

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

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

Figure 2.4.1-3: Proposed Pipelines for Bruinsburg Storage Site

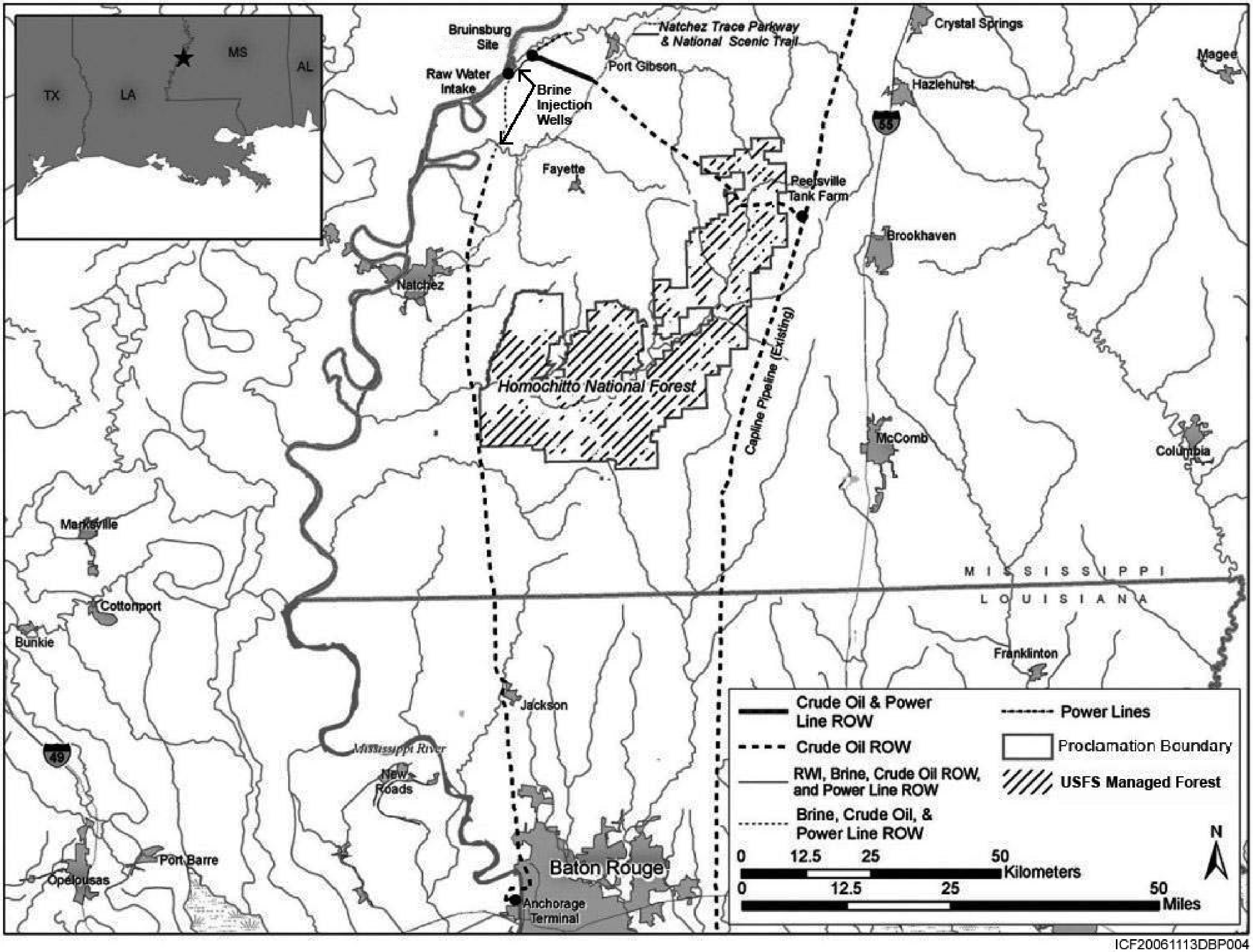


Figure 2.4.1-4: Proposed Layout of Peetsville Tank Farm

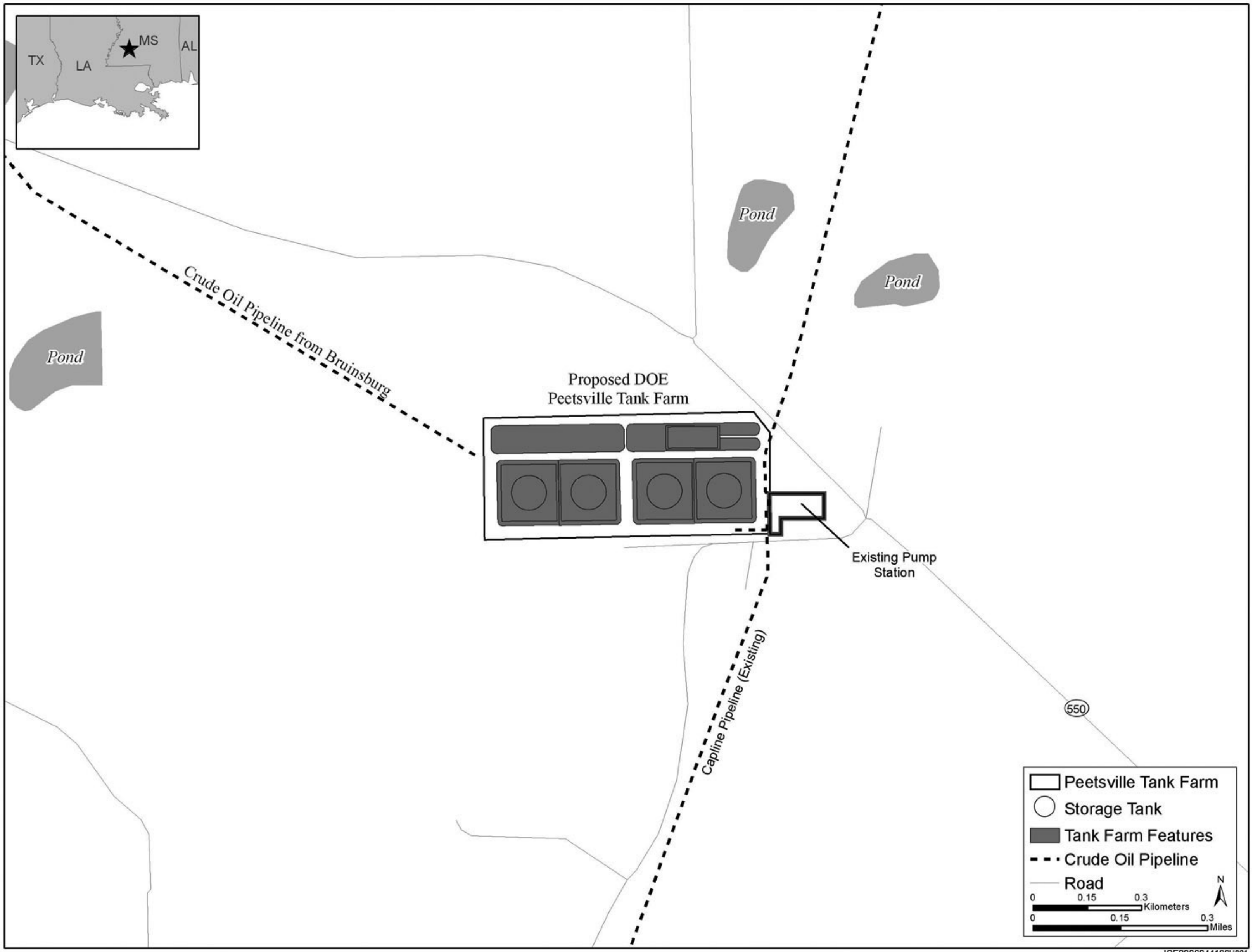


Figure 2.4.1-5: Proposed Layout of Anchorage Tank Farm

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

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

2.4.2 Chacahoula Storage Site

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

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

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

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

Figure 2.4.2-1: Location of Proposed Chacahoula Storage Site

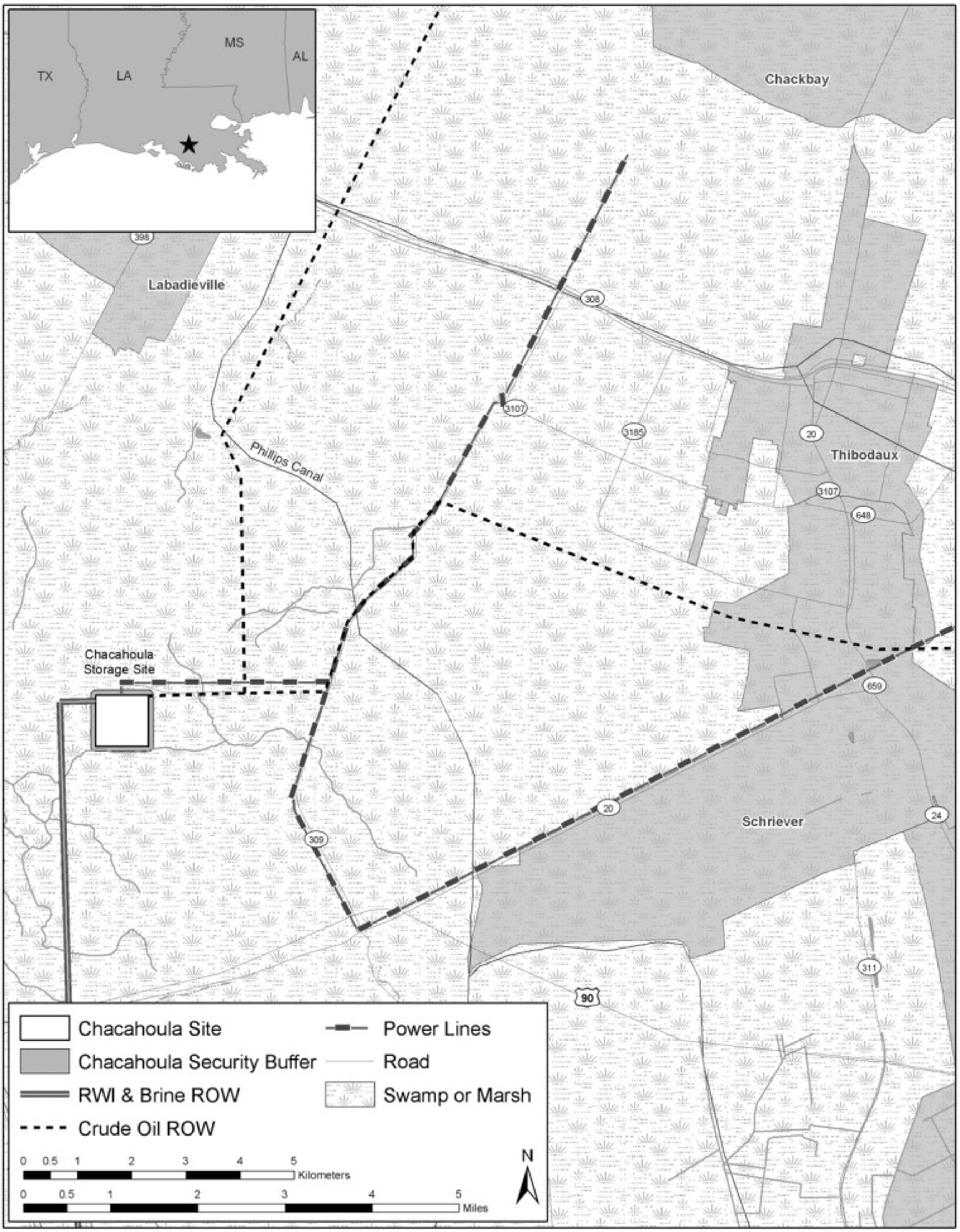


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Figure 2.4.2-2: Proposed Layout of Chacahoula Storage Site

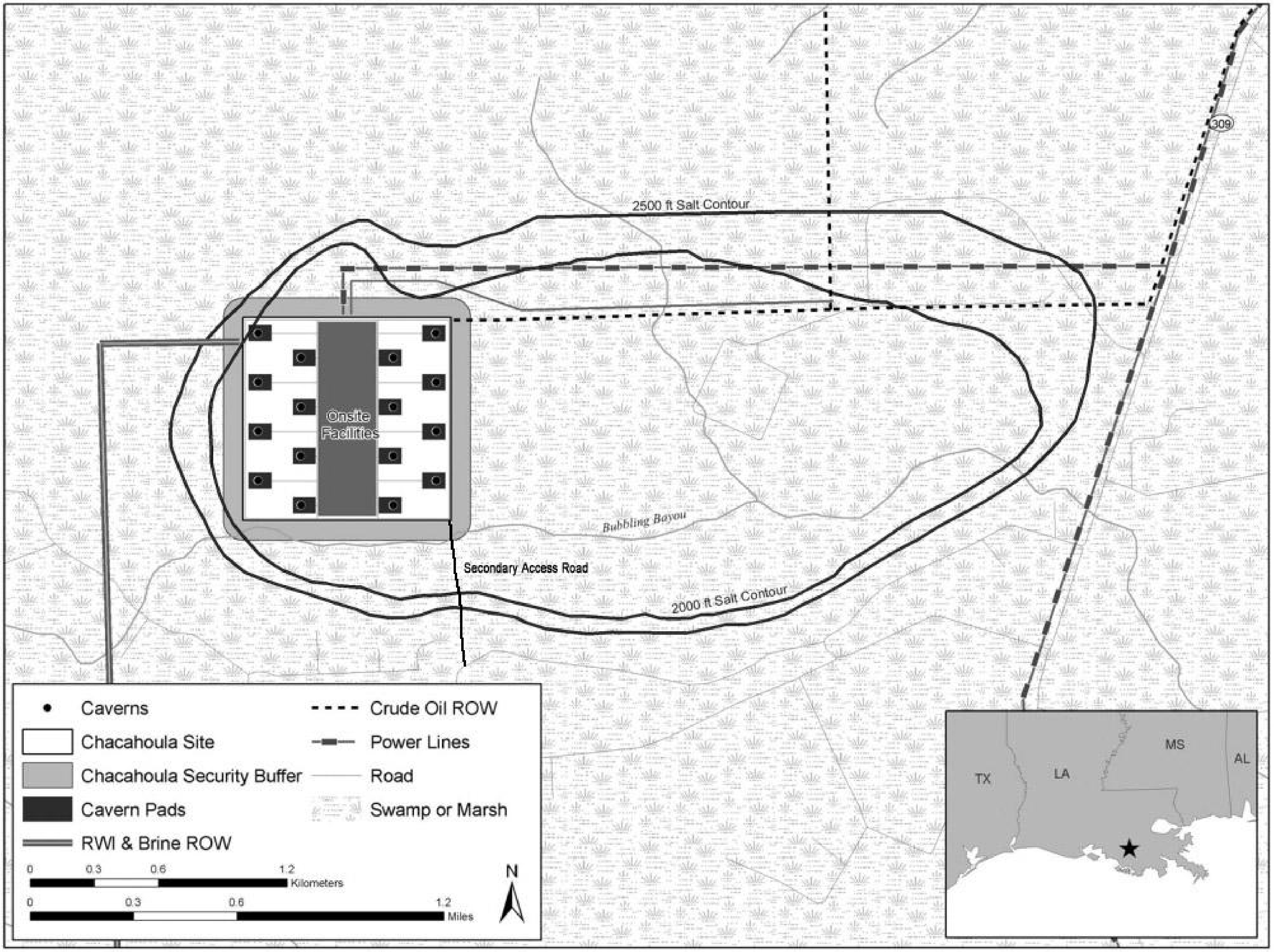

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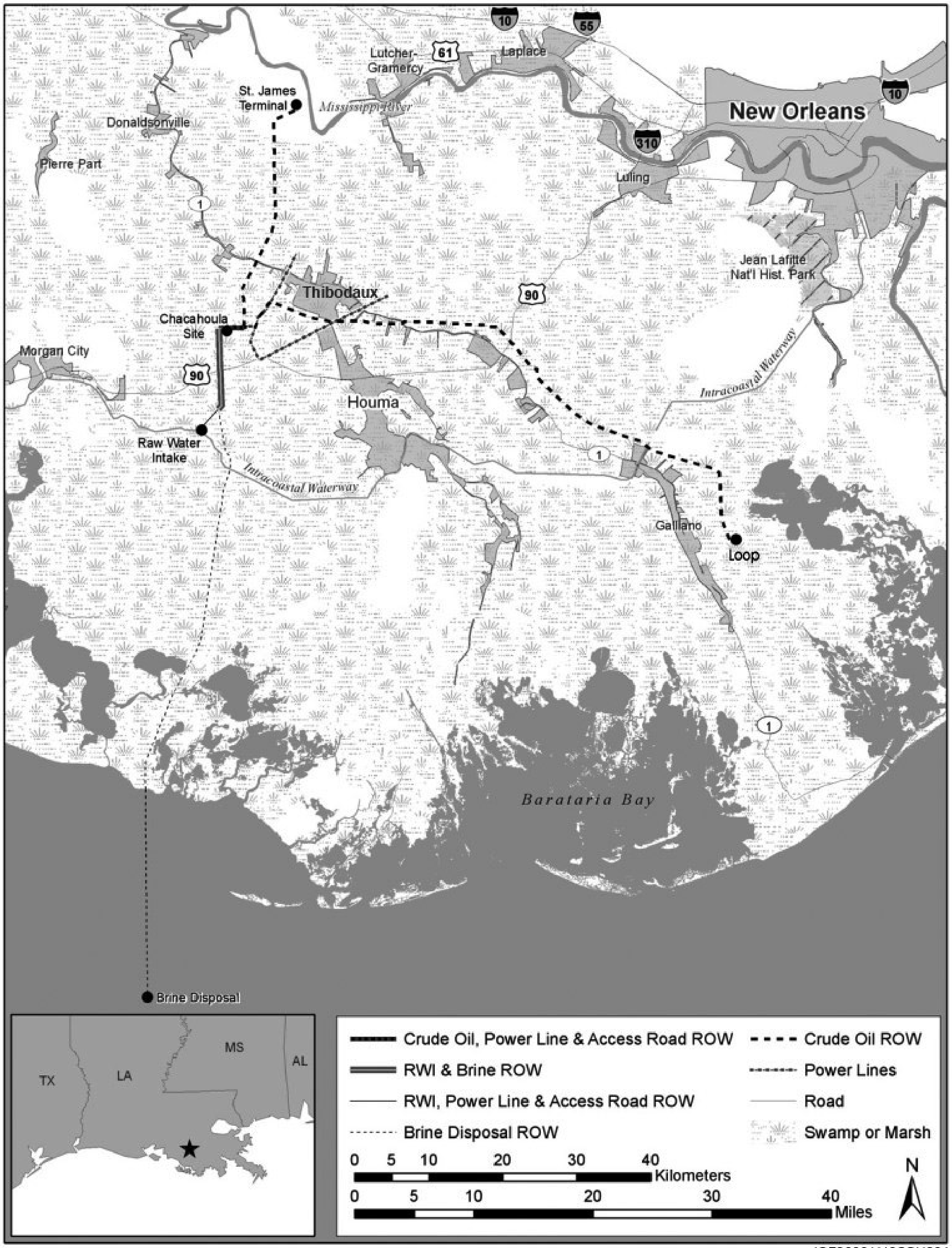
Figure 2.4.2-3: Proposed Pipelines of Chacahoula Storage Site



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

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

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

2.4.3 Richton Storage Site

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

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

Figure 2.4.3-1: Location of Proposed Richton Storage Site

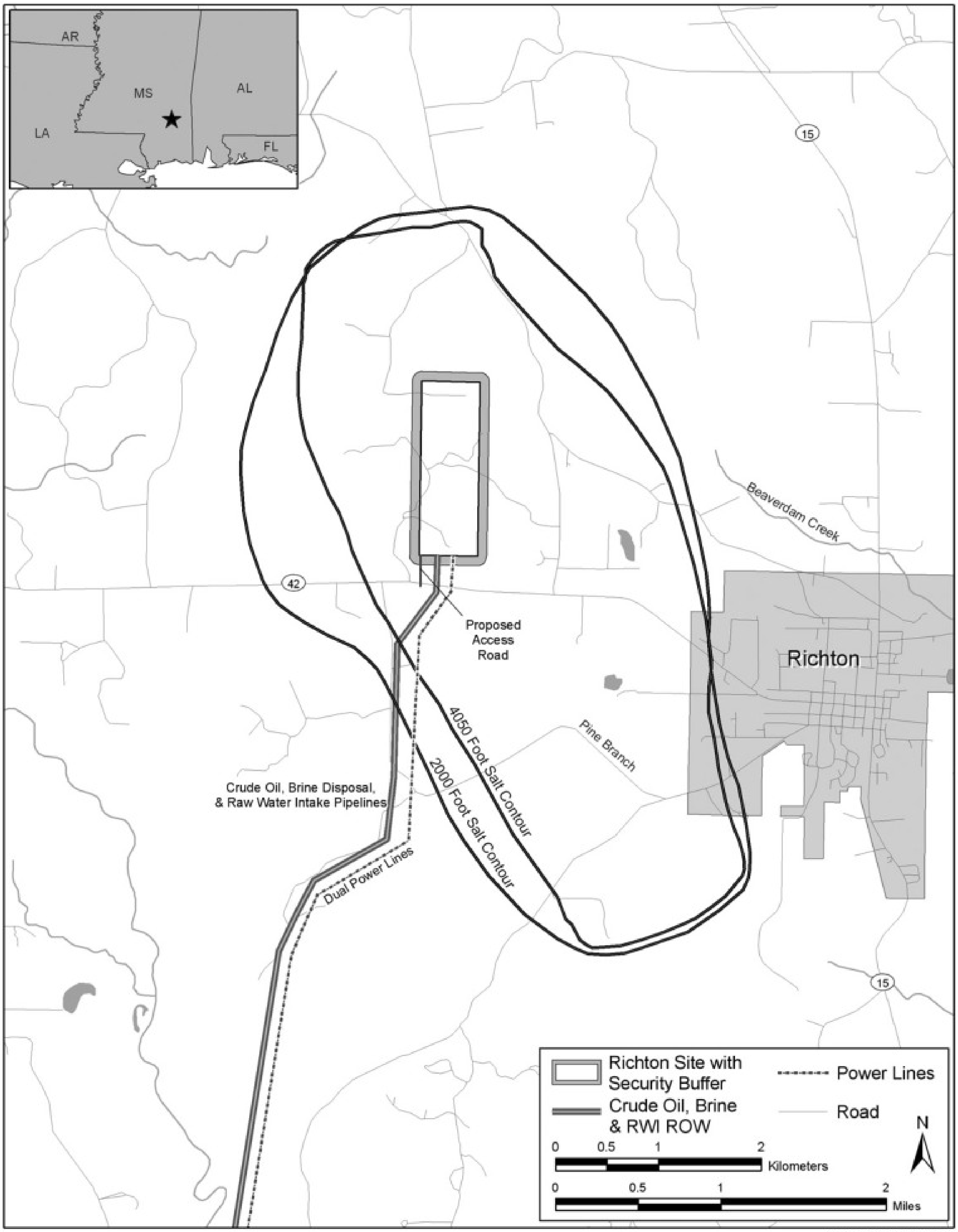

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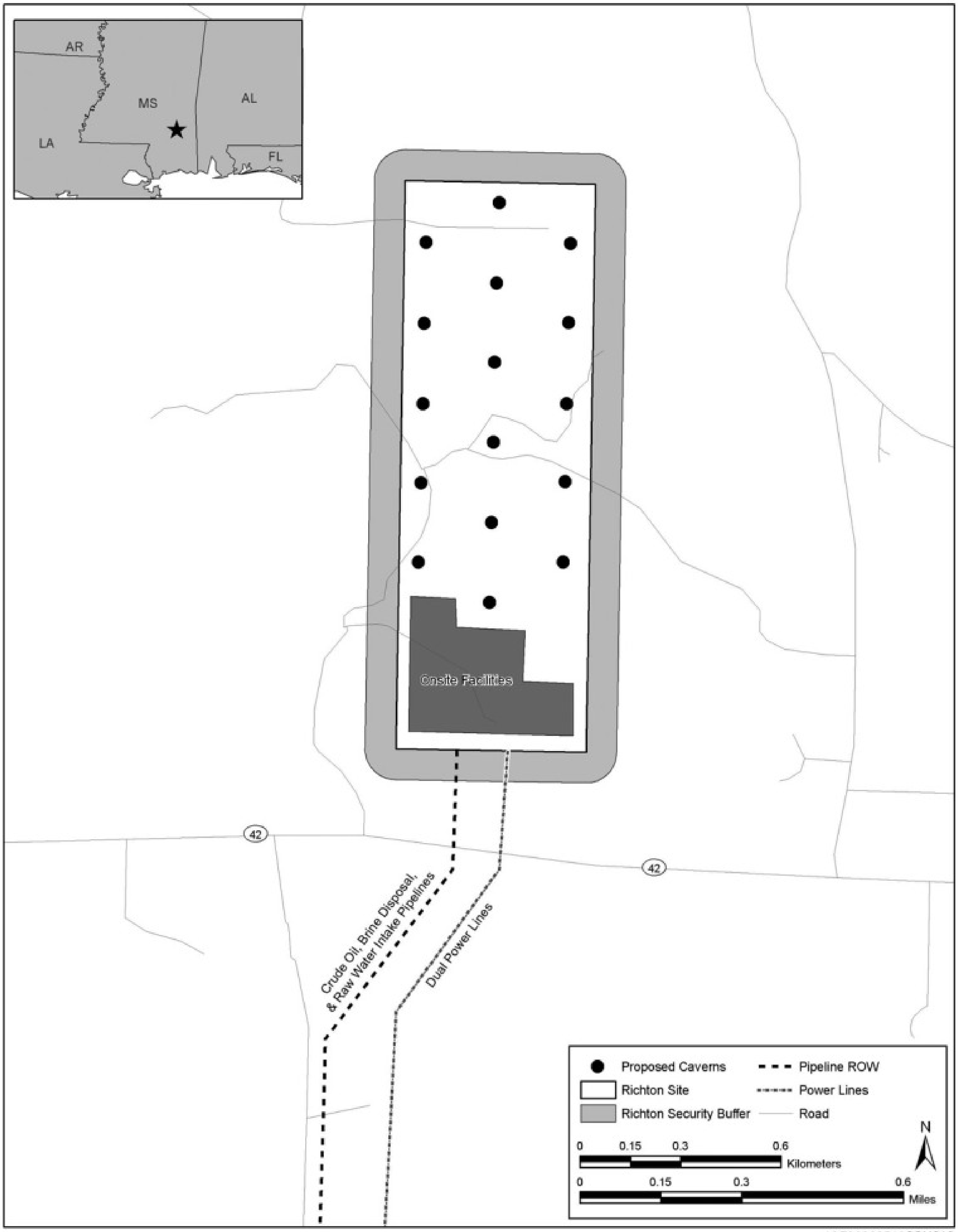
Figure 2.4.3-2: Proposed Layout of Richton Storage Site



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

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

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

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

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

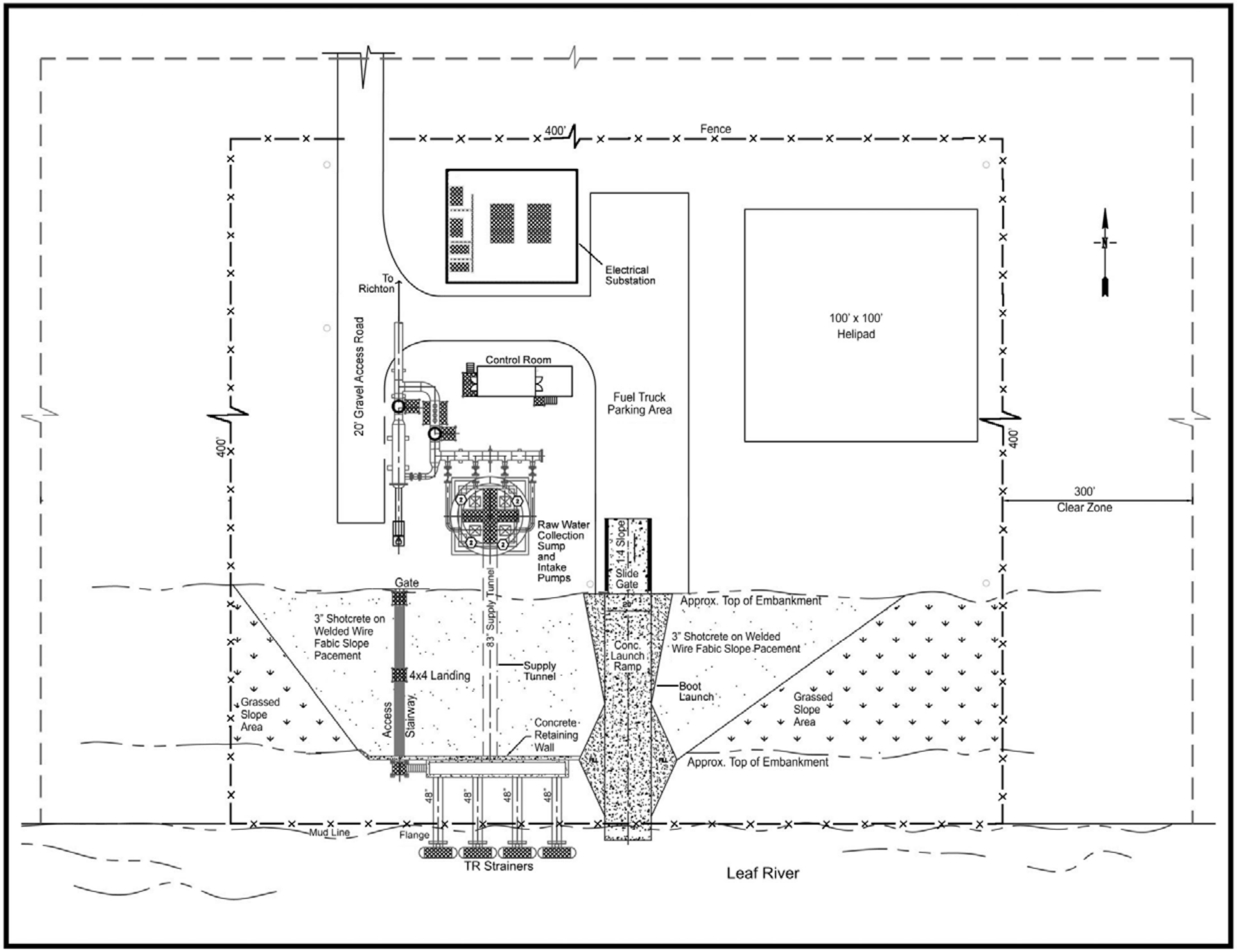


Figure 2.4.3-4: RWI Structure at Pascagoula (Richton Alternatives)

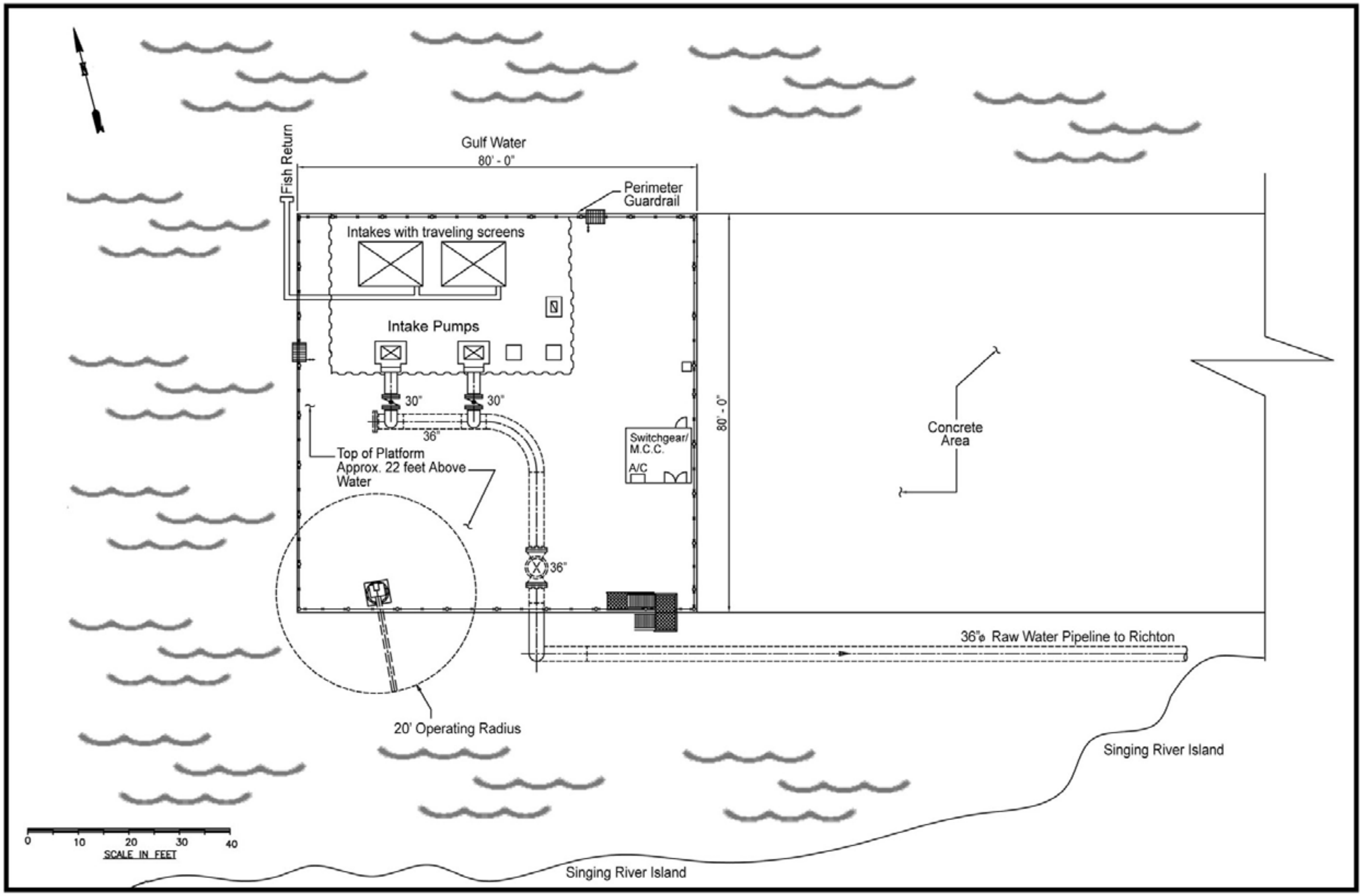
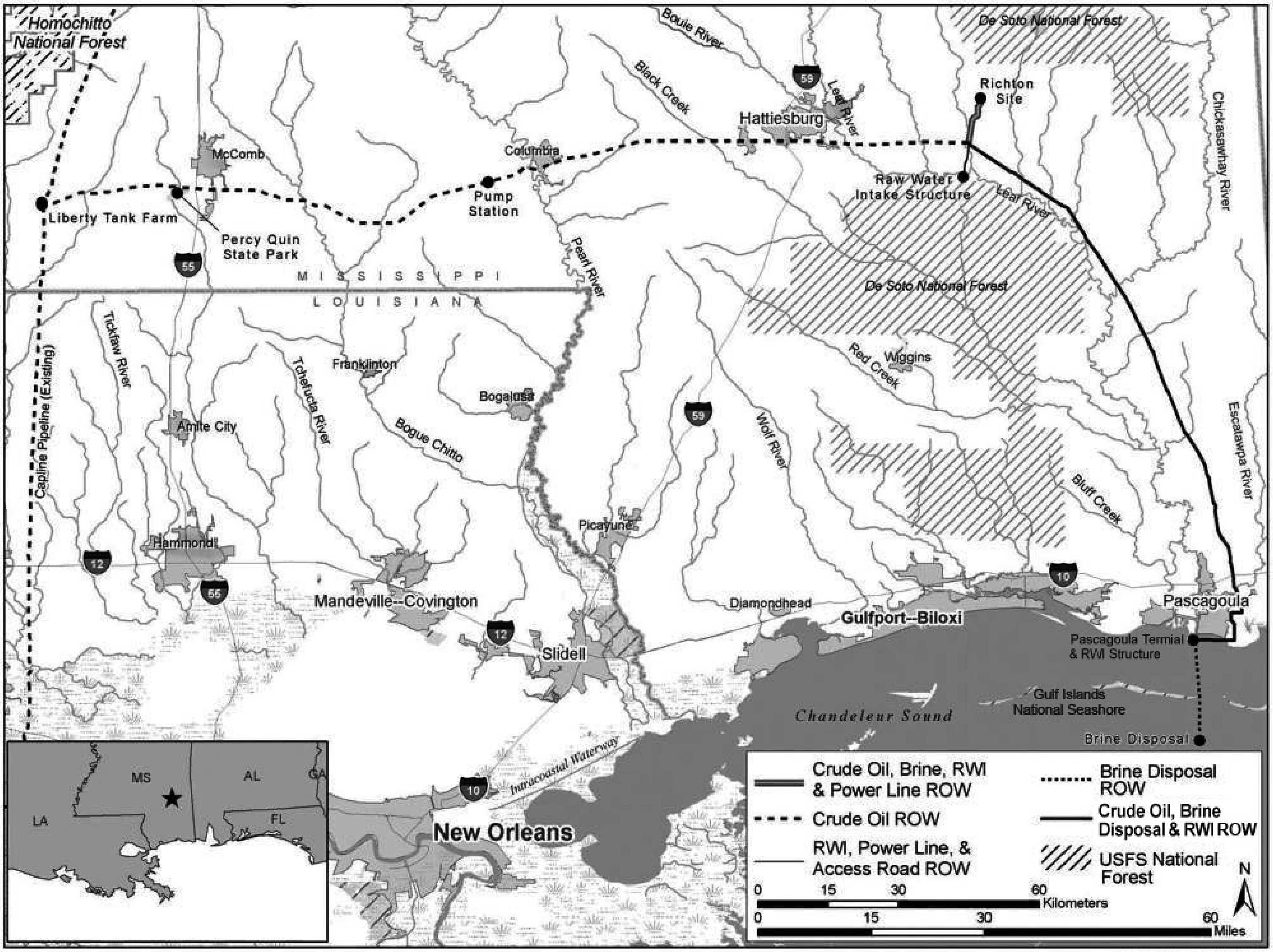


Figure 2.4.3-5: Proposed Pipelines for Richton Storage Site



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

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

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

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

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

2.4.4 Stratton Ridge Storage Site

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

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

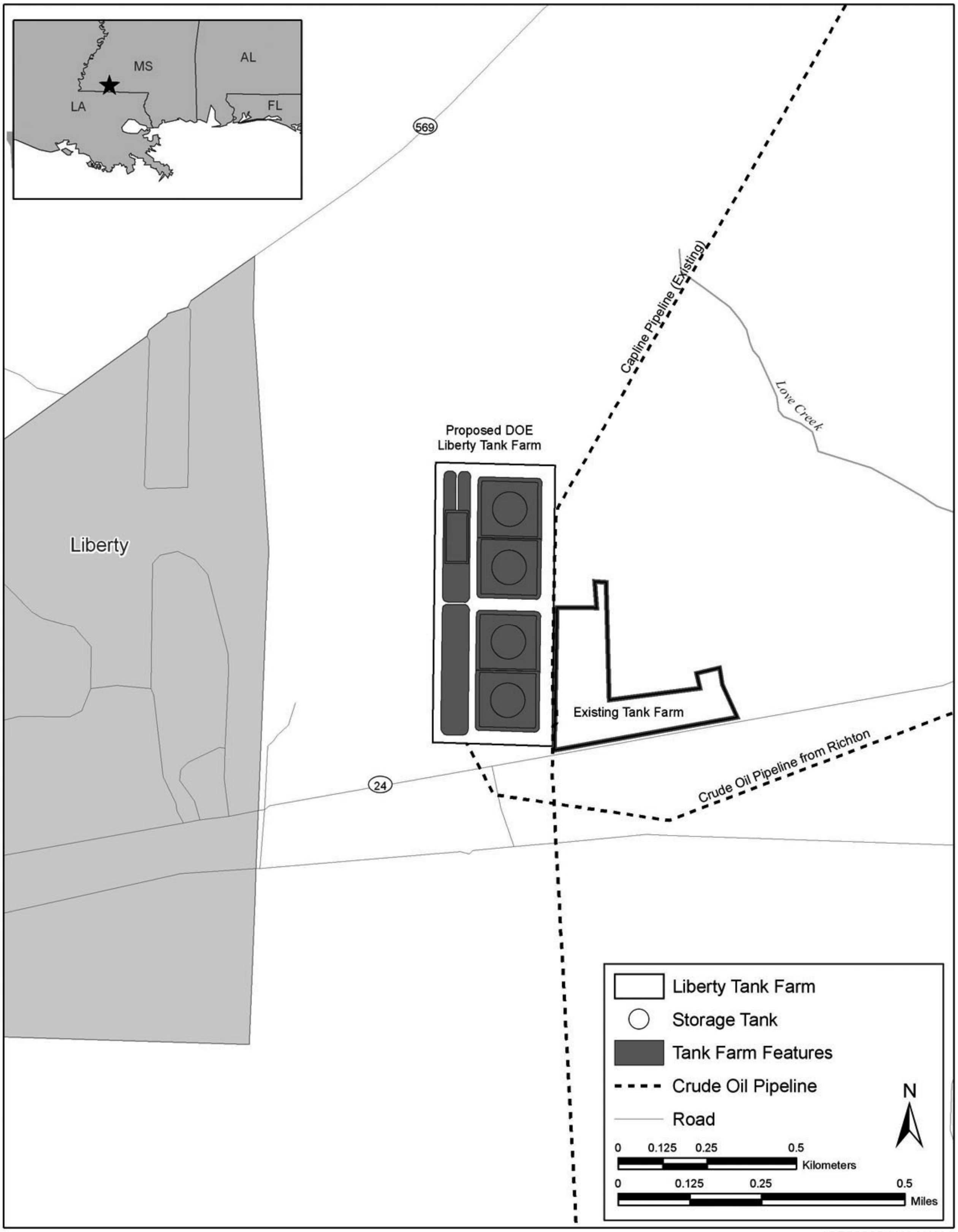

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Figure 2.4.3-7: Proposed Layout of the Pascagoula Terminal

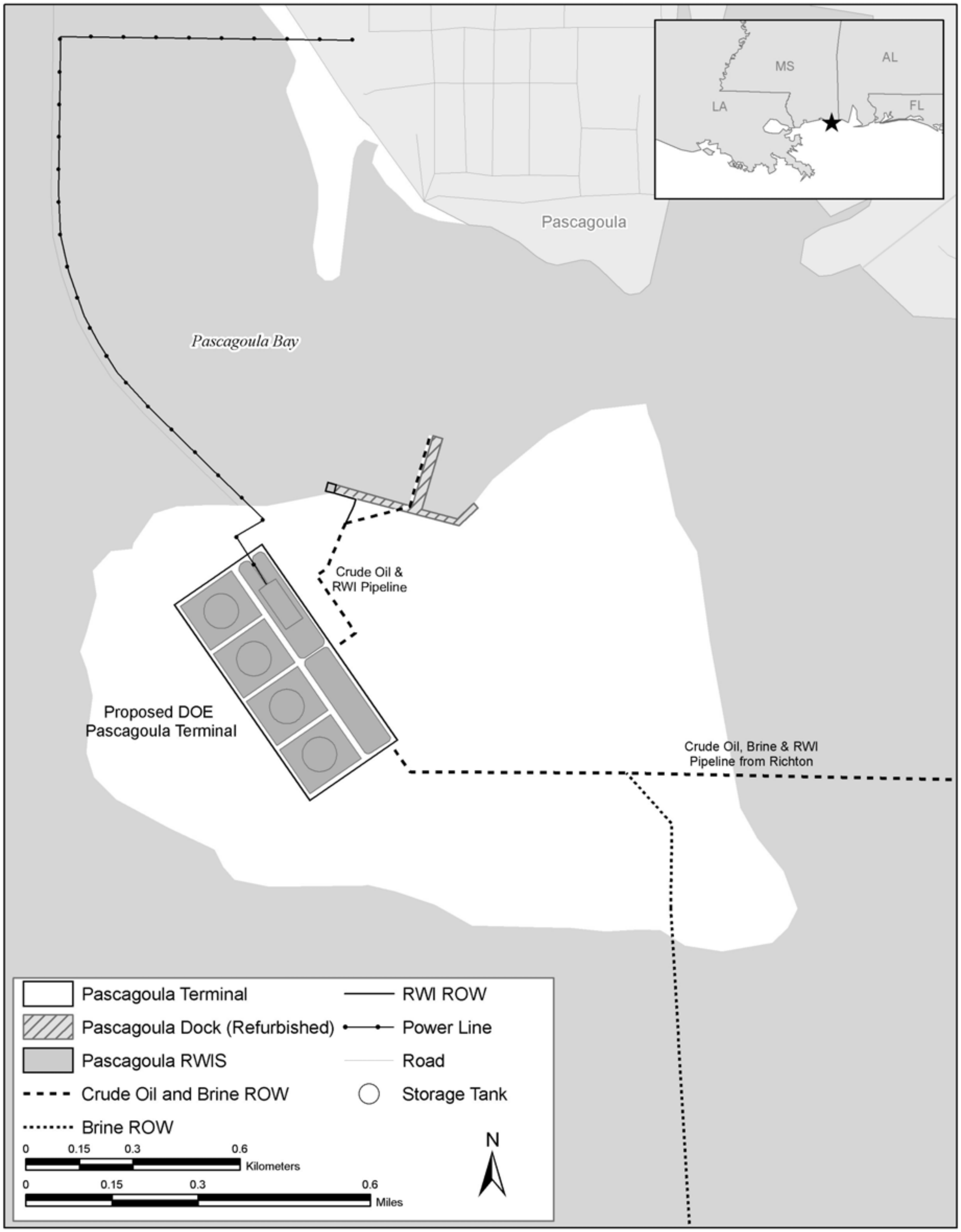

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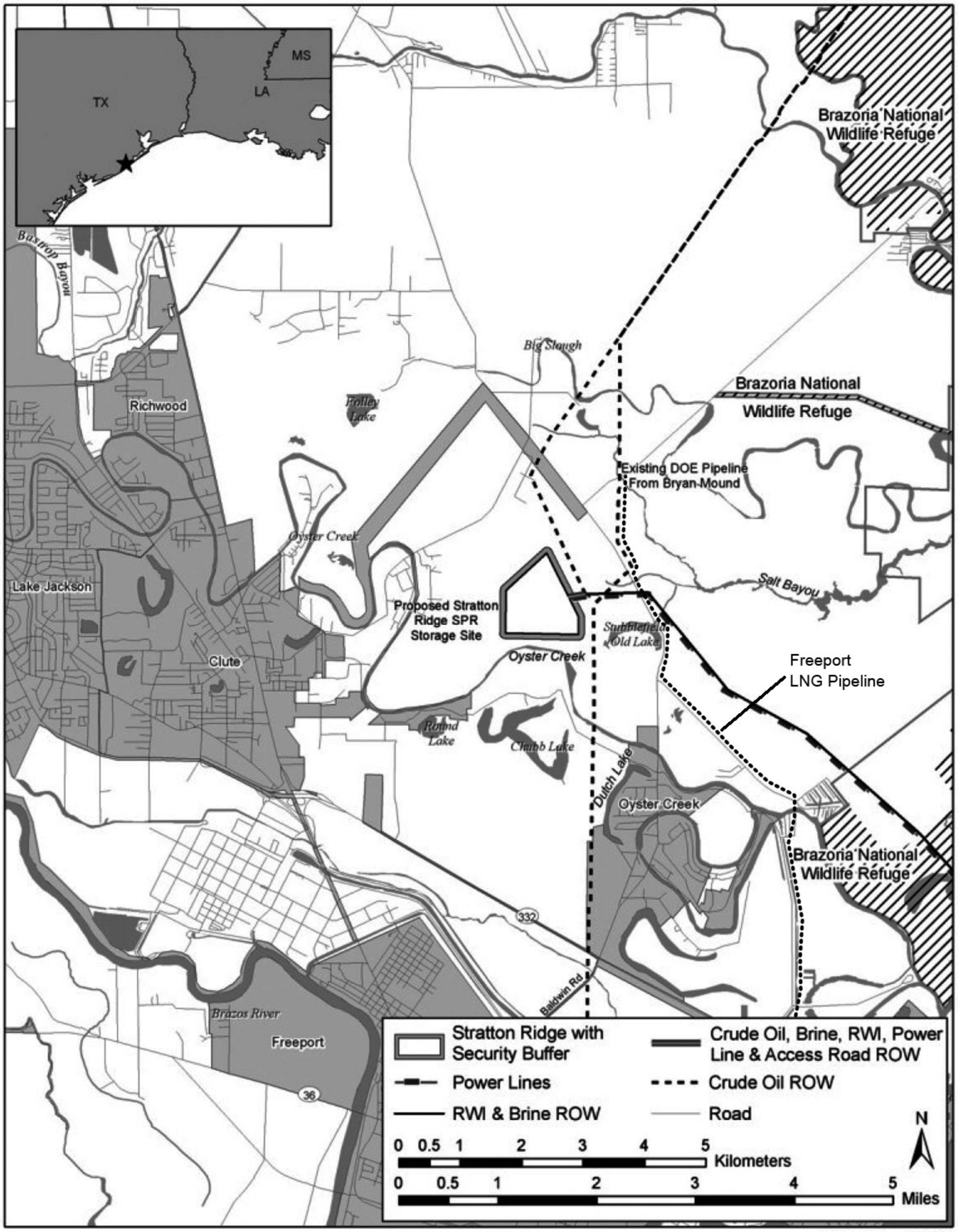
Figure 2.4.4-1: Location of Proposed Stratton Ridge Storage Site



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

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

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

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

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

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

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

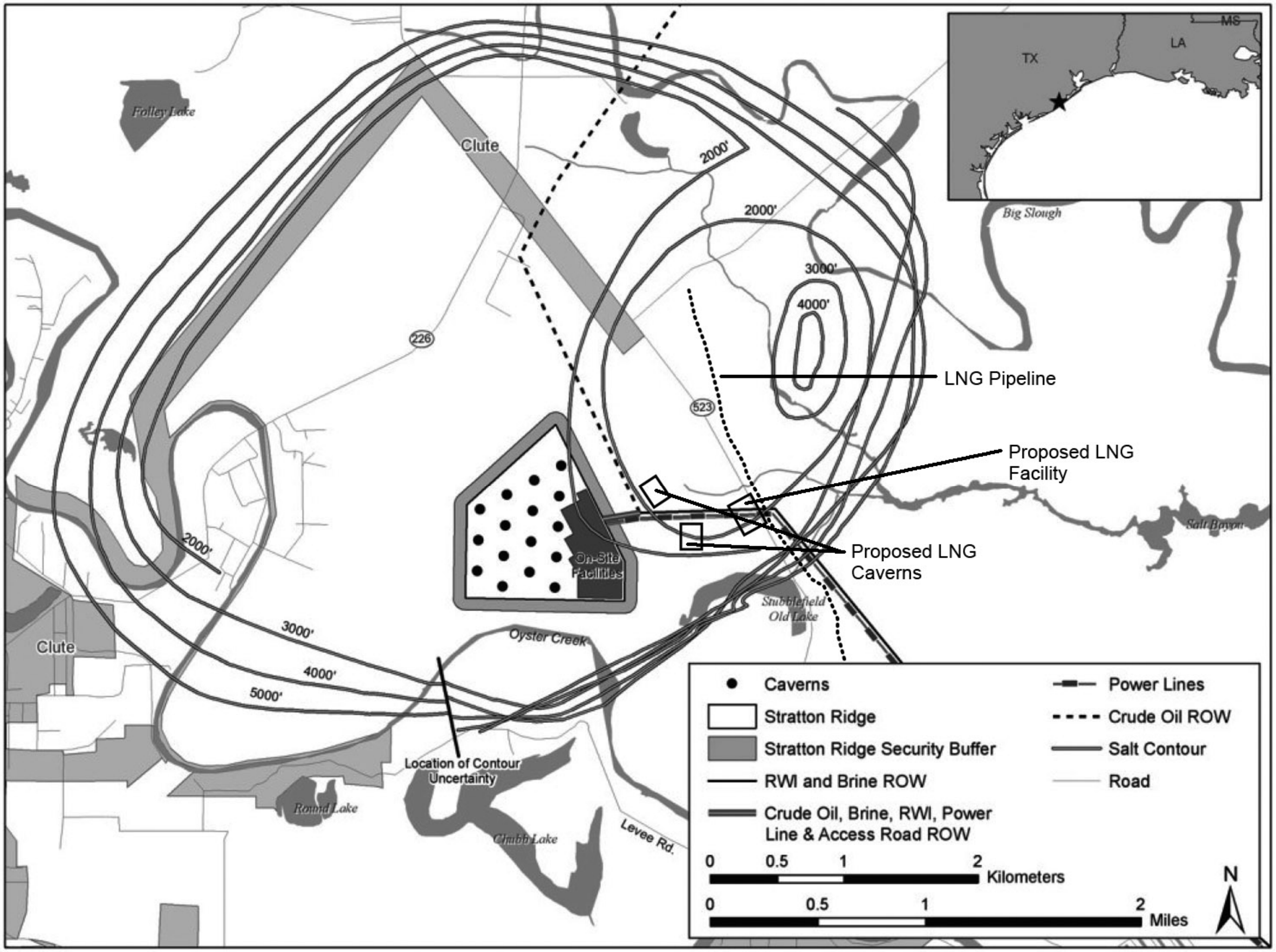

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Figure 2.4.4-3: Proposed Pipelines for Stratton Ridge Storage Site

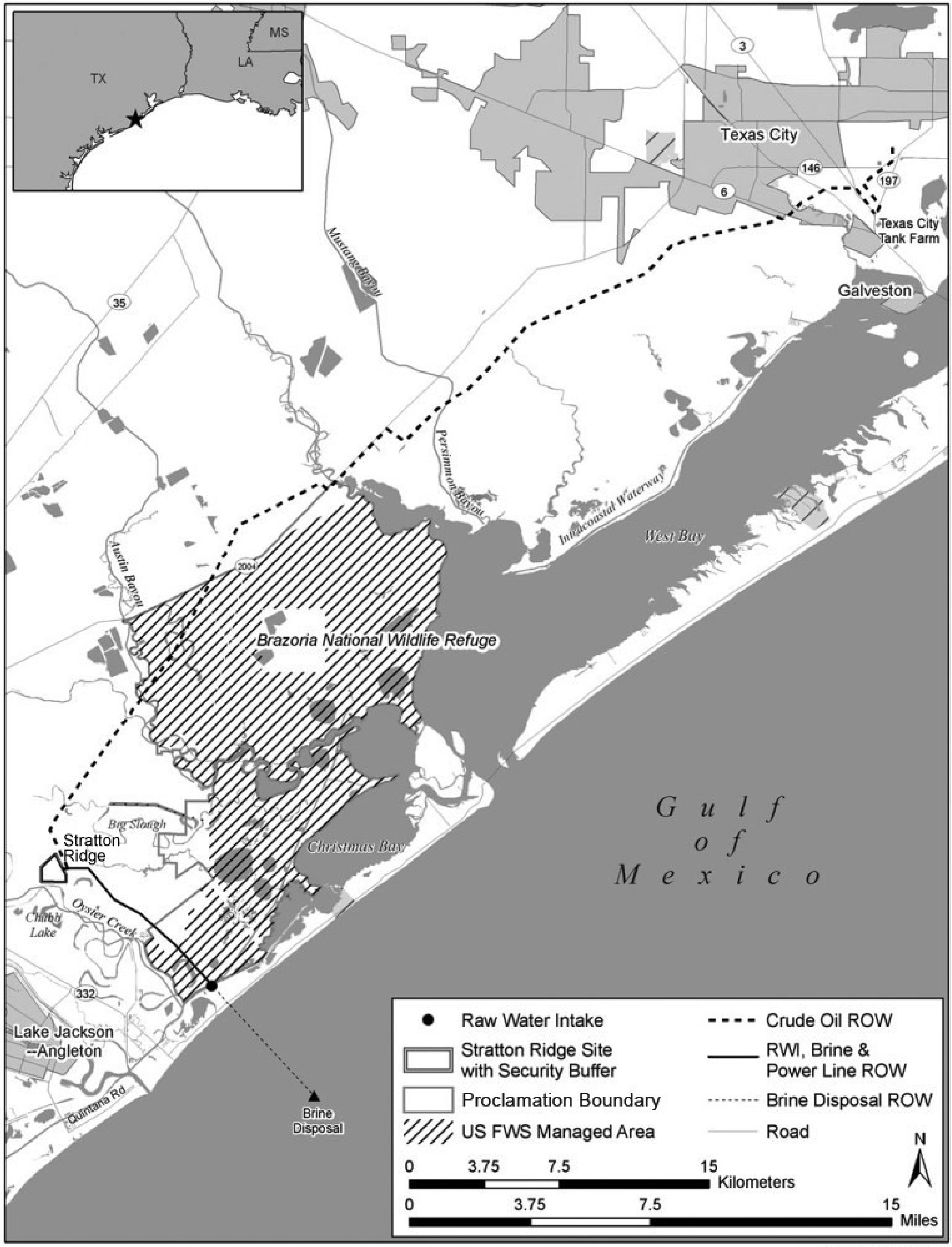

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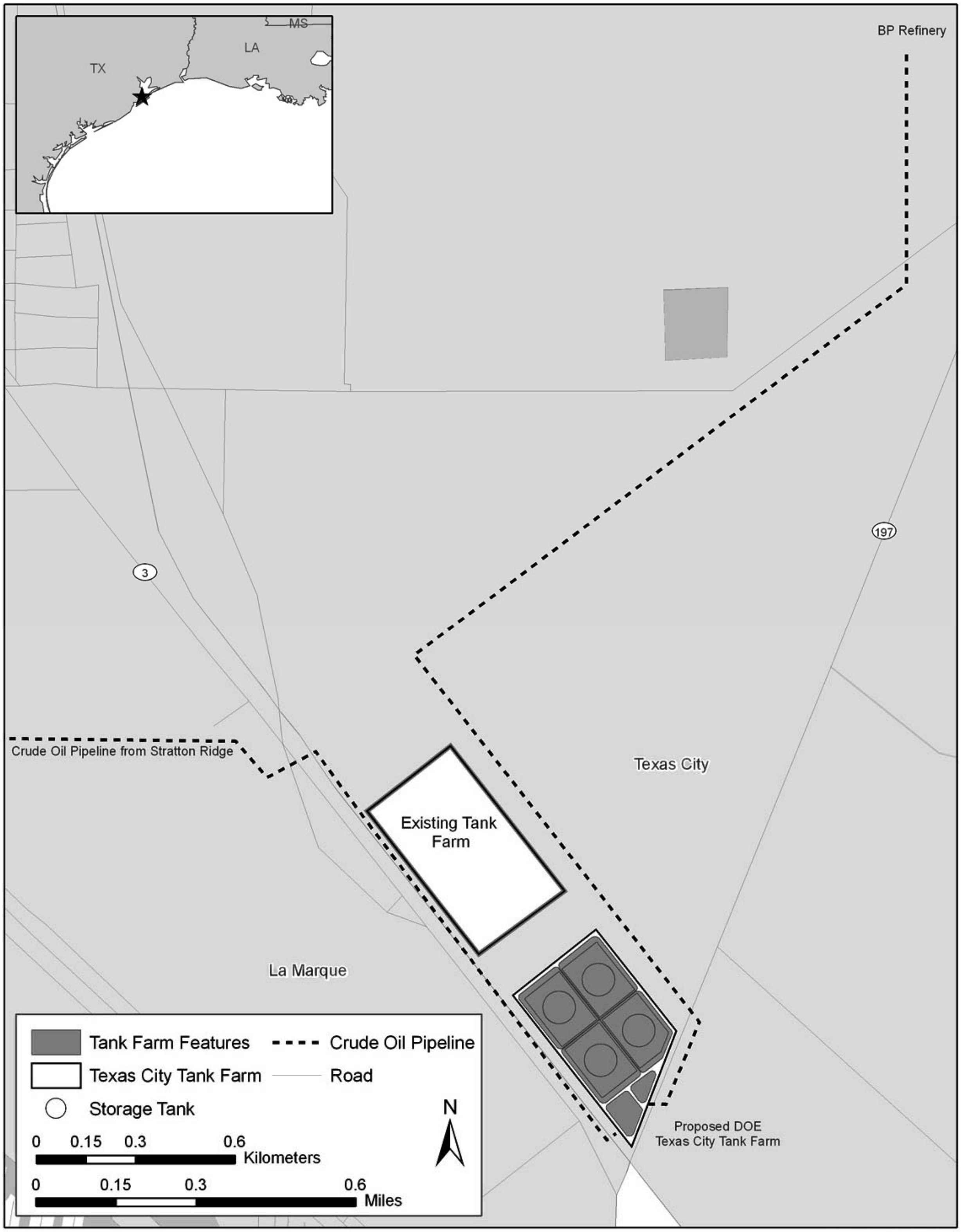
Figure 2.4.4-4: Proposed Layout of Texas City Tank Farm



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2.5 EXPANSION AT EXISTING SPR SITES

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

2.5.1 Bayou Choctaw Expansion Site

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

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

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

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

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

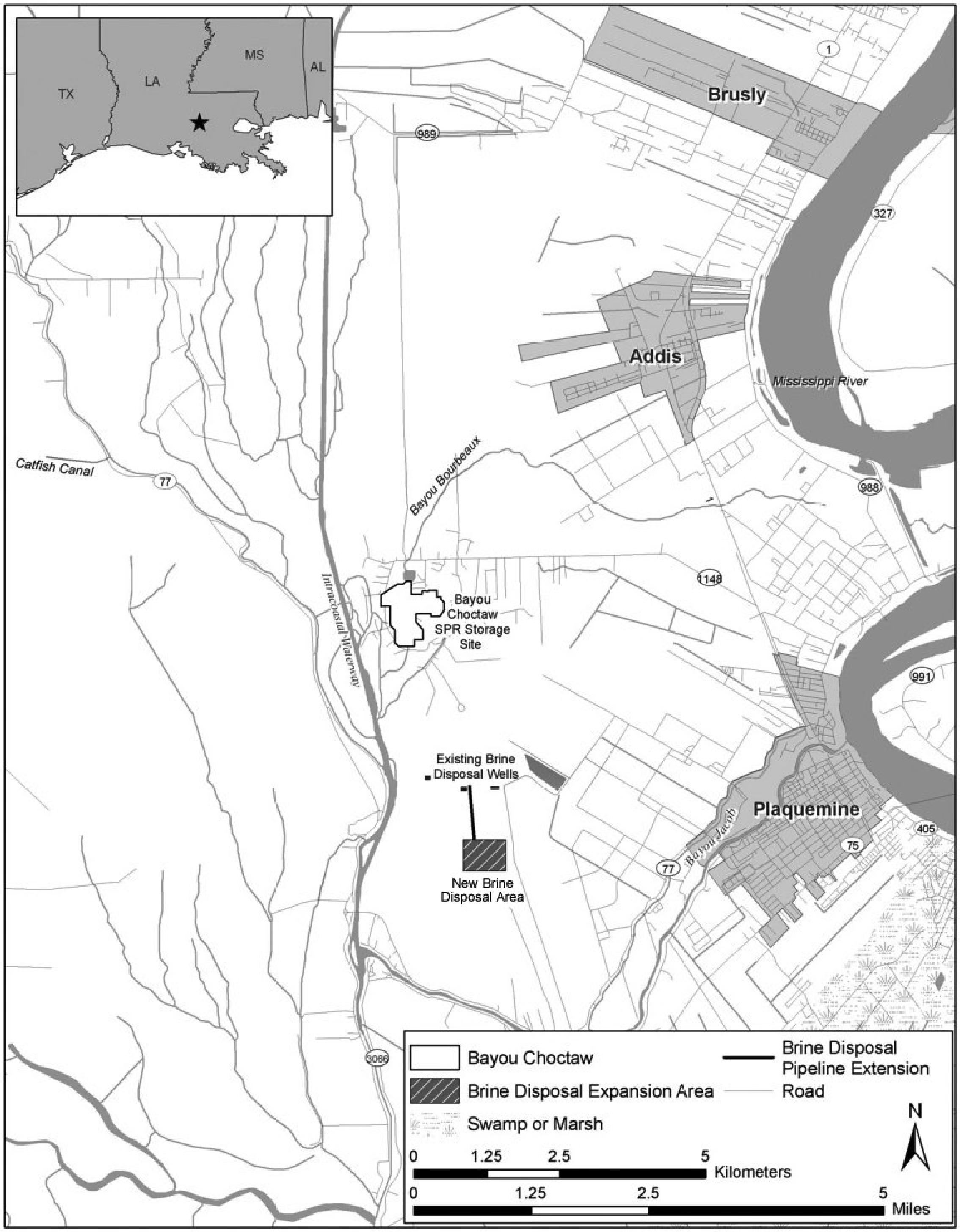
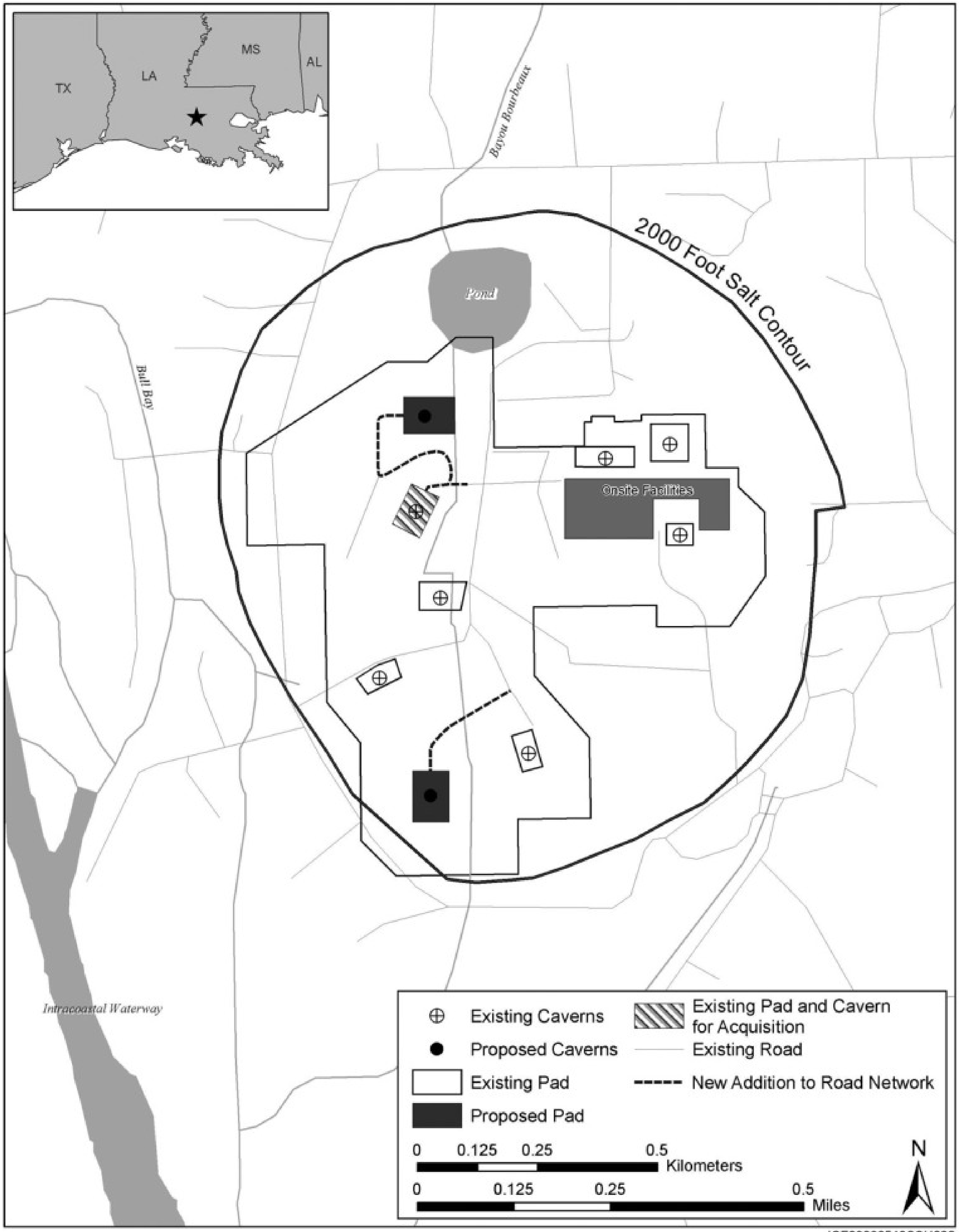


Figure 2.5.1-2: Layout and Proposed Expansion for Bayou Choctaw Storage Site



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2.5.2 Big Hill Expansion Site

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

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

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

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

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

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

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

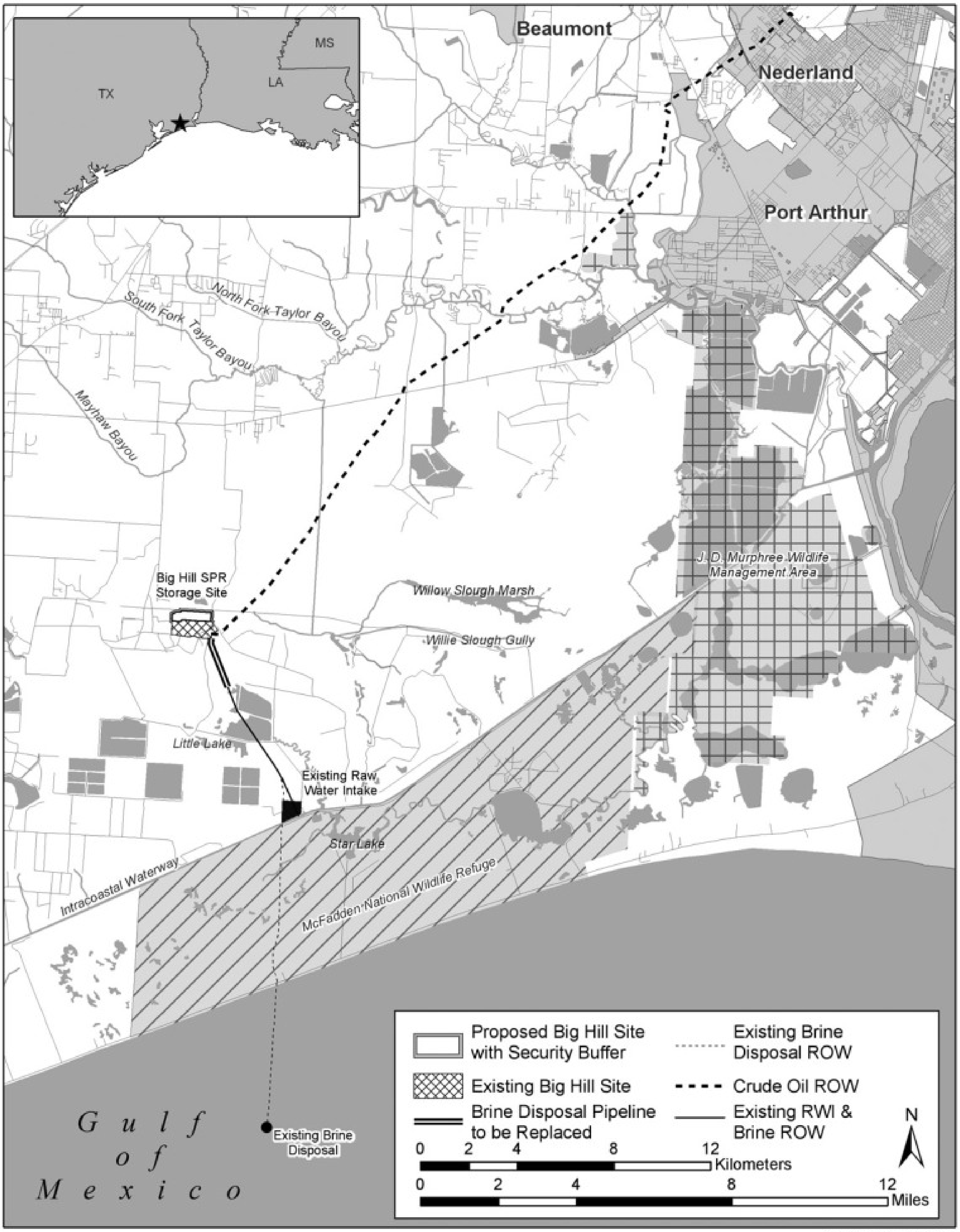

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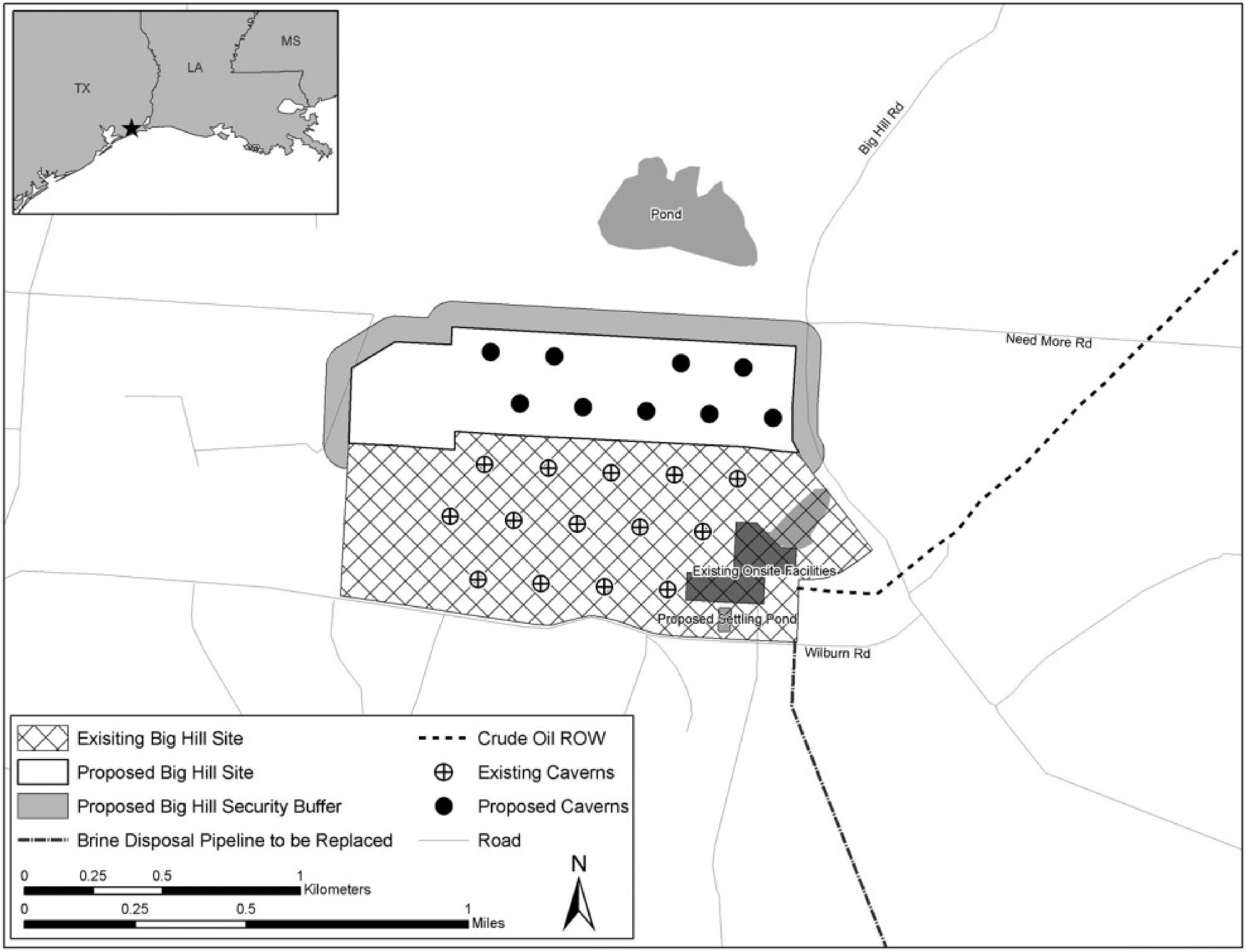
Figure 2.5.2-2: Layout and Proposed Expansion for Big Hill Storage Site



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2.5.3 West Hackberry Expansion Site

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

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

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

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

2.6 ALTERNATIVES ELIMINATED FROM DETAILED STUDY

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

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

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

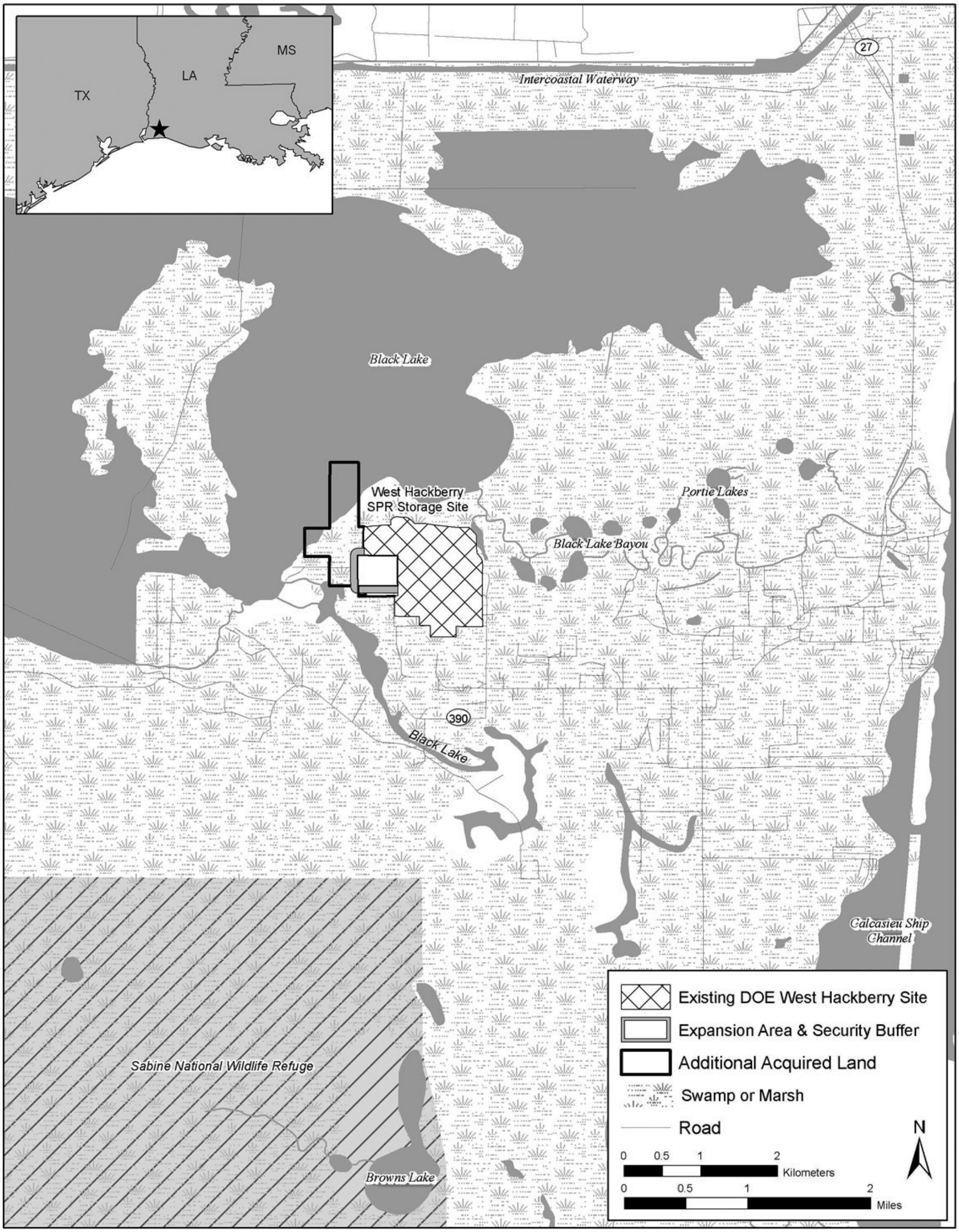

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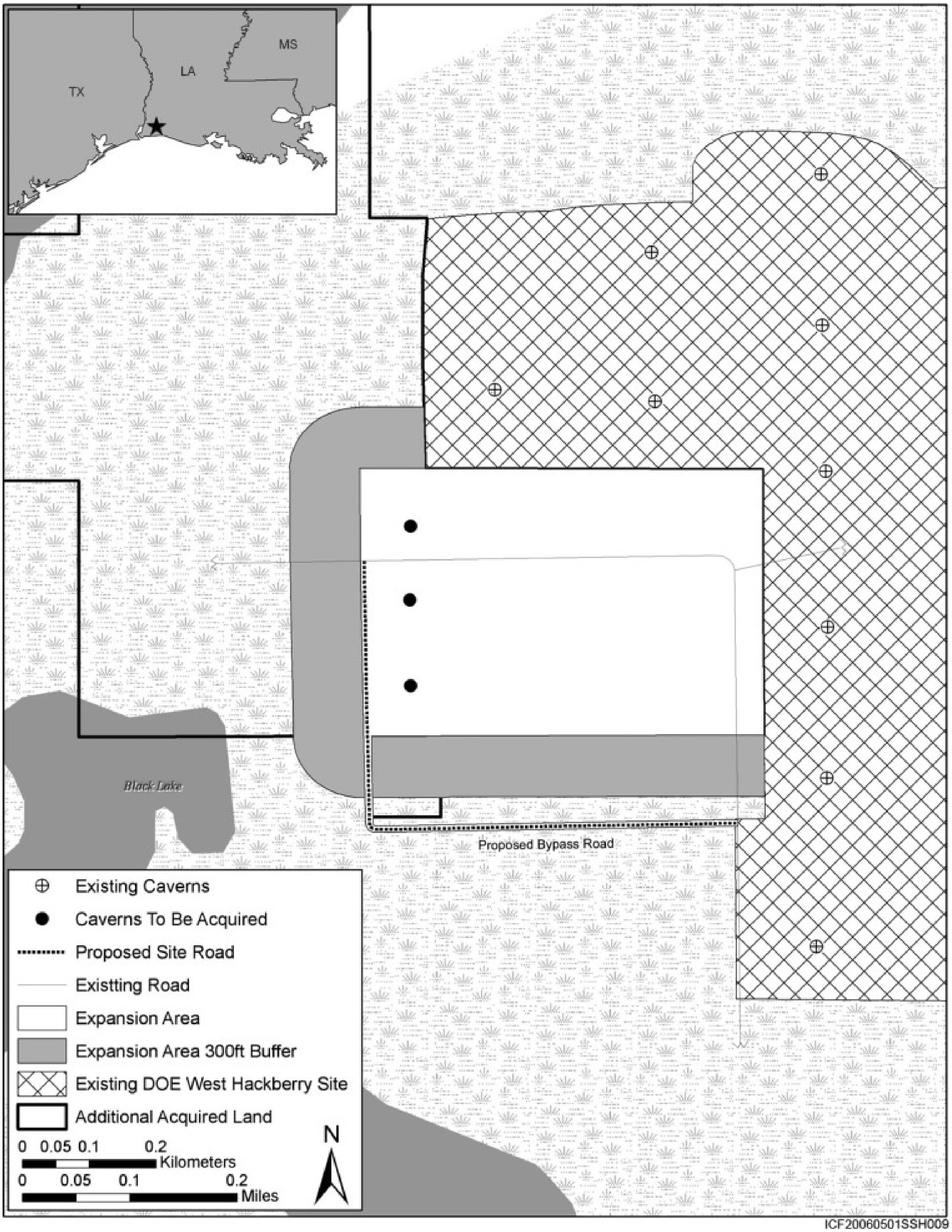
Figure 2.5.3-2: Layout and Proposed Expansion of West Hackberry Storage Site



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

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

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

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

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

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

Underground injection presents technical, operational, and hydrogeological obstacles.

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

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

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

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

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

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

2.7 COMPARISON OF ALTERNATIVES

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

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

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

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

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

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

2.7.1 Environmental Risks and Public and Occupational Safety and Health

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

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

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

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

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

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

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

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

2.7.2 Land Use

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

Possible Land Use Conflicts

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

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

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

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

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

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

Visual Resources

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

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

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

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

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

Farmland

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

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

Coastal Zone Management

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

2.7.3 Geology and Soils

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

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

2.7.4 Air Quality

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

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

2.7.5 Water Resources

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

Surface Water

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

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

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

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

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

Groundwater

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

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

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

Floodplains

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

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

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

2.7.6 Biological Resources

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

Plants, Wetlands, and Wildlife

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Threatened and Endangered Species

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

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

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

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

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

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

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

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

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

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

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

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

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

<u>Stratton Ridge Site and Associated Infrastructure</u>

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

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

Special Status Area

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

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

Essential Fish Habitat

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

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

2.7.7 Socioeconomics

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

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

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

2.7.8 Cultural Resources

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

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

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

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

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

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

2.7.9 Noise

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

2.7.10 Environmental Justice

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

2.7.11 Comparison of Alternatives

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1 mile = 1.609 kilometers

1 acre = 0.405 hectares

1 gallon = 0.0037854 cubic inches

1 inch = 2.54 centimeters

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

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