DRAFT
DAMAGE ASSESSMENT AND RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT FOR BAYOU VERDINE, CALCASIEU PARISH, LOUISIANA

Public Review Draft

March 27, 2009

Prepared by the:

National Oceanic and Atmospheric Administration

Louisiana Department of Environmental Quality

Louisiana Department of Wildlife and Fisheries

and

United States Fish and Wildlife Service

acting on behalf of the

United States Department of the Interior

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1 INTRODUCTION

This Draft Damage Assessment and Restoration Plan/Environmental Assessment (Draft DARP/EA) has been developed by the Louisiana Department of Environmental Quality (LDEQ), the Louisiana Department of Wildlife and Fisheries (LDWF), the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce, and the United States Fish and Wildlife Service (USFWS) acting on behalf of the U.S. Department of the Interior (DOI), (collectively, 'the Trustees'[1]) to address natural resources (including ecological services) injured, lost or destroyed due to releases of hazardous substances into Bayou Verdine and a substantial portion of Coon Island Loop in Calcasieu Parish, Louisiana[2].

Bayou Verdine is a shallow and sinuous bayou located within the Calcasieu Estuary southwest of the city of Westlake and slightly northwest of the city of Lake Charles. Its headwaters originate in an agricultural area immediately north and northwest of petroleum facilities that are owned and operated by ConocoPhillips Company ('ConocoPhillips') and Sasol North America Inc. ('Sasol NA'). The bayou generally flows in a south-southeast direction through an industrialized area before entering the Calcasieu River at Coon Island Loop. Historical operations at these two facilities have resulted in releases of hazardous substances, such as polynuclear aromatic hydrocarbons (PAHs), heavy metals, and other hazardous compounds, into the Calcasieu Estuary (the "Estuary"). This Draft DARP/EA

[1] The Louisiana Department of Natural Resources (LDNR) is also a designated state natural resource trustee in Louisiana but, because the natural resource impacts covered by this plan are outside Louisiana's defined coastal zone, LDNR did not directly participate in its development. The Trustees, however, coordinated with and kept LDNR informed during the assessment and restoration planning process to ensure that there were no potential impacts to trust resources in the State's defined coastal zone due to hazardous substance releases within the scope of this assessment.

[2] The scope of the injury assessment in this Draft DARP/EA reflects a threshold examination of the nature and extent of the contamination in the Calcasieu RI study area that could be attributed to hazardous substance releases from the Conoco or Sasol NA facilities. This examination led to an initial identification of areas of potential concern. The potential for natural resource injuries in these areas was then evaluated in light of the presence of hazardous substances potentially from either facility at levels of concern (i.e., concentrations with potential to adversely affect natural resources or services). Areas in which the hazardous substances from the Conoco or Sasol NA facilities posed little or no potential for causing or contributing to injuries to natural resources were excluded from further analysis.

addresses only injuries to natural resources in the Estuary that are or may be attributable to releases from these two facilities. It does not address natural resource injuries in the Estuary due to releases of hazardous substances by any other party.

This Draft DARP/EA describes the Trustees' proposed assessment of the natural resource injuries attributable to hazardous substances released from the ConocoPhillips and Sasol NA facilities into Bayou Verdine and Coon Island Loop (hereafter, the 'Site'). Further, it identifies the restoration action that the Trustees prefer and, therefore, are proposing for use to compensate for those injuries. The injury assessment and restoration actions proposed herein were developed by the Trustees working in cooperation with ConocoPhillips and Sasol NA, the potentially responsible parties (PRPs) for the Site. The Trustees and PRPs elected to use an integrated approach to response and natural resource damage assessment (NRDA) planning. Such cooperation resulted in the identification of a restoration action that both the Trustees and the PRPs consider appropriate to compensate for the nature and scale of natural resource injuries attributable to past operations at ConocoPhillips' and Sasol NA's facilities, and as a basis for settling the public's corresponding natural resource damage claims.

Under this Draft DARP/EA, assessed resource injuries would be compensated by constructing approximately 14.7 acres and enhancing approximately 230.0 acres of a brackish marsh as well as enhancing approximately 30.0 acres of mud flats. In order to accomplish this, the following activities/features are proposed to be undertaken or incorporated: levee degradation, marsh creation, and levee gapping. The proposed actions will result in the restoration of hydrology and marsh creation by placement of degraded levee material into open water areas. The location of the proposed restoration is a former dredge disposal site near West Cove Canal[3] within the Sabine National Wildlife Refuge (NWR). The refuge is managed by USFWS, and is located within the Calcasieu Estuary watershed, downriver from the Site.

This action may be implemented by the PRPs, under oversight by the Trustees, pursuant to the terms of a settlement of natural resource damage claims for the Site embodied in a formal Consent Decree.

[3] West Cove Canal is the name used by the U.S. Geological Survey (USGS) on their topographic maps to label the channel bordering the southern boundary of the proposed restoration site. However, local users of the Sabine NWR also refer to it as Hog Island Gully. The Trustees will use West Cove Canal throughout this document, as well as in supporting documents.

1.1 AUTHORITY

This Draft DARP/EA was prepared jointly by the Trustees pursuant to their respective authorities and responsibilities as natural resource trustees under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. § 9601 *et seq.*; the Federal Water Pollution Control Act, 33 U.S.C. § 1251, *et seq.*) (also known as the Clean Water Act or CWA), and other applicable federal or state laws, including Subpart G of the National Oil and Hazardous Substances Contingency Plan (NCP), at 40 C.F.R. §§ 300.600 through 300.615, and DOI's CERCLA natural resource damage assessment regulations at 43 C.F.R. Part 11 (NRDA regulations), which provide guidance for the natural resource damage assessment and restoration planning process under CERCLA.

1.2 NEPA COMPLIANCE

Actions undertaken by the Trustees to restore natural resources or services under CERCLA and other federal laws are subject to the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 *et seq.*, and the regulations guiding its implementation at 40 C.F.R. Parts 1500 through 1517. NEPA and its implementing regulations outline the responsibilities of federal agencies when preparing environmental documentation. In general, federal agencies contemplating implementation of a major federal action must produce an environmental impact statement (EIS) if the action is expected to have significant impacts on the quality of the human environment. When it is uncertain whether the proposed action is likely to have significant impacts, federal agencies prepare an environmental assessment (EA) to evaluate the need for an EIS. If the EA demonstrates that the proposed action will not significantly impact the quality of the human environment, the agency issues a Finding of No Significant Impact (FONSI), which satisfies the requirements of NEPA, and no EIS is required. For a proposed restoration plan, if a FONSI determination is made, the Trustees may then issue a final restoration plan describing the selected restoration action(s).

In accordance with NEPA and its implementing regulations, this Draft DARP/EA summarizes the current environmental setting; assesses the injury to or loss of natural resources or ecological services associated with the Site; describes the purpose and need for restoration actions; identifies alternative actions; assesses their applicability and potential impact on the quality of the physical, biological and cultural environment; and summarizes the opportunity the Trustees provided for public participation in the decision-making process. This information has been used to make a threshold determination as to whether preparation of an EIS is required prior to selection of the final restoration action. Based on the EA integrated into this document, the federal Trustees – NOAA and USFWS – do not believe that the proposed restoration action meets the threshold requiring an EIS, and pending

consideration of public comments on this Draft DARP/EA, propose to issue a Finding of No Significant Impact as described in Section 7.

1.3 PUBLIC PARTICIPATION

The Trustees have prepared this Draft DARP/EA for public review and comment. It provides the public with information on the natural resource injuries and service losses assessed in connection with the Site, the resource restoration objectives that guided the Trustees in developing this plan, the restoration alternatives that were considered, the process used by the Trustees to identify the preferred restoration alternative and the rationale for its selection. Public review of this Draft DARP/EA is the means by which the Trustees seek comment on the analyses used to define and quantify the resource injuries and losses as well as on the restoration action proposed for use to compensate for those injuries and losses. As such, it is an integral and important part of the NRDA process and is consistent with all applicable state and federal laws and regulations, including NEPA and its implementing regulations, and the regulations guiding assessment and restoration planning under CERCLA at 43 C.F.R. Part 11.

This Draft DARP/EA is being made available for review and comment by the public for a period of 30 days. The deadline for submitting written comments on the Draft DARP/EA is specified in one or more public notices issued by the Trustees to announce its availability for public review and comment. Comments are to be submitted in writing via mail, email, or fax to:

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1315 East-West Highway
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The Trustees will consider all written comments received within the comment period prior to approving and adopting a Final Damage Assessment and Restoration Plan/Environmental Assessment (Final DARP/EA). Written comments received and the Trustees' responses to those comments, whether in the form of plan revisions or written explanations, will be summarized in the Final DARP/EA.

1.4 ADMINISTRATIVE RECORD

The Trustees have maintained records documenting the information considered and actions taken by the Trustees during this assessment and restoration planning process, and these records collectively comprise the Trustees' administrative record (AR) supporting this Draft DARP/EA. Public comments submitted on this Draft DARP/EA, as well as the Final DARP/EA, would be included in this AR. The AR records are available for review by interested members of the public. Interested persons can access or view these records at the Calcasieu Parish Central Branch Library, at the following address:

Calcasieu Parish Central Branch Library
301 W. Claude Street
Lake Charles, LA 70605
(337) 475-8798

Arrangements must be made in advance to review or obtain copies of these records by contacting the person listed above. Access to and copying of these records is subject to all applicable laws and policies including, but not limited to, laws and policies relating to copying fees and the reproduction or use of any material that is copyrighted.

2 PURPOSE AND NEED FOR RESTORATION

This section generally describes the area of the Estuary affected by releases of hazardous substances by the PRPs (ConocoPhillips and Sasol NA), summarizes the response actions that have been, will be, or are expected to be undertaken to address that contamination, summarizes the Trustees' assessment of natural resource injuries and losses attributable to that contamination, including area, and associated compensation requirements, and provides information on the physical, biological and cultural environments in the affected area.

2.1 OVERVIEW OF THE SITE

The Site is situated within the Calcasieu Estuary, which is located in southwestern Louisiana (Figure 2.1). The Estuary and its associated tributaries (including Bayou Verdine) comprise a large, tidally influenced wetland system approximately 40 miles in length, extending north from the Gulf of Mexico to the saltwater barrier upstream of Lake Charles. The system is an important nursery area for and supports an abundant array of fish and wildlife species.

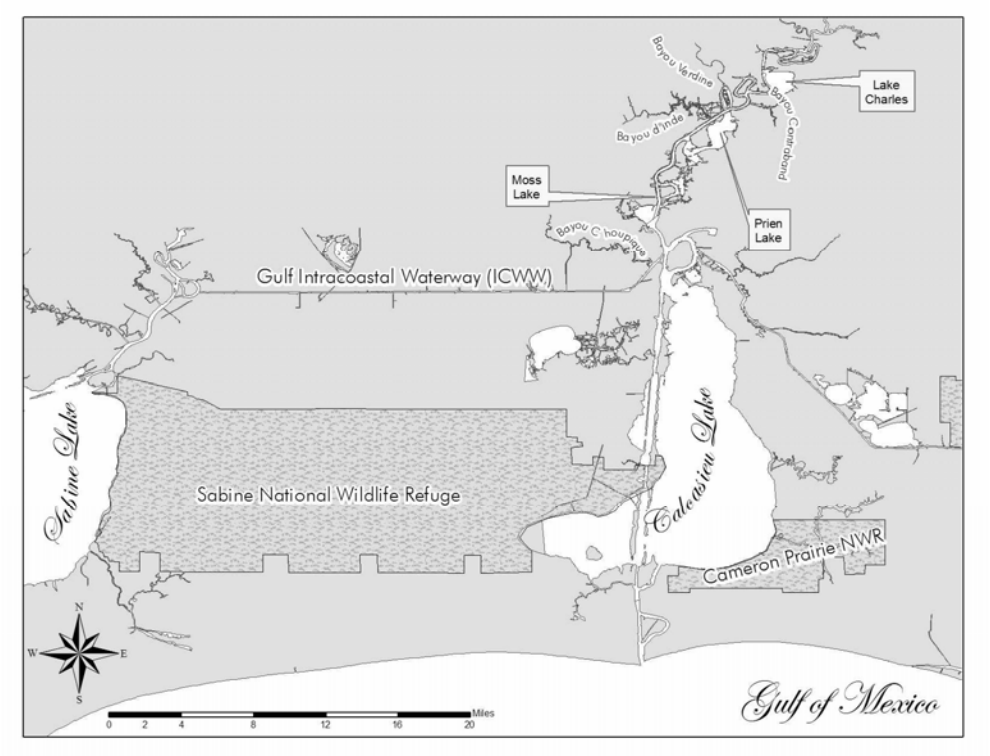

Figure 2.1 – Calcasieu Estuary Location Map

Bayou Verdine and Coon Island Loop, the areas comprising the Site, are located in the upper Estuary, southwest of the City of Westlake and slightly northwest of the City of Lake Charles, within Calcasieu Parish. The upper Estuary is characterized by industrial development associated with petroleum refining and chemical production. Over 30 major companies have facilities in this area.

Bayou Verdine is a shallow and sinuous wetland system, approximately 4.2 miles long, originating in an agricultural area immediately north-northwest of the ConocoPhillips and Sasol NA facilities. The bayou generally flows south-southeast, subject to tidal influences, through an industrialized area before entering the Calcasieu River at Coon Island Loop. Coon Island Loop is a readily identifiable reach that connects with the Calcasieu Ship Channel at the southern end of Coon Island, just to the north of the Loop 210 bridge. The area surrounding the Site is very industrialized, though there is some marsh habitat fringing the Coon Island shoreline.

Several major industrial facilities are sited along Bayou Verdine, including those owned and operated by ConocoPhillips and Sasol NA.

2.1.1 The ConocoPhillips and Sasol NA Facilities

ConocoPhillips

ConocoPhillips operates a petroleum refinery along the bayou. It is located primarily on the north and east side of Bayou Verdine to the north of I-10 (Figure 2.2). The facility covers approximately 675 acres, 75 of which are occupied by the refinery process areas. ConocoPhillips' facility border reaches to the north and east of the bayou and the facility has been a site of operations since 1942.

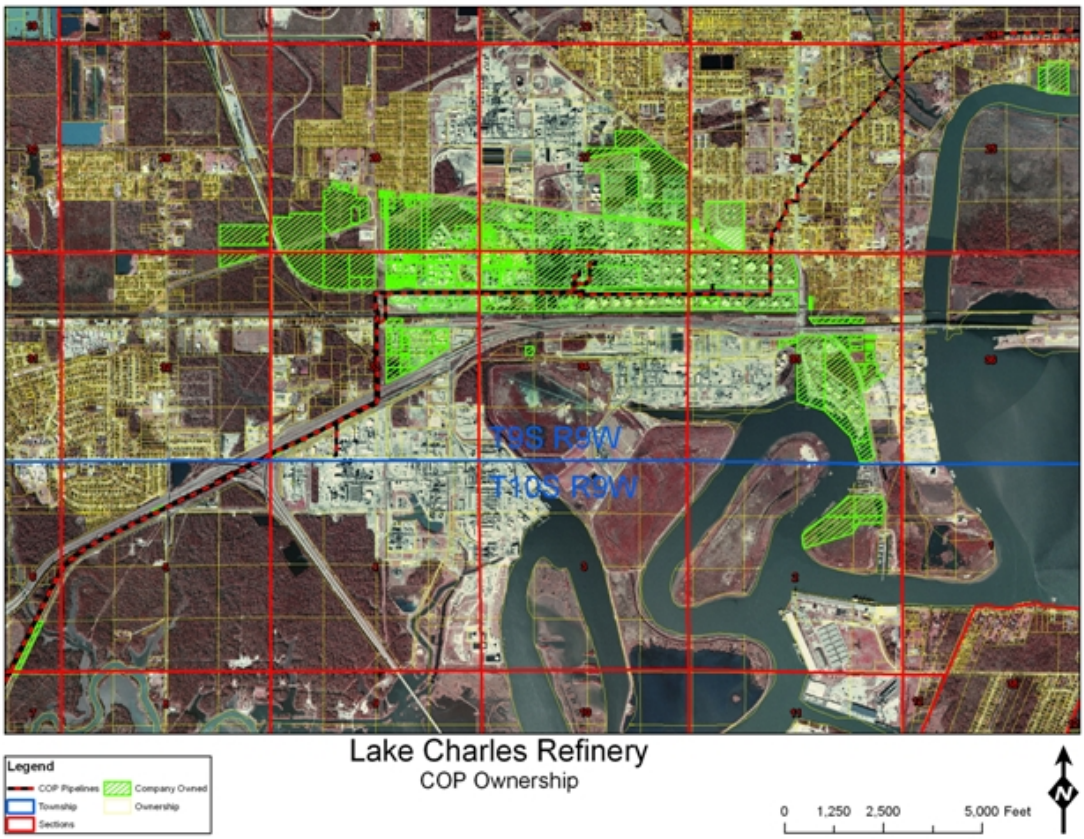

Figure 2.2 – ConocoPhillips and Sasol NA Facility Locations, Calcasieu Parish, LA.

ConocoPhillips' Lake Charles Refinery has a production capacity of 252,000 barrels per day. The refinery processes heavy, high-sulfur and low-sulfur crude, and produces a full range of fuel products. It also provides the feedstock for Excel Paralube, ConocoPhillips' joint venture facility that produces high-quality lubricating base oils. This operation accounts for approximately 10 percent of lubricating base oil production in the United States. In recent years, ConocoPhillips upgraded the Lake Charles Refinery to process synthetic crude oil from the Petrozuata heavy-oil joint venture in Venezuela.

This facility discharges into Bayou Verdine through numerous outfalls and into the Calcasieu River through two (Figure 2.3). Most of these outfalls are primarily for surface water runoff; however, outfalls 001, 002, and 006 receive process wastewater or overflow from waste treatment or storage areas and are more likely to generate streams with contaminated effluent. The facility's discharge history includes both permit exceedences and spills into Bayou Verdine involving such substances as ethylene dichloride (EDC), crude oil, diesel, hexavalent chromium, and cobalt.

Sasol North America

In 1984, Vista Chemical Company (now Sasol North America Inc.) purchased the Lake Charles Chemical Complex from Conoco Inc. Vista Chemical Company was renamed CONDEA Vista Company in 1996 and Sasol North America Inc. in 2001. This facility is immediately to the north of the ConocoPhillips refinery. It began operations as early as 1965 under a division of ConocoPhillips. The facility had process wastewater and stormwater outfalls permitted to discharge into Bayou Verdine (Figure 2.3). These outfalls received flow from various operational units at the facility, including the Alcohol Unit, East Lake Charles Chemical Plant Sanitary Sewers, Ethoxylate Unit, Normal Paraffin Unit, Ethylene Unit, Steam Plant, Linear Alkyl Benzene Plant, and Vinyl Chloride Monomer Plant. The Vinyl Chloride Monomer Plant was sold to Georgia Gulf in 1999. The facility's discharge history also includes both permit exceedences and spills into Bayou Verdine involving such substances as EDC, benzene, toluene, chromium, zinc, chloroform, and methyl chloride.

Operations at the ConocoPhillips and Sasol NA facilities have resulted in the releases of hazardous substances into the surrounding environment over several decades.

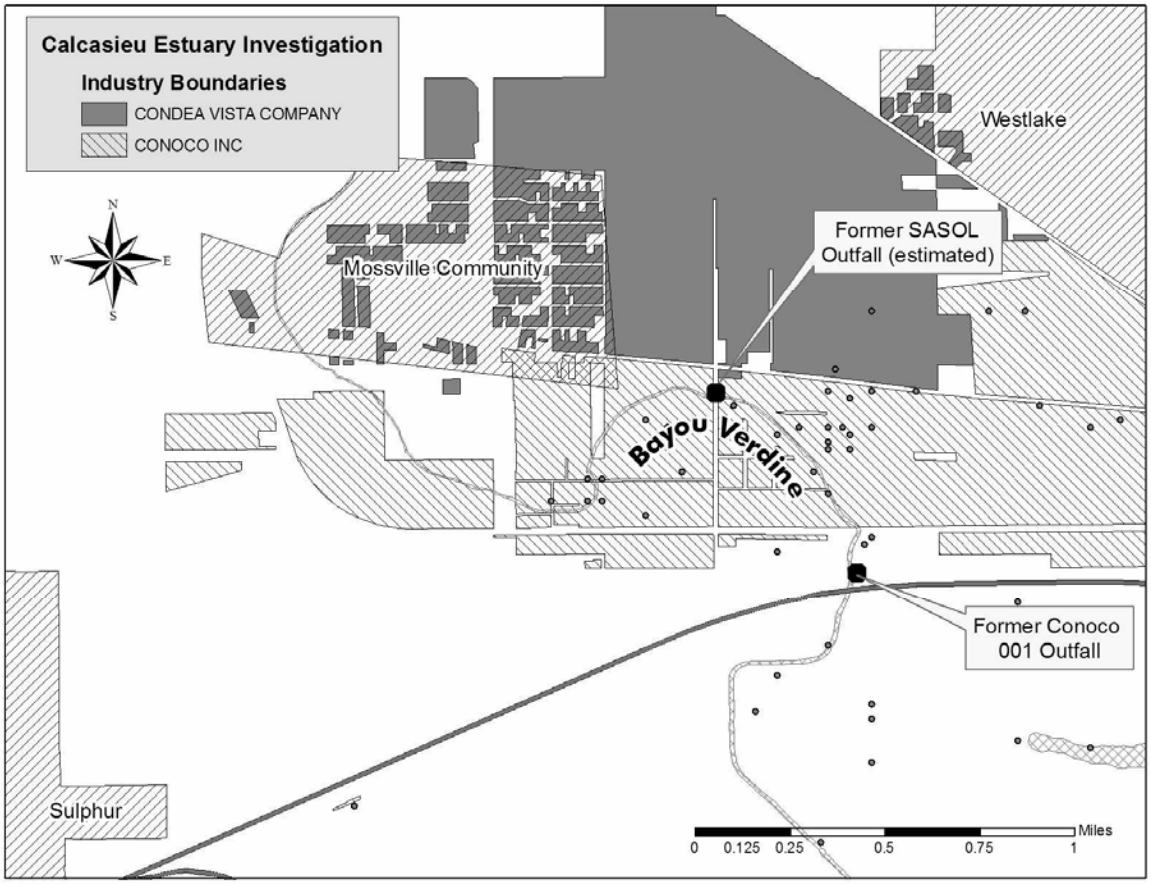

Figure 2.3 – ConocoPhillips and Sasol NA Facility Boundary and Outfall Locations, Calcasieu Parish, LA.

2.1.2 Human Use Characteristics

Calcasieu Parish is one of 64 parishes (counties) in Louisiana and occupies 2,775 km^2 of the state. It is part of the Lake Charles metropolitan area, which ranked as having the 7^{th} largest population (pop. 183,577) in the state's census report for 2000. The parish also includes the cities of Sulphur, Westlake, and Mossville.

The economy of the area has its origins in the abundant natural resources found within the parish. The early economy was based upon farming, fishing, and the harvest of longleaf yellow pine and cypress for lumber. The discovery of sulfur in 1869 and oil in the early 1900s significantly increased economic growth in the area. Chemical manufacturing and petroleum refining operations began in the early 1920s, following the discovery of local petroleum and gas reserves. In the mid 1920s, a 34-mile channel was dredged from Lake Charles to the Gulf of Mexico to establish a deep-water port and enhance industrial

development in and around Lake Charles. The region eventually became a major American producer of oil and natural gas and a center for petroleum refining and petrochemicals manufacturing. Over 30 major companies operate facilities in the upper Estuary today, collectively producing a wide range of industrial chemicals, petroleum products, and commercial feedstocks. Due to the magnitude of industrial activity in the area, the Port of Lake Charles is ranked as the 13th largest seaport in the United States.

The land around Bayou Verdine and Coon Island Loop is characterized by a variety of uses, including mixed rural, residential, commercial, and industrial applications. Heavy industry, particularly petroleum and chemical refining and production, predominate land usage in the southern section of the bayou. The industrial development in the vicinity of the Site has had a significant impact on the local system. Sections of Bayou Verdine have been rerouted in the past to accommodate adjacent industrial facilities[4]. Barges present at the confluence of Bayou Verdine with Coon Island Loop generally preclude entering the bayou via water and terrestrial access is also restricted via the surrounding private industrial properties. There are no public boat launching sites or other types of public access points found along the bayou itself. The eastern arm of Coon Island Loop is approximately one to three meters in depth and is not used by commercial vessels, but the western arm of the loop is an active shipping channel that is periodically dredged. This channel is part of the Calcasieu Ship Channel, the marine industrial transport corridor from the Port of Lake Charles to the Gulf of Mexico. The area surrounding Coon Island Loop is also fairly industrialized, supporting several major facilities as well as oil and gas production. Coon Island Loop is accessible for water-based recreational activities, such as fishing. However, Coon Island is primarily used as a dredge spoil containment and storage location. These industrial usages and overall setting significantly limit public access to or use of the Site for other purposes by humans.

2.1.3 Surface Water Characteristics

Bayou Verdine and its surrounding area are located within the 100-year and 500-year flood plains of the Calcasieu River basin, and the elevation gradients are small. Relief in the area

[4] During the 1950s, the southernmost 1,000 meters of the bayou were rerouted to the west when Olin Corporation (Olin) built the West Pond over the original bayou. The former route of Bayou Verdine downstream of I-10 was to the east of its present course; however, the confluence with the Coon Island Loop was near its present mouth (PRC 1994). Following the initial plant build-up, the only reported dredging in Bayou Verdine was performed by PPG in the North Dock Area (at the confluence of Bayou Verdine and the Coon Island Loop) in 1992 and involved dredging the area to a depth of 6 meters to accommodate barge traffic (PRC 1994).

of the bayou ranges from 1 to 5 meters above mean sea level (MSL). Bayou Verdine is tidally-influenced throughout, both wind and lunar driven, with up to 3 to 6 inches of daily water fluctuation (U. S. Army Corps of Engineers ('USACE'), 1976). Estimated average flow rate for the bayou is approximately 8 cubic feet per second (cfs) in its southern reaches (USACE, 1976).

The character of the bayou varies considerably as it proceeds downstream. According to the USFWS National Wetland Inventory Map, the upper reaches of the bayou (from point of origin to I-10) are comprised of a palustrine wetland system that is periodically flooded during storm events and a riverine segment that is permanently flooded. The upper portions of the bayou have not been dredged and are generally undisturbed in geometry and vegetation. The lower segment of the bayou has been dredged and extensively modified (with a portion of this section re-routed) to create an industrial canal. The lower bayou has significant industrial development and is used as a slip for barges that service nearby petrochemical facilities.

Bayou Verdine and Coon Island Loop are approximately one to three meters in depth, ten meters wide, and exhibit a salinity gradient. The freshwater typical at the origin of the Bayou gradually transitions to brackish water near the confluence of Coon Island Loop and the Calcasieu River. At the confluence of Bayou Verdine and Coon Island Loop, the bayou discharges into a deep channel that is a conduit for brackish to saline water from the ship channel. The engineered confluence is wider than the natural opening and allows for greater tidal influence and storm surge up the bayou.

Overall, Bayou Verdine is a low-energy and low-flow system. Water flow in the bayou is generally sustained by run-off from industrial sources, with minor contributions from municipal, agricultural, and rural residential areas. Shallow groundwater also appears to enter the bayou under gaining stream conditions (IT Corp. 1995).

Bayou Verdine is a net sediment exporter, receiving sediments from the undeveloped land to the northwest and from industrial areas associated with ConocoPhillips, Sasol NA, and PPG. Sediments within the bayou tend to be silts and silty sands. This appears to be the combined result of overland soil erosion. In addition, black coke fines from the ConocoPhillips refinery are widespread in the lower portion of the bayou. Sediments in the upper reaches of Bayou Verdine tend to be finer grained, indicating the approximate extent of tidal surge deposition.

2.1.4 Habitat Characteristics

Past residential, commercial, rural, and industrial development along Bayou Verdine and adjacent to Coon Island Loop has affected the character of the area as a resource habitat to some degree, particularly in channelized sections of Bayou Verdine. The variety of habitat types present (Figure 2.4) reflect the salinity gradient across the Site.

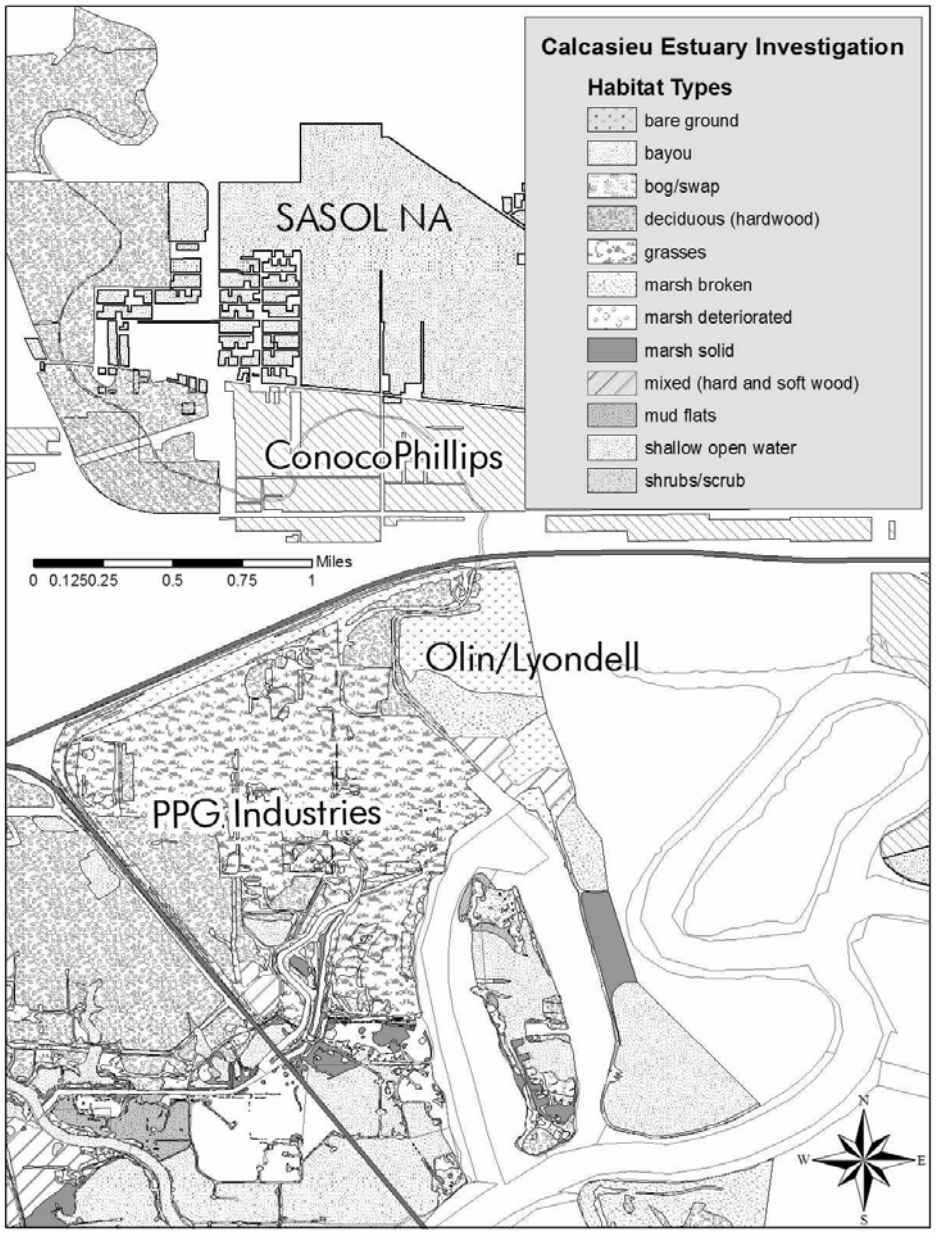

Figure 2.4 – Habitat Types Found Within the Bayou Verdine Area, Calcasieu Parish, LA.

Due to the salinity gradient across the Site, the habitat conditions in this area are generally suitable for a wide array of fish. Freshwater fish species likely to be present in the upper reaches of Bayou Verdine include those listed in Table 2.1. Fish species that would be common to brackish areas (lower Bayou Verdine and Coon Island Loop) include those identified in Table 2.2. Utilization of these areas could occur year-round for the species listed in these tables.

Table 2.1 – Common Freshwater Fish

Common Name	**Species**	**Common Name**	**Species**
Mississippi silvery minnow	*Hybognathus nuchalis*	golden shiner	*Notemigonus crysoleucas*
creek chub	*Semotilus atromaculatus*	carp	*Cyprinus carpio carpio*
channel catfish	*Ictalurus punctatus*	pirate perch	*Aphredoderus sayanus*
mosquito fish	*Gambusia affinis*	white bass	*Morone chrysops*
yellow bass	*Morone mississippiensis*	stripped bass	*Morone saxatilis*
rock bass	*Ambloplites rupestris*	green sunfish	*Lepomis cyanellus*
bluegill	*Lepomis macrochirus*	warmouth	*Lepomis gulosus*
longear sunfish	*Lepomis megalotis*	redear sunfish	*Lepomis microlophus*
spotted sunfish	*Lepomis punctatus*	white crappie	*Pomoxis annularis*
black crappie	*Pomoxis nigromaculatus*	sand darter	*Ammocrypta clara*
banded darter	*Etheostoma zonale*	freshwater drum	*Aplodinotus grunniens*
spotted gar	*Lepisosteus oculatus*	longnose gar	*Lepisosteus osseus*
bowfin	*Amia calva*	bigmouth buffalo	*Ictiobus cyprinellus*
smallmouth buffalo	*Ictiobus babalus*	paddlefish	*Polyodon spathula*
largemouth bass	*Micropterus salmoides salmoides*		

Table 2.2 – Common Brackish Water Fish

Common Name	**Species**	**Common Name**	**Species**
red drum	*Sciaenops ocellatus*	southern flounder	*Paralichthys lethostigma*
sheepshead	*Archosargus probatocephalus*	Atlantic croaker	*Micropogonias undulates*
spot	*Leiostomus xanthurus*	sand seatrout	*Cynoscion arenarius*
spotted seatrout	*Cynoscion nebulosus*	Gulf menhaden	*Brevoortia petronus*
bay anchovy	*Anchoa mitchilli*	catfishes	*Ictaluridae* spp.
sheephead minnow	*Cyprinodon variegates*	livebearers	*Poeciliidae* spp.
killifishes	*Fundulide* spp.	silversides	*Menidia* spp.
gobies	*Gobiidae* spp.		

During a small portion of the year, the area would provide habitat services essential to numerous species of marine invertebrates, including white shrimp *(Litopenaeus setiferus)* and the blue crab (*Callinectes sapidus*). Brown shrimp (*Farfantepenaeus aztecus*), one of the

most abundant shrimp species, undergo post-larval and juvenile growth in brackish water areas of the Estuary, including in Bayou Verdine and Coon Island Loop. Similarly, shortly after being spawned offshore in late summer, blue crab larvae migrate inshore and utilize fresh and brackish water environments, including those within Bayou Verdine and Coon Island Loop, to continue their life cycle.

Benthic resources such as copepods, polychaetes, mollusks and amphipods occupy vegetated and open water areas within Bayou Verdine and Coon Island Loop. There is some marsh habitat fringing Coon Island within the loop itself.

2.2 SUMMARY OF RESPONSE ACTIONS

Over the years, the Calcasieu Estuary has been the subject of a number of investigations and environmental response actions under the direction or oversight of the U. S. Environmental Protection Agency (USEPA) and/or LDEQ. The most extensive effort to date, however, to identify the nature and extent of hazardous substances present in the Estuary, was the USEPA-lead Remedial Investigation (RI) of contaminants in sediments, surface water and biota in the Calcasieu Estuary completed in 1999 (ENTRIX 1999). That investigation focused on four Areas of Concern (AOCs) within the Estuary: Bayou d'Inde, Bayou Verdine, Upper Calcasieu River (starting with the salt water barrier) and the Lower Calcasieu River (including Indian Marais Lagoon and ending at Moss Lake) (Figure 2.5). The AOC boundaries were developed in the early stages of the RI and aided in management and evaluation of the full study area. The information provided by that RI is being used by USEPA and LDEQ to assist in planning and to inform decisions regarding appropriate clean-up actions in the Estuary.

The Bayou Verdine AOC encompasses the lower 2.9 miles of the bayou, bounded downstream at its confluence with the Calcasieu River at Coon Island Loop and upstream at a point approximately 0.5 miles upstream of Old Trousdale Road. The Bayou Verdine AOC includes the Bayou Verdine channel and its tributaries and each of their associated surface waters, sediments, soils, biota, adjoining shorelines and banks, riparian habitats, and wetlands. Coon Island Loop is part of the Upper Calcasieu AOC.

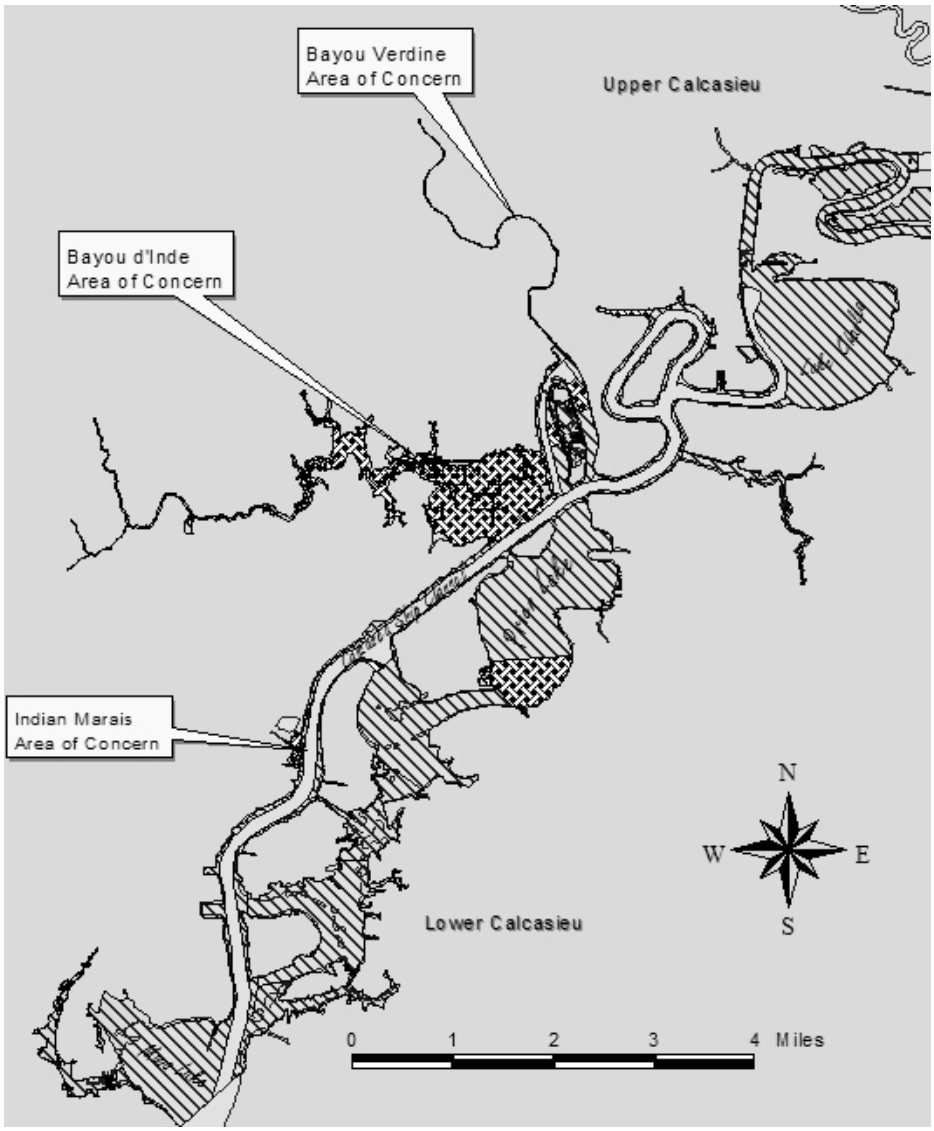

Figure 2.5 – Calcasieu Estuary Study Areas of Concern

The characterization of contaminants in the Bayou Verdine AOC largely resulted from work carried out jointly by ConocoPhillips and Sasol NA. This information, in combination with other data collected in the bayou by USEPA, was used to produce a Baseline Ecological Risk Assessment for Bayou Verdine (Bayou Verdine BERA) (ENTRIX, 2001a). This work was performed under USEPA and LDEQ oversight, in cooperation with the Trustees. The nature and extent of the contamination in Coon Island Loop and its ecological risks were addressed in a separate Baseline Ecological Risk Assessment encompassing the Upper Calcasieu AOC (USEPA 2003).

As a result of these investigations, two response actions have been identified to address the contamination within Bayou Verdine. These actions are expected to meet response objectives for the Bayou Verdine AOC.

The first action was undertaken by ConocoPhillips and Sasol NA in 2002-2003 as a USEPA-approved time-critical removal action. It addressed contamination (free phase EDC) found at the interface of the bayou's sediment bed with the underlying clay layer (ENTRIX 2001a), in a localized area of the bayou near its confluence with West Ditch (the West Ditch Area)[5]. The action entailed the removal of all sediments in a defined area of the bayou and placement of a barrier and cover over the underlying clay. The work was completed in 2003.

The second action is a non-time critical removal action that the USEPA has approved for use to address the risks posed by the remaining contamination in the Bayou Verdine AOC. This action will consist of the dredging of sediments from certain areas of the bayou's main channel, with upland on-site consolidation and containment. It will result in a substantial reduction in the mass of contaminants in the bayou. Any contamination residual to this action will be addressed through natural recovery processes (e.g., biodegradation of organics; new sedimentation). This action was identified based on the results of the Engineering Evaluation/Cost Analysis (EE/CA) for the Bayou Verdine AOC. ConocoPhillips and Sasol NA will implement this removal action under CERCLA Section 106, under USEPA oversight.

Response actions in Coon Island Loop (part of the Upper Calcasieu AOC) have been defined based on the results of the extensive RI work undertaken by the USEPA. Monitored natural attenuation is the preferred response action for this area as natural attenuation is occurring at an acceptable rate for a majority of this area[6]. Portions of Coon Island Loop are also periodically dredged to maintain access to PPG's marine docks and a barge terminal, and to maintain navigability of the waterway, pursuant to USACE permits. This dredging entails removal of sediments to confined disposal facilities, an action that further reduces or eliminates resource exposure to contaminants in these areas. This periodic activity expedites

[5] The EDC had been detected by Conoco and Sasol NA during investigations in preparation for an Engineering Evaluation/Cost Analysis (EE/CA) for the Bayou Verdine AOC.

[6] The area within Coon Island Loop not subject to this response action is where PCBs had the potential to cause injury to resources. This area was excluded from the injury analysis for this Site, and therefore excluded from response activities to be undertaken by ConocoPhillips and Sasol NA, because their facilities are not linked to PCB releases into the Estuary.

contaminant remediation and facilitates natural recovery in the Loop. Natural recovery is, therefore, expected to address residual contamination in the sediments of the Loop.

The response actions described or outlined above, if appropriately planned and implemented, should be sufficient to protect natural resources from future harm due to hazardous substances releases from the PRP's facilities, and to allow natural resources affected by those releases the opportunity to return to baseline conditions within a reasonable period of time. The Trustees will continue to work with the USEPA as well as ConocoPhillips and Sasol NA to ensure response decisions and plans are protective of natural resources. Response actions, however, do not compensate the public for the resource injuries or losses caused by these hazardous substances, including any losses of resources or resource services pending recovery or due to response actions undertaken (e.g., the removal of sediments within the bayou). The investigations of contaminants in Bayou Verdine and in Coon Island Loop revealed the presence of hazardous substances at levels sufficient to cause harm to natural resources within these areas.

2.3 STRATEGY FOR ASSESSING RESOURCE INJURIES AND COMPENSATION REQUIREMENTS

The Trustees' goal in this NRDA process has been to reliably identify the nature and extent of natural resource injuries attributable to historical releases of hazardous substances into the Estuary from the ConocoPhillips and Sasol NA facilities, to identify injuries from response actions planned or undertaken, to quantify the resulting resource and ecological service losses[7], and to provide the technical basis for determining the need for, type of, and amount of restoration appropriate to compensate the public for those losses. The remainder of this section provides an overview of the Trustees' assessment strategy for this Site, including the approaches used to evaluate potential injuries to specific resources, quantify associated losses, and identify the preferred restoration alternative proposed in Section 6.

As noted in subsection 1.1, the assessment process is guided by the NRDA regulations issued under CERCLA and found at 43 C.F.R. Part 11. For the Site, the Trustees and PRPs identified an assessment approach that could be performed in conjunction with the remedial investigations undertaken and the response planning pertinent to Bayou Verdine and Coon Island Loop. This "integrated" approach permits data sharing, since much of the data needed

[7] *Ecological services* means the "physical and biological functions performed by the resource including the human uses of those functions. These services are the result of the physical, chemical, or biological quality of the resource". (43 C.F.R. § 11.14(nn)).

to support response planning can be useful in evaluating and estimating natural resources injuries. Additionally, such integration typically results in time and cost savings, and promotes efficiency in the overall process. Further, NRDAs undertaken with the cooperation of PRPs avoid costly litigation and expedite restoration of the environment.

The Trustees sought to directly link injury assessment and restoration planning, so these processes would occur simultaneously and allow restoration-based compensation to be defined more directly and quickly. In a restoration-based assessment, injuries to and/or losses of natural resources and ecological services are quantified in ways that facilitate the identification of restoration projects that serve to compensate the public with the same level, type and quality of resources, or resource services, as were lost. The restoration-based assessment approach is consistent with the CERCLA NRDA regulations at 43 C.F.R. § 11.31. They allow restoration planning to be included as part of the Assessment Plan Phase where available data are sufficient to support their concurrent development.

2.3.1 Injury Assessment and Loss Quantification

The injury assessment process has two stages: 1) resource injury evaluation and 2) resource and service loss quantification. A number of factors are considered in identifying and quantifying resource injuries, including, but not limited to:

- the hazardous substances of concern ('contaminants of concern', or COCs)

the specific natural resources and ecological services of concern;

the evidence indicating exposure, pathway and injury;

the mechanism(s) by which injury to natural resources of concern would occur;

the type, degree, spatial and temporal extent of injury; and

the type(s) of restoration that would be appropriate and feasible for use as compensation.

To evaluate injury to resources for the Site, the Trustees reviewed existing information, including remedial investigation data, ecological risk assessments, and scientific literature, and applied their collective knowledge and understanding of the function of the terrestrial and aquatic ecosystems at and near the Site. Identifying and understanding the COCs for the Site, as well as their pathways to and potential effects on ecological receptors, is key to the Trustees' approach to injury assessment. PAHs and heavy metals were identified as the primary COCs for natural resource damage assessment purposes for the Site.

Data from site-specific studies as well as results of studies reported in the scientific literature were used to identify and estimate resource injuries, as part of a Habitat Equivalency Analysis (HEA) (NOAA, 2000). The HEA method is recognized as a valid and reliable procedure for quantifying ecological losses and for scaling or evaluating its restoration equivalent. The data generated by the USEPA and PRPs was used to create a spatial representation of the distribution of COCs across the Site in relation to the locations of the different habitat areas by plotting the data on aerial photographs using software combining database and GIS packages (MS Access/ArcView 3.3). With the concentrations of COCs in each habitat area plotted, the amount of potentially affected acreage was determined for each habitat type. Estimates of the extent or degree of injury for each habitat area (percent resource services lost due to contamination) were then developed using peer-reviewed scientific literature, and best professional judgment consistent with the Trustees' collective resource expertise. In the event of technical uncertainty, conservative assumptions or inputs (i.e., in favor of the natural resources and leading to higher estimates of injury) were used in the analysis in lieu of conducting additional studies.

Calculation of time-based injury durations were performed using conservative estimates of the duration of the recovery period for the individual habitat areas based on contaminant concentrations and planned response. For areas where some response has occurred or is planned, years to partial or full recovery were conservatively estimated and used as inputs.

This injury assessment approach resulted in a conservative estimate of the total potential number of wetland service acre-years lost due to the natural resource injuries attributable to the COCs at the Site. This quantification of total services lost is expressed as the number of discounted service acre years (DSAYs) lost due to the assessed injuries. In this context, the assessed DSAYs represent the amount of total habitat services lost, in acre-years (adjusted to the present time).

The Trustees' Proposed Restoration Plan to compensate for assessed natural resource losses is set forth and described in Sections 3.0 (The Affected Environment), 4.0 (Proposed Injury and Service Loss Evaluation), 5.0 (The Restoration Planning Process), 6.0 (Restoration Alternatives Comparison) and Section 7.0 (Analysis and Preliminary Finding of No Significant Impact).

2.4 Evaluation of Hurricanes Katrina and Rita Impacts to the Bayou Verdine Injury Assessment

The evaluation of natural resource injuries and service losses proposed herein for the Site was developed and is based on environmental data and information collected prior to 2005, the year that Hurricanes Katrina and Rita came ashore along the Louisiana/Mississippi coast. Hurricane Katrina brought major storm surge, catastrophic flooding and destructive wind conditions to eastern Louisiana, Mississippi and Alabama coastal areas. Hurricane Rita made land-fall in eastern Texas/western Louisiana just 26 days later and caused extensive damage in the lower Calcasieu Estuary.

In developing this Draft DARP, the Trustees considered whether reliance on the injury evaluation and analyses for the Site developed prior to 2005 was still reasonable after these storms. To address this, the Trustees considered whether one or both of these storms were likely to have significantly affected the presence and distribution of hazardous substances in Bayou Verdine and Coon Island Loop, or the residual effects of known or anticipated response actions in these areas. The Trustees considered information relating to the storms and results of sediment sampling in the upper Calcasieu Estuary prior to and after the storms. Their evaluation indicates the storms likely did not alter the presence and distribution of hazardous substances at the Site in any material way. In this Draft DARP, therefore, the Trustees are proposing the injury assessment as originally developed for the Site. The Trustees' evaluation of this issue is summarized in a Draft Technical Memorandum dated June 22, 2006, that is included in the Draft DARP at Appendix B**.**

3 THE AFFECTED ENVIRONMENT

In restoration planning, the Trustees emphasis has been on the areas and resources directly affected by the historical releases of hazardous substances into the Estuary from ConocoPhillips and Sasol NA facilities, however, the Trustees have also recognized that the injured resources are part of a larger ecological system - the Calcasieu Estuary. Accordingly, in developing this Draft DARP/EA, appropriate restoration opportunities within that system have been considered. Under this approach, natural resource Trustees are better able to compensate for resource injuries while also taking into account the multiple ecological and human use benefits of restoration within the larger ecosystem.

This section provides additional information on the physical, biological and cultural environments within the Calcasieu Estuary, in which the restoration action proposed in this Draft DARP/EA would occur, consistent with NEPA. The information in this Section, together with other information in this document, provides the basis for the Trustees' evaluation of the potential environmental impacts of the alternative restoration actions listed in Section 5 (Restoration Alternatives Comparison) as well as the potential impacts of the restoration action proposed in Section 6. The scope of the environmental impacts addressed in this Draft DARP/EA include those on wildlife, fish and invertebrates, essential fish habitat, threatened and endangered species, farmland and urban development, recreation resources, water and sediment quality, air quality, cultural resources, hazardous and toxic waste, and environmental justice.

3.1 THE PHYSICAL ENVIRONMENT

The Calcasieu Estuary is located in the coastal plain of the southwestern corner of Louisiana, north of the Gulf of Mexico, and encompasses the Calcasieu River from the Gulf to the saltwater barrier at Lake Charles. The Estuary was initially formed as a bay in the drowned river valley of the Calcasieu River during the Holocene rise of sea level. The lower end of the river was naturally blocked by a bar formation, with only a small tidal pass outlet. Before the bar was removed and the channel dredged for navigation, the lakes and adjacent marshes were largely freshwater. Now, the Estuary is comprised of a complex interconnected system of bayous, bays, shallow lakes, and dredged ship channels fringed by saline and brackish marshes. The predominant hydrologic components of the Estuary include Lake Charles, Prien Lake, Moss Lake, and Calcasieu Lake, and major tributaries of the system include Bayou d'Inde, Bayou Verdine, Bayou Contraband, and Bayou Choupique.

The Estuary is largely nestled among urban districts of Calcasieu and Cameron Parishes. The upper Estuary in Calcasieu Parish is heavily developed and highly industrialized. The Calcasieu Ship Channel, a dredged navigational channel, is maintained within the Calcasieu River at between 35 to 42 feet in depth, with the channel increasing in depth as it approaches the Gulf. This channel serves as the marine industrial transport corridor from the Port of Lake Charles to the Gulf of Mexico. The active portion of the ship channel is routinely dredged, at an average of once every two to four years. The Calcasieu River has a tidal range of two feet at its mouth that decreases in amplitude as the channel proceeds upriver.

The lower portion of the Estuary is largely comprised of undeveloped coastal marshes, habitat that provides essential support for many species of fish and wildlife. Two national wildlife refuges are located in the lower Estuary – the Sabine National Wildlife Refuge (Sabine NWR) and the Cameron Prairie NWR. These areas are owned and managed by the USFWS for conservation and protection of natural resources.

The lakes and river channel bottoms consist mainly of sand and gravel deposits, natural levees of fine sands, and mud deposits with organic-rich muddy backswamp deposits between them. The silt is typically black with plant and shell fragments. Sediments generally become finer and more stable in the upstream reaches of the Estuary where vegetation is more prevalent and tidal surge tends to be lowest.

The Calcasieu Estuary has been impacted by industrial development, including through discharges and other types of contaminant releases. The nature and extent of hazardous substances in the Estuary was extensively investigated in the RI process, by four major component areas (Figure 3.1):

Upper Calcasieu River - This area includes a large, industrial ship canal approximately 15 miles in length and occupying 2,871 acres. It includes Lake Charles, the upper Calcasieu River and shipping channel, and the Coon Island Loop.

Lower Calcasieu River – This area includes another large, industrial ship canal extending 8 miles in length from Coon Island to the outflow of Moss Lake and occupying 3,976 acres. It includes Prien Lake, Moss Lake, the Calcasieu ship canal, and the old channel of the Calcasieu River.

Bayou d'Inde – This is the narrow, sinuous channel, approximately 9 miles in length that ends at its confluence with the Calcasieu River. It occupies 1,486 acres. Most of the bayou area is uncharacterized, back-water marsh located southwest of Lake Charles.

Bayou Verdine – This is a small tributary of the Calcasieu River, which enters the river at the north end of the Coon Island Loop, after winding 4.2 miles through residential and industrial areas.

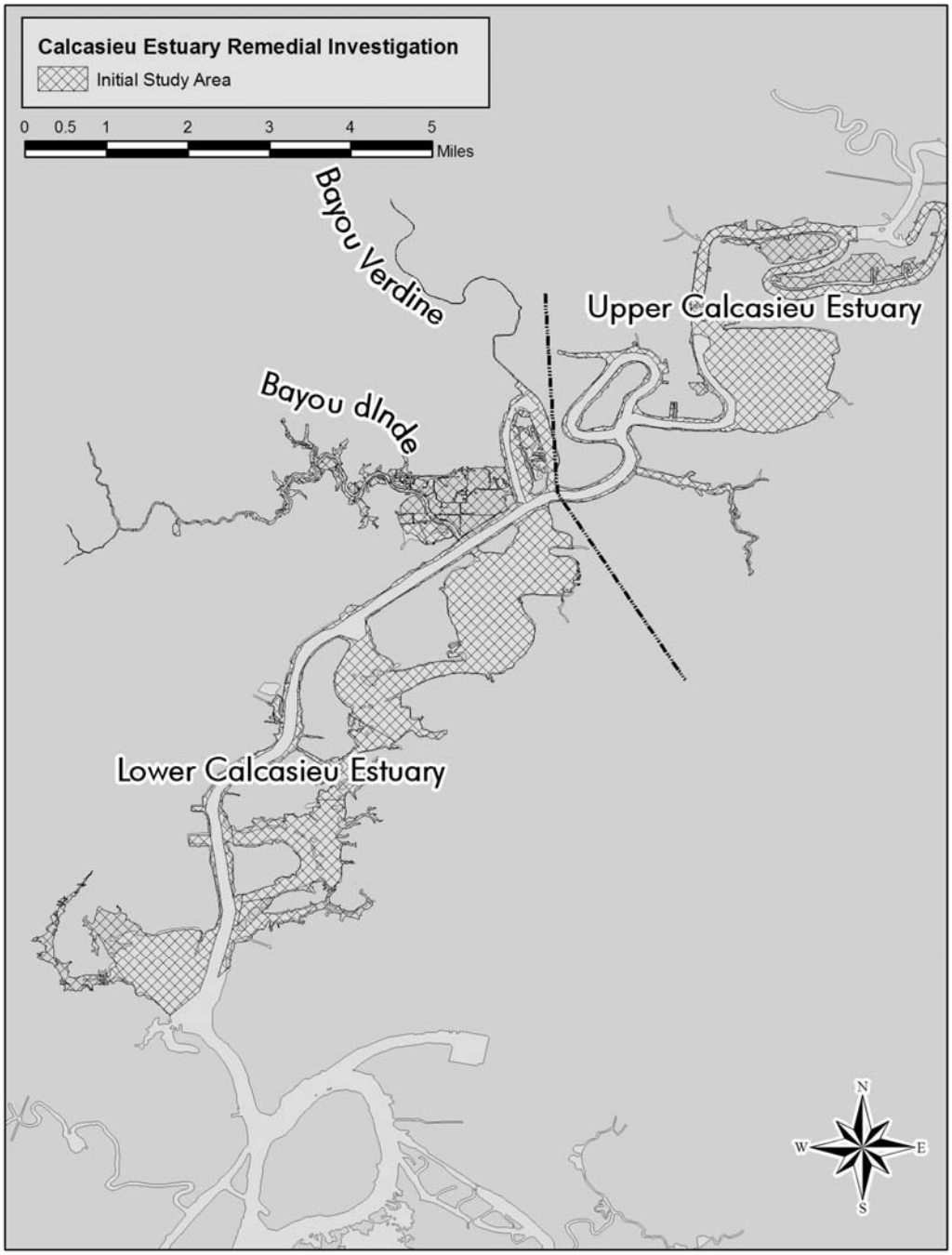

Figure 3.1 – Four Major Component Areas Investigated in the Remedial Investigation Process.

The physical characteristics of the Estuary make it quite diverse. The Estuary is comprised of a variety of different types of water bodies and it ranges over approximately 38 miles from north to south. The waters of the Estuary range from freshwater to saline and cross through industrial and rural settings. The energy of the system ranges from lotic (river) to lentic (lakes). These factors all contribute to the diversity of habitats found in the system.

The restoration action proposed in Section 6 would occur in the lower portion of the Calcasieu Estuary, within the Sabine NWR. The refuge is located in Cameron Parish, a largely rural parish composed of various types of coastal marsh habitat, upland prairie/range, and some localized small communities. The proposed restoration site consists of brackish marsh habitat, which is surrounded by levees generated by disposal of dredge material from the Calcasieu Ship Channel. These levees have significantly altered the hydrologic regime of this area, thus limiting the productivity of the marsh habitat. This Draft DARP/EA is focused on the effects of the contamination found within Bayou Verdine and most of the Coon Island Loop area, which have resulted in injury to or loss of benthic resources. Compensation for these losses or injuries will be achieved by degrading the levee to improve the hydrologic flow through the marsh, and will create marsh through placement of levee soil into open water areas.

3.2 THE BIOLOGICAL ENVIRONMENT

The Calcasieu Estuary provides important habitat for wildlife including migratory waterfowl, shorebirds, and wading birds and also serves as a valuable nursery and breeding habitat for numerous estuarine-dependent sport and commercial fish and shellfish. The Calcasieu region, including Calcasieu Lake and its surrounding environment, has several types of habitats including Estuary habitats of various salinities, fresh and salt marshes, and forests.

Salt Marsh

Salt marshes can be found at and around the margins of sounds and estuaries, backs of barrier islands, and old flood tide deltas near closed inlets with regular saltwater tides. Salt marsh vegetation is dominated by smooth cordgrass (*Spartina alterniflora*) at the lower elevations (low marsh) typically between mean low tide and mean high tide. Zonation of vegetation occurs between mean tide and mean high tide with zones of black needlerush (*Juncus romerianus*), smooth cordgrass (*Spartina alterniflora*), and sometimes other brackish marsh species. Salt marsh communities are highly productive due to the dynamic environment in which they are found. In this setting, organic matter is regularly removed and sediment deposited by the tides. Under optimal conditions (*i.e.*, presence of a coarse-grain sediment source) tidal sedimentation causes a rise in the marsh surface and landward migration of the marsh. Sediment may also be deposited on the shoreline, causing estuarine-ward progradation of the marsh. Marshes on the backsides of barrier islands may be subject to episodic burial by sand overwash. Salt marshes are distinguished from all other community types by the dominance of smooth cordgrass (*Spartina alterniflora*), as well as by their tidal, saltwater environments. Relatively narrow zones of brackish marsh at the upper edge are

considered part of the salt marsh, but larger expanses in the heads of creeks and in the interior of large marsh islands are considered separate brackish marsh communities

Brackish/Intermediate Marsh

This marsh type is found along the margins of sounds and estuaries somewhat removed from connection with the sea, so that salinity is diluted by freshwater inflow and tidal range is generally less than in salt marshes. Those marshes in areas with substantial regular lunar tides have a regular input of nutrients, which makes them highly productive. In addition to high inflow of nutrients, regularly flooded marshes are typically supplied with abundant sediment and may produce tidal mud flats and estuarine ward progradation of the marsh. Areas with only irregular wind tidal flooding have much less nutrient input, less mineral sedimentation, and accumulate relatively more organic matter. They lack mud flats and their estuarine edges are scarped and erosional. As sea level rises, mineral or organic sedimentation causes the marsh surface to rise; the landward edge will migrate landward; and changes in tidal inlets may cause changes in salinity.

Brackish marshes are distinguished by their tidal environment and usually by the dominance of black needle rush (*Juncus romerianus*). There is a primary difference in dynamics between the regularly flooded marshes in the southern portion of the coastal zone and the predominantly irregularly flooded marshes in the northern coastal zone. Areas exposed to wave action from large estuaries may also be different in dynamics from narrow marshes in small tributaries.

Tidal Freshwater Marsh

This marsh type is found at the margins of estuaries, or drowned rivers and creeks, where they are regularly or irregularly flooded with freshwater tides. Historically, this marsh type was extensive, but its range has steadily reduced since the mid-1950's due to numerous factors including subsidence, sea-level rise, saltwater intrusion, and altered hydrology as a result of river leveeing and oil and gas access canals. Tidal freshwater marshes are sustained largely through tidal flooding, which brings in nutrients derived from seawater and varying amounts of sediment to the community. Regularly flooded marshes are reported to have high productivity, equivalent to salt marshes at the same latitude (Odum *et al*. 1984). Irregularly flooded marshes and marshes in areas with little mineral sediment are assumed less productive. Tidal freshwater marsh is distinguished from adjacent swamp forest and upland forests by the lack of a dominant tree or shrub layer.

Wetland Forest (Evergreen, Deciduous, and Mixed)

Wetland forests, besides being broken into evergreen, deciduous, and mixed are segmented by their flooding frequency. Those areas that experience permanent to semi-permanent flooding are deepwater swamps while those receiving only seasonal riverine pulses are generally characterized as bottomland hardwood (BLH) forests. The distinction is not only made because of flooding regime, but the species composition that occurs as a result. In Louisiana, the bald cypress (*Taxodium distichum*) and tupelo (*Nyssa* spp.) swamps are the major deepwater forested wetlands and are characterized by bald cypress – water tupelo communities with permanent or near permanent standing water (Mitsch and Gosselink 1993). Bottomland hardwood forests usually occur as an ecotone between aquatic and upland ecosystems but have distinct vegetation and soil characteristics. The vegetation in BLH forests is dominated by diverse trees that are adapted to the wide variety of environmental conditions on the floodplain. Typical species are black willow (*Salix nigra*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), laurel oak (*Quercus laurifolia*), American elm (*Ulmus americana*), and sweetgum (*Liquidambar styraciflua*), to name a few.

Cheniers

Cheniers are coastal ridges, exclusive to western Louisiana, that typically have higher relief than outlying barrier islands. As a result, these ridges are historically known for supporting maritime forests dominated by live oaks (*chenier* is French for oak). Those forests that escaped the human impacts of deforestation and agriculture play an important ecological role as a temporary habitat for many migrating species. Also, because cheniers are above sea level, some by as much as three meters, it is one of the more important continuous habitats for mammals and birds in coastal Louisiana.

Aquatic Biota

The Calcasieu Estuary supports a diverse assemblage of aquatic life, including plants (both vascular and non-vascular) and animals (invertebrates, fish, mammals, reptiles, etc.). These organisms depend upon the Estuary to provide habitat for foraging, mating, rearing young, and other important life functions. Several of the organisms found within the Calcasieu Estuary are among those vital to the economy of Louisiana, as well as a significant element of outdoor recreational opportunities touted by the state.

Among the great variety of fish found in the Gulf are red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), pinfish (*Lagodon rhomboides*), sheepshead (*Archosargus probatocephalus*), sand seatrout (*Cynoscion arenarius*), spotted seatrout (*Cynoscion nebulosus*), silver seatrout (*Cynoscion nothus*), Atlantic croaker (*Micropogonias undulatus*), spot (*Leiostomus xanthurus*), striped mullet (*Mugil cephalus*), white mullet (*Mugil curema*),

sea catfish (*Arius felis*), gafftopsail catfish (*Bagre marinus*), bay anchovy (*Anchoa mitchilli*), and southern flounder (*Paralichthys lethostigma*) (Calcasieu BERA, USEPA 2003). These species spend (at a minimum) a portion of their life cycle in the Estuary, primarily during spawning, and many are fished commercially. Various species migrate up the protected bayous to spawn and hatch their young. The quiet, less saline upper reaches of the Estuary provide habitat for these hatchlings, nurturing them into juveniles. The hatchlings return to the Gulf as young adults to complete their growth cycle.

Phytoplankton, zooplankton, and aquatic invertebrates living in the Estuary provide food for several fish and bird species. Phytoplankton consists of various forms of algae (green, red, and brown species), diatoms, desmids, euglenoids, and cyanobacteria (formerly blue-green algae) (USEPA 2003). Zooplankton consists of various animals ranging from primitive forms such as protozoans to more complex animals such as crustaceans and insects. Smaller zooplankton commonly found in the Estuary include calanoid copepods, barnacle larvae, and shrimp (USEPA 2003). The Calcasieu Estuary also contains a variety of larger zooplankton including brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopenaeus setiferus*), brackish grass shrimp (*Palaemonetes intermedius*), grass shrimp (*Palaemonetes kadiakensis*), blue crab (*Callinectes sapidus*), Gulf crab (*Callinectes similis*), western stone crab (*Menippe adina*), squid (*Lolliguncula brevis*), and crayfish (*Procambarus* sp.) (USEPA, 2003).

The sediments within the Estuary support benthic organisms, including annelid worms, small crustaceans (amphipods, isopods, copepods, and juvenile decapods), mollusks, and other small bottom-dwellers in salt marshes and un-vegetated sub tidal sediments. Among these benthic organisms are herbivores (eating algae or other live plant material), detritivores (feeding on decaying organic matter in surface sediments or sediment-bound nutrients and organic substances that are not generally available to epiphytic or pelagic organisms), carnivores (preying on other benthic organisms), and omnivores (a combination). These organisms provide the nutritional base for developing stages of many finfish and shellfish and, thus, affect all trophic levels in the Calcasieu Estuary.

Terrestrial Biota

The southern marshes and swamps of Louisiana are the home of a wide variety of wildlife. White-tailed deer (*Odocoileus virginianus*) are abundant throughout the state. Common small mammals include bats (order Chiroptera), rabbit (*Sylvilagus aquaticus*), raccoon (*Procyon lotor*), eastern fox squirrel (*Sciurus niger*), nutria (*Myocastor coypus*), and river otter (*Lutra canadensis*) (USEPA, 2003). The more remote areas of the swamp contain muskrats (*Ondatra zibethicus)* and mink (*Mustela vision)* in addition to other fauna.

More than one-half of the bird species of North America are resident in the state or spend a portion of their migration there. Species of migratory wildfowl are the most abundant. They include several species of ducks and geese that spend winters on the tidal marshes along the Gulf coast. The most common of the state's water birds include the laughing gull (*Larus atricilla*), royal tern (*Sterna maxima*), brown pelican (*Pelecanus occidentalis*), and black skimmer (*Rynchops niger*). Birds found in the marshes include the marsh wren (*Cistothorus palustris*), seaside sparrow (*Ammodramus maritumus*), red-winged blackbird (*Agelaius phoeniceus*), Wilson snipe (*Charadrius wilsonia*), woodcock (*Scolopax minor*), and species of sandpipers (*Actitis* spp.).

Alligators (*Alligator mississippiensis)* are common in southern Louisiana swamps; one was spotted in the Lower Calcasieu study area during the RI. Other reptiles found in the state include turtles, lizards, and both poisonous and non-poisonous snakes. The snakes found in Louisiana include the coral snake (*Lampropeltis getula holbrooki*), western pygmy rattler (*Sistrurus miliarius streckeri*), canebrake rattler (*Crotalus horridus*), copperhead (*Agkistrodon cantortrix*), Texas rat snake (*Elaphe obsolete lindheimeri)*, speckled kingsnake (*Lampropeltis getula holbrooki*), and water moccasin (*Agkistrodon piscivorus*). Common reptiles also found within the terrestrial areas include the ground skink (*Scincella lateralis*) and red-eared slider (*Chrysemys scripta elegans*) (USEPA, 2003).

3.3 THE CULTURAL AND HUMAN ENVIRONMENT

The Estuary includes Calcasieu Parish, Cameron Parish located to the south, and the remainder of the Calcasieu Estuary watershed. The economy of the area has its origins in the abundant natural resources found within the parish. The early economy was based upon farming, fishing, and the harvest of longleaf yellow pine and cypress for lumber. The lower portion of the Calcasieu Estuary, which is largely rural, has maintained an economy on these natural resources. Petrochemical refining and production, however, has driven the economy of Calcasieu Parish in more recent years. The first natural gas field was discovered in Louisiana in 1823 at a depth of 400 feet, marking the first exploitation of naturally existing chemical compounds within the region. In 1869, the first sulphur mine in the U.S. was constructed, ending a monopoly held by Sicily. The City of Sulphur was created around the mines and named for its product. The discovery and development of the oil and gas reserves of coastal Louisiana in the early Twentieth century led to the siting and growth of many petroleum refineries and chemical production facilities along the Calcasieu River. As many as 30 major corporations have facilities located within the upper Estuary, including those of ConocoPhillips and Sasol NA. These facilities produce a wide range of industrial and

commercial products, and contribute significantly to the local and national economies as sources for a variety of fuels produced for local and national markets.

In the late 1800s and early 1900s, Southwest Louisiana experienced a significant amount of growth and expansion due to the development of these area industries. To support and encourage further growth of those industries, a deep-water channel from Lake Charles to the Gulf of Mexico, known as the Calcasieu Ship Channel, was established in the early 1900s. This action resulted in the creation of the Port of Lake Charles in 1926. Today, the Port of Lake Charles is a major facilitator of both foreign and domestic trade in numerous products, including rice, crude oil, compressed natural gas, gasoline, and petroleum coke. The Port of Lake Charles is ranked among the top five domestic ports for exportation of rice, is 13th in the U.S. and foreign ports for total tonnage of traded goods, and ranks 27th for total value of traded goods among all ports.

Recreational and commercial fishing occur throughout the Estuary and have influenced the cultural history and economy of both Calcasieu and Cameron Parishes. Species fished include blue crab, red drum, black drum, spotted sea trout, southern flounder, Atlantic croaker, striped mullet, sheepshead, and sea catfish. The Estuary is a popular destination for recreational fishing, with red and black drum, sea trout, sheepshead, and flounder being the most commonly harvested species. Commercially, large numbers of blue crab are harvested in the Estuary, including in the surrounding salt marshes. White shrimp and brown shrimp are also economically important species found in the system. These human activities are dependent upon the condition of the coastal and marine habitats that are essential in the life cycles of these resources. Other recreational activities, such as swimming, water skiing, wildlife viewing, and boating, also occur in the Estuary. These activities do occur in the vicinity of the Site but are most prevalent in the lower portion of the Estuary.

The lower portion of the Estuary, from Moss Lake south to the Gulf of Mexico, is located within Cameron Parish. Cameron Parish is primarily rural, supporting some small communities, agricultural operations (cattle grazing), and habitat utilized by numerous species of fish and wildlife. It is primarily undeveloped, and retains much of the early historical cultural and human uses including farming, hunting, and fishing. Small rural communities have been established, but mainly along the coast, since most of the land within the area is marsh/wetland. A large portion of Cameron Parish is included within two designated National Wildlife Refuges - Sabine NWR and Cameron Prairie NWR. Both of these Refuges, as well as surrounding marshes, constitute essential habitat to fish and wildlife, both resident and migratory in nature. Thus, human uses of the lower Estuary are

largely based upon these natural resources. Both public and commercial interests throughout the Estuary benefit from the abundance of organisms supported by this natural environment.

3.4 Threatened and Endangered Species

The Endangered Species Act (ESA) of 1973 (16 U.S.C. §§1531, *et seq*.) requires federal agencies to conserve endangered and threatened species and to conserve the ecosystems upon which these species depend. LDWF's Natural Heritage Program (LNHP) also identifies species that are of special concern to the State. Table 3.1 provides a list of federally recognized endangered or threatened species reported to reside in or migrate through the Sabine National Wildlife Refuge (NWR).

Table 3.1 – Threatened and Endangered Species Potentially Utilizing the Sabine NWR, Cameron Parish, LA

Common Name	Scientific Name	Status
Mammals		
West Indian manatee	*Trichechus manatus*	Endangered
Reptiles		
green sea turtle	*Chelonia mydas*	Threatened
hawksbill sea turtle	*Eretmochelys imbricate*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
leatherback sea turtle	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Endangered
Birds		
brown pelican	*Pelecanus occidentalis*	Endangered
piping plover	*Charadrius melodus*	Threatened

3.4.1 Threatened and Endangered Species Habitat Descriptions

West Indian Manatee

Federally listed as endangered, West Indian manatees (*Trichechus manatus*) occasionally enter Lakes Pontchartrain and Lake Maurepas, and associated coastal waters and streams during the summer months. Manatees have been reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. They have also been occasionally observed elsewhere along the Louisiana Gulf Coast. The Manatee has declined in numbers due to collisions with boats and barges, entrapment in

flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals.

Brown Pelican

Endangered brown pelicans (*Pelecanus occidentalis*) are currently known to nest and forage in coastal areas. The nearest brown pelican nest is on Rabbit Island, about 13 miles due south, but that is an incidental site. The main colonies are over 150 miles to the east. They are rarely seen inland or far out to sea and mostly feed in shallow estuarine waters. Pelicans make extensive use of sand spits, offshore sand bars, and islets for nocturnal roosting and daily loafing, especially by nonbreeders and during the non-nesting season. Dry roosting sites are essential. Some roosting sites eventually may become nesting areas. Pelican nests are usually located on coastal islands, on the ground or in small bushes and trees (Palmer 1962). Major threats to this species include chemical pollutants, colony site erosion, disease, and human disturbance.

Piping Plover

The threatened piping plover (*Charadrius melodus*) winters in coastal Louisiana and nests are known to occur 18 miles to the south. Piping plovers may be present in Louisiana for up to 8 months, arriving from the breeding grounds as early as late July and remaining until late March. Piping plovers feed extensively on intertidal beaches, mudflats, sandflats, algal flats, and washed over passes with no or very sparse emergent vegetation and require unvegetated or sparsely vegetated sand, mud or algae flats for roosting. Roosting areas may have debris, detritus, or micro-topographic relief, offering refuge to plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, as the suitability of a particular site for foraging or roosting is dependent on local weather and tidal conditions. Plovers may move among sites as environmental conditions change. Critical habitat identifies specific areas that are essential to the conservation of the species. The primary constituent elements for wintering piping plover critical habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. Those elements are found in geologically dynamic coastal areas that support intertidal beaches and flats (between annual low tide and annual high tide) and associated dune systems and flats above annual high tide. Important components (or primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal

flats above high tide are also important, especially for roosting plovers. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

Kemp's Ridley Sea Turtle

The Kemp's ridley is an endangered sea turtle that occurs mainly in the coastal areas of the Gulf of Mexico and northwestern Atlantic Ocean. Juveniles and sub-adults occupy shallow, coastal regions and are commonly associated with crab-laden, sand or muddy water bottoms. Small turtles are generally found in nearshore areas of the Louisiana coast from May through October. Adults may be abundant near the mouth of the Mississippi in the spring and summer. Adults and juveniles move offshore to deeper, warmer water during the winter. Between the East Gulf Coast of Texas and the Mississippi River Delta, Kemp's ridleys use nearshore waters, ocean sides of jetties, small boat passageways through jetties, and dredged and nondredged channels. They have been observed within both Sabine and Calcasieu Lakes. Major threats to this species include over-exploitation on their nesting beaches, drowning in fishing nets, and pollution.

Green Sea Turtle

The threatened green sea turtle probably occurs along the Louisiana coast and may nest on the barrier islands (Dundee and Rossman 1989). Their distribution can be correlated to water temperature, grassbed distribution, location of nesting beaches, and associated ocean currents. The primary nesting sites in U.S. Atlantic waters are along the east coast of Florida, with additional sites in the U.S. Virgin Islands and Puerto Rico (NMFS and USFWS 1991a). Females deposit up to 7 clutches, and the number of nests has been estimated to be between 350 to 2,300 nests annually. Green sea turtles nest at 2-, 3-, or 4-year intervals. Long migrations have been documented between feeding and nesting grounds. Adult green sea turtles feed almost exclusively on seagrasses growing in shallow water flats, but invertebrates and carrion are also important components of their diet (Dundee and Rossman 1989).

Hawksbill Sea Turtle

The likelihood of encountering the endangered hawksbill sea turtle in Louisiana coastal waters is considered minimal. Nesting occurs principally in Puerto Rico and the U.S. Virgin Islands. Within the continental United States, nesting is restricted to the southeast coast of Florida and the Florida Keys. Hawksbill turtles nest at low densities in aggregations of 1 to 100 adults. Less than two nests annually have been observed in Florida and Texas (NMFS

and USFWS 1993). Only one record of a hawksbill in Louisiana has been reported (Fuller *et al.* 1987). This species is an omnivore, feeding primarily on invertebrates and marine vegetation (Dundee and Rossman 1989). Florida is considered foraging habitat for those turtles, and Texas may be foraging habitat for hatchlings and juveniles (77 observations of small turtles were reported between 1972 and 1984) from the nesting sites in Mexico (NMFS and USFWS 1993).

Leatherback Sea Turtle

The endangered leatherback sea turtle occurs mostly in continental shelf waters, but will occasionally enter shallow waters and estuaries. Adults are highly migratory and they exhibit seasonal fluctuations in distribution in response to the Gulf Stream and other warm water features. Habitat requirements for juvenile and post-hatchling leatherbacks are unknown. Leatherback turtles are omnivorous but feed primarily on jellyfish and other cnidarians (NMFS and USFWS 1992).

Nesting occurs from February through July at sites located from Georgia to the U.S. Virgin Islands. Nesting leatherbacks occur along beaches in Florida, Nicaragua, and islands in the West Indies; however, no nesting has been reported in Louisiana (Dundee and Rossman 1989). In Louisiana, leatherbacks are believed to occur offshore in deep waters.

Loggerhead Sea Turtle

The endangered loggerhead sea turtle is capable of living in a variety of environments, such as in brackish waters of coastal lagoons and river mouths. During the winter, they may remain dormant, buried in the mud at the bottom of sounds, bays, and estuaries. The major nesting beaches are located in the southeastern United States, primarily along the Atlantic coast of Florida, North Carolina, South Carolina, and Georgia (NMFS and USFWS 1991b). Loggerheads probably range all along the Louisiana coast; however, Dundee and Rossman (1989) reported specimens only from Chandeleur Sound and Barataria Bay in Eastern waters of the state. The loggerhead's diet includes marine invertebrates such as mollusks, shrimp, crabs, sponges, jellyfish, squid, sea urchins, and basket stars (NMFS and USFWS 1991b). Adult loggerheads feed in waters less than 50 meters deep, while the primary foraging areas for juveniles appears to be in estuaries and bays.

3.5 Essential Fish Habitat

Under the Magnuson-Stevens Fisheries Conservation and Management Act of 1996 (Public Law 104-297), the Gulf of Mexico Fishery Management Council identified Essential Fish Habitat (EFH) for those species managed under its fisheries management plans. EFH is defined by the act as being "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity".

The Gulf of Mexico Fishery Management Council lists the following federally managed species within the project area of the selected restoration alternative: white shrimp (*Litopenaeus setiferus*), brown shrimp (*Farfantepenaeus aztecus*), and red drum (*Sciaenops ocellatus*). A brief discussion of the identified EFH and Habitat Areas of Particular Concern (EFH-HAPCs) local to and potentially affected by the selected project for each species follows.

Distribution and Summary of Habitats Used by Shrimp

Brown and white shrimp use a variety of habitats as they grow from planktonic larvae to spawning adults. Brown shrimp are found within estuaries to offshore depths of 110 meters throughout the Gulf; white shrimp inhabit estuaries and to depths of 40 meters offshore in the coastal areas extending from Florida's big bend through Texas. Brown and white shrimp are generally abundant in the central and western Gulf.

Brown Shrimp

Brown shrimp eggs are found on the sea bottom and occur offshore. The larvae occur offshore and begin to migrate to estuaries as postlarvae. Postlarvae migrate through passes on flood tides at night mainly from February – April with a minor peak in the fall. Postlarvae and juveniles are common to highly abundant in all U.S. estuaries from Apalachicola Bay in the Florida panhandle to the Mexican border. In estuaries, brown shrimp postlarvae and juveniles are associated with shallow vegetated habitats but also found over silty sand and non-vegetated mud bottoms. Postlarvae and juveniles have been collected in salinity ranging from zero to 70 ppt.

The density of postlarvae and juveniles is highest in marsh edge habitat and submerged vegetation, followed by tidal creeks, inner marsh, shallow open water, and oyster reefs; in unvegetated areas muddy substrates seem to be preferred. Juveniles and sub-adults of brown

shrimp occur from secondary estuarine channels out to the continental shelf but prefer shallow estuarine areas, particularly the soft, muddy areas associated with plant-water interfaces. Sub-adults migrate from estuaries at night on ebb tide on new and full moon. Abundance offshore correlates positively with turbidity and negatively with hypoxia. Adult brown shrimp occur in neritic Gulf waters (*i.e.*, marine waters extending from mean low tide to the edge of the continental shelf) and are associated with silt, muddy sand, and sandy substrates.

White Shrimp

White shrimp are offshore and estuarine dwellers and are pelagic or bottom dwelling, depending on life stage. The eggs are bottom dwelling and larval stages float passively; both occur in near-shore marine waters. Postlarvae migrate through passes mainly from May-November with peaks in June and September. Migration is in the upper two meters of the water column at night and at mid-depths during the day.

Postlarval white shrimp become benthic upon reaching the nursery areas of estuaries, where they seek shallow water with muddy-sand bottoms high in organic detritus or abundant marsh, and develop into juveniles. Juveniles are common to highly abundant in all Gulf estuaries from Texas to about the Suwanee River in Florida. Postlarvae and juveniles inhabit mostly mud or peat bottoms with large quantities of decaying organic matter or vegetative cover. Densities are usually highest in marsh edge and submerged aquatic vegetation, followed by marsh ponds and channels, inner marsh, and oyster reefs.

Juveniles prefer lower salinity waters (less than 10 ppt), and are frequently found in tidal rivers and tributaries throughout their range. As juvenile white shrimp approach adulthood, they move from the estuaries to coastal areas where they mature and spawn. Migration from estuaries occurs in late August and September and appears to be related to size and environmental conditions (*e.g.*, sharp temperature drops in fall and winter). Adult white shrimp are bottom dwelling and generally inhabit nearshore Gulf waters to depths less than 30 meters on bottoms of soft mud or silt.

Distribution and Summary of Habitats Used by Red Drum

Red drum are distributed over a geographical range from Massachusetts on the Atlantic coast to Tuxpan, Mexico (Simmons and Breuer 1962). In the Gulf of Mexico, red drum occur in a variety of habitats, ranging from depths of about 40 meters offshore to very shallow estuarine

waters. They commonly occur in virtually all of the Gulf's estuaries where they are found over a variety of substrates including sand, mud and oyster reefs. Red drum can tolerate salinities ranging from freshwater to highly saline, but optimum salinities for the various life stages have not been determined.

Types of habitat occupied depend upon the life stage of the fish. Spawning occurs in deeper water near the mouths of bays and inlets, and on the Gulf side of the barrier islands (Simmons and Breuer 1962). The eggs hatch mainly in the Gulf, and larvae are transported into the Estuary where the fish mature before moving back to the Gulf (Perret *et al.* 1980). Adult red drum use estuaries, but tend to spend more time offshore as they age. Schools of large red drum are common in deep Gulf waters. All marine habitat of the Gulf where red drum is known to occur is considered essential habitat for red drum.

Larval red drum feed almost exclusively on mysids, amphipods, and shrimp, whereas larger juveniles feed more on crabs and fish. Overall, crustaceans (crabs and shrimp) and fishes are most important in the diet of red drum; primary food items are blue crabs, striped mullet, spot, pinfish, and pigfish. As they grow larger, red drum eat proportionately more crabs, with fish diminishing in importance as food for the largest red drum. Protection of estuaries is especially important not only to maintenance of EFH for red drum but also because so many of the prey species of red drum are estuarine dependent (*e.g.*, shrimp, blue crab, striped mullet and pinfish).

4 PROPOSED INJURY AND SERVICE LOSS EVALUATION

This section of the Draft DARP/EA describes the Trustees' proposed assessment of natural resource injuries due to hazardous substances released from the ConocoPhillips and Sasol NA facilities.

The evaluation and estimate of potential natural resource injuries presented in this section was developed by the Trustees, within a joint technical workgroup formed by the Trustees and the PRPs as part of a cooperative NRDA process. In evaluating and estimating injuries within this workgroup, a 'Reasonably Conservative Injury Evaluation' (RCIE)[8] approach was applied. The workgroup used historical data, scientific literature on contaminant effects, and the results of both the Bayou Verdine and Calcasieu Estuary BERAs. Indeed, all available relevant sediment, toxicity and tissue data resulting from remedial investigations conducted by the USEPA for the Calcasieu Estuary and by the PRPs for Bayou Verdine, as well as other historical information on the presence of contaminants in the Estuary were used. The data were then assembled into a relational database/GIS[9] for analysis.

Although developed cooperatively within the workgroup, the assessment approach and resource injury and loss evaluation presented in this section is that of the Trustees, as the Trustees are solely responsible for ensuring that this assessment plan and its outcome are consistent with the goals of the NRDA process.

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[8] The RCIE approach uses conservative values and assumptions, i.e., those favoring natural resources and the public's interests in injured resources, to address or resolve uncertainties in assessment analyses. The approach, thus, tends to result in an upper-end estimate of how much injury occurred or how much restoration is required. RCIE assumptions are often used in initial analyses to guide Trustees in determining the appropriate level of effort to apply in obtaining more refined estimates. Sometimes, as is the case for most of the assumptions used in this assessment, the cost to develop more precise estimates or further refine parameters used in the analysis would exceed the potential resulting change in the cost of restoration. In these instances, the use of conservative assumptions in the final analysis, rather than developing more precise point estimates, results in an overall cost savings to the public's trust agencies and PRPs while still protecting the public's interest in obtaining sufficient restoration for the injuries.

[9] This database is located at:
http://response.restoration.noaa.gov/cpr/watershed/calcasieu/calc_html/calcenv.html

4.1 SCOPE OF INJURY ASSESSMENT

As a threshold evaluation, the nature and extent of the contamination in the Estuary that could be attributed to historical releases of hazardous substance from the ConocoPhillips or Sasol NA facilities was examined. Areas with hazardous substances potentially from either facility were identified as 'areas of potential concern'. Within these general areas, the potential for natural resource injuries was then considered further based on the presence of hazardous substances at levels of concern (*i.e.*, concentrations with potential to adversely affect natural resources or services). Areas in which the PRPs' contaminants were not likely to pose a substantial potential for injury to natural resources or services were excluded from further analysis in this process.

This threshold evaluation considered information from many sources, including the results of the work to characterize contaminants in Bayou Verdine carried out by ConocoPhillips and Sasol NA, the Bayou Verdine BERA; the results of the RI for the other portions of the Estuary; records and information bearing on past and present operations from these facilities; scientific literature; as well as the Trustees' knowledge and understanding of the ecosystem in this area. Because much of this information arises from recent, comprehensive investigations of the Estuary conducted or supported by the USEPA, the PRPs, and the Trustees, there is a high technical confidence that areas identified in this evaluation are appropriate for evaluating injury to natural resources and services associated with the PRPs' releases.

This threshold evaluation indicated that the potential for injury to natural resources associated with historical releases of hazardous substances from the ConocoPhillips and Sasol NA facilities is limited to Bayou Verdine and Coon Island Loop, including the associated wetlands and the biota utilizing these areas. Accordingly, the Trustees' injury and service loss evaluation focused on resource injuries and losses in these two areas.

4.2 PATHWAYS TO TRUST RESOURCES

Identifying and understanding the COCs for the Site, as well as their pathways to and potential effects on ecological receptors, is critical to the Trustees' approach to injury assessment. A *pathway* is defined as the route or medium (for example, water or soil) through which hazardous substances are transported from the source of contamination to the natural resource of concern (43 C.F.R. § 11.14).

Records and information bearing on past and present operations at the ConocoPhillips and Sasol NA facilities, including exceedance records and spill reports, indicate the facilities

released a number of different constituents, but principally crude oil refinery constituents, including heavy metals (e.g. zinc), some volatile organic compounds (e.g., benzene), and semi-volatile compounds (e.g., polycyclic aromatic hydrocarbons, or PAHs). (See subsection 4.3 – Contaminants of Concern (COCs))

Results of the Calcasieu Estuary RI and other relevant data revealed that sediments in Bayou Verdine and Coon Island Loop were contaminated with hazardous substances that are characteristic of crude oil refinery constituents and that refinery wastes, spills and past housekeeping practices at the PRP facilities are, or have been, sources of the hazardous substances that have come to be located in Bayou Verdine and Coon Island Loop sediments. Fish and other aquatic receptors known to utilize these areas are able to come in contact with the contamination in these sediments.

4.3 CONTAMINANTS OF CONCERN (COCS)

One of the earliest steps in this NRDA process involved the identification of hazardous substances that should be included in the list of COCs. To develop this list, the Trustees worked cooperatively with the USEPA during and after their preparation of the RI/FS and BERA for the Calcasieu Estuary. The RI identified the nature and extent of hazardous substances and the BERA assessed ecological risks to biota due to contaminant exposures. For Bayou Verdine and Coon Island Loop, that process led the Trustees to focus on PAHs, PCBs, and select metals, *i.e.*, chromium, copper, lead, nickel and zinc, as the contaminants posing a threat to natural resources.

The Calcasieu RI detected PAHs and zinc[10] (Zn) in the sediments of lower Bayou Verdine at concentrations exceeding screening guidelines. In contrast, sediments within Coon Island Loop had lower zinc concentrations, generally below screening guidelines, but high concentrations of PAHs and PCBs. The Calcasieu BERA indicates the primary COCs within Bayou Verdine and Coon Island Loop that pose an ecological risk to biota due to exposure are PAHs and zinc, and PAHs and PCBs, respectively.

The ConocoPhillips and Sasol NA facilities are not linked to PCB releases into the Estuary; therefore, the area within Coon Island Loop where PCBs had the potential to cause injury to resources was excluded from the injury analysis for this Site. For purposes of the NRDA for this Site, the Trustees considered only the potential for resource injuries due to the PAHs and zinc.

[10] Zinc dominated the COC metals, and so was used as a proxy for COC metals.

Polynuclear Aromatic Hydrocarbons (PAHs)

PAHs are organic contaminants that tend to sorb to particulates and sediments. PAHs can bioaccumulate but do not tend to biomagnify because PAHs are rapidly metabolized (Eisler, 1987). PAHs are not very soluble in water and have a strong affinity for particles in aquatic systems, particularly fine particles with high organic content. Fine particles containing PAHs are easily transported downstream with prevailing water currents. The PAHs with high solubilities (such as naphthalene) may remain dissolved in surface water, while those with lower solubilities are likely to form associations with colloidal material or suspended particulates. Hence, PAHs are commonly associated with suspended particulates in aquatic systems. While PAHs associated with suspended particulates may be photochemically degraded, biodegraded, transported to other areas, and incorporated into aquatic biota, deposition and consolidation with bedded sediments probably represents one of the most important environmental fate processes for this class of compounds. Hence, sediments represent the major environmental sink for PAHs.

Water-borne PAHs can be acutely lethal to invertebrates, fish, and amphibians; long-term exposure to sub-lethal levels can impair survival, growth and reproduction. Similarly, exposure to sediment-associated PAHs can adversely affect the survival, growth, and reproduction of benthic invertebrates. Fish investigations have shown that exposure to PAH contamination can induce mortality and a variety of internal and external abnormalities. Sediments heavily contaminated with industrial waste PAHs have directly caused increased body burdens and increased frequency of liver neoplasia in fishes (Eisler, 1987).

Zinc

Zinc (Zn) is an elemental metal found naturally in the earth's crust, usually at low levels. Zinc has many specific industrial uses and, as a result, is often found at problematic levels at contaminated sediment sites in industrialized estuaries.

In aquatic systems, Zn can be found in several forms, including the toxic ionic form, dissolved forms (i.e., salts), and various inorganic and organic complexes. While Zn can form associations with particulate matter and be deposited on bottom sediments, sediment-associated Zn can also be remobilized in response to changes in physical-chemical conditions in the water body.

The acute toxicity of dissolved Zn is strongly dependent on water hardness; however, chronic toxicity is not. Long-term exposure to dissolved Zn has been shown to adversely affect the survival, growth, and reproduction of fish, invertebrates, and aquatic plants. Exposure to

sediment-bound Zn may cause reduced survival and behavioral alterations in sediment-dwelling organisms. In birds and mammals, dietary exposure to elevated levels of Zn can cause impaired survival, growth, and health.

4.4 EVALUATION OF INJURY

As noted earlier, the Trustees and PRPs formed a joint technical workgroup and used an RCIE approach[11] to evaluate and estimate potential resource injuries attributable to releases from the PRPs' facilities. In applying the RCIE approach, the workgroup made use of all available evidence, including data from site investigations, values from existing scientific literature and the substantial collective experience within the workgroup.

In considering whether the hazardous substances in the Bayou Verdine and Coon Island Loop were sufficient to cause harm to natural resources or resource services in these areas, the Trustees used the GIS database to compare contaminant concentrations from the two relevant sediment quality guidelines[12] to those measured in the sediment to determine the geographic extent of the potential for natural resource injuries.

Multiple environmental stresses, including PAHs, metals, and sulfide, as well as variations in dissolved oxygen and salinity, were found to be the most important factors responsible for the risk to natural resources. The risk to resources, however, was not equally distributed over the study area. The highest risks were found to be confined to sediments located in the lower two-thirds of Bayou Verdine (ENTRIX, 1999).

The Bayou Verdine BERA concluded that hazardous substances in Bayou Verdine sediments posed no unacceptable risks to upper trophic level organisms (e.g., fish, birds, reptiles, mammals), but that there was risk to benthic (i.e., sediment dwelling) organisms from the contaminants in the sediments. Since the Bayou Verdine BERA found ecological risk was confined to benthic organisms, the Trustees' evaluation of potential natural resource injuries in Bayou Verdine and Coon Island Loop (also contaminated with PAHs) relied primarily on available sediment contaminant chemistry data, toxicity test results, and benthic community analyses.

The Trustees' evaluation of the potential for injuries to natural resources, including recreational services losses, for this Site is summarized in the following subsections.

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[11] See footnote 4 for explanation of RCIE approach.

[12] See section 4.4.4 for a discussion of these guidelines, the Effects Range Low and Effects Range Medium.

4.4.1 Evaluation of Potential Injuries to Surface Water Resources

The Trustees evaluated the potential for injury to planktonic organisms living in the water column due to contamination within Bayou Verdine and Coon Island Loop. Plankton consists of a diverse group of organisms inhabiting the water column that lack the ability to effectively move against currents and are, therefore, transported by water movement. Most species classified as plankton are either herbivorous or are lower trophic level predators.

Some early studies found a few contaminants at levels exceeding relevant water quality criteria at a limited number of stations in Bayou Verdine and Coon Island Loop (ChemRisk, 1994). In Bayou Verdine, some of these observations showed concentrations of nickel and zinc exceeding the USEPA chronic marine ambient water quality criteria (AWQC) for protection of aquatic organisms in surface waters and revealed copper levels exceeding the USEPA acute water quality criterion. In Coon Island Loop, lead surface water concentrations were found to exceed the chronic marine AWQC. Surface water samples collected in 1999 and 2000 for the Bayou Verdine BERA indicated that concentrations of contaminants were below the established water quality criteria for the protection of aquatic life and, as such, not at levels indicative of potential injury (ENTRIX, 1999). Based on this recent data, the Trustees found that the potential for any ongoing or present injury to planktonic organisms directly exposed to the contaminants released by the PRPs to be negligible. Further, planktonic organisms have brief life cycles and can effectively recruit from adjacent waters. When water column contamination drops below levels of concern, planktonic organisms naturally recover to baseline conditions very rapidly. Thus, based on the available evidence, the Trustees concluded that the plankton are most likely at baseline conditions in these areas.

The Trustees also examined the potential for interim water column losses due to past injury back to the year 1981[13]. Although past injuries and interim losses may have in fact occurred, quantifying any such loss retroactively is difficult given the limited supporting data available prior to 1999, and is unlikely to yield very accurate results. Additionally, in considering whether to address past losses, the Trustees recognized that the water quality standards used to evaluate the potential for injury to planktonic organisms are technically conservative (i.e., are more likely to over-estimate potential risk). The Trustees also considered the nature of the exposure to planktonic organisms. Unlike benthic organisms, which are relatively sedentary, plankton drift with water currents, thus reducing their exposure to contaminants

[13] The year in which CERCLA became effective.

present in the water column in these areas by resulting in exposures more temporary in nature than for benthic organisms. This further reduces the likelihood that significant losses of planktonic organisms occurred in the past. Finally, the contaminants released by the PRPs tend to be hydrophobic in nature and thus tend to partition (or bind) to sediments, rather than remain in the water column. For these and all preceding reasons, the Trustees found no significant potential for injury to water column organisms in the past.

As a final consideration, the Trustees recognized that most potential restoration projects undertaken to compensate for benthic injuries would ecologically benefit other resources, including water column organisms which may experience short-term impacts. During the construction phase of this project, some short-term and localized adverse impacts will occur to water column organisms. As a result of earth-moving activities, there will be localized increases in turbidity and sedimentation near the project area. These conditions may affect fish and filter feeders in the local area, by clogging gills, increasing mucus production and smothering organisms found in the shallow open-water area. However, all the restoration alternatives evaluated in Section 6, except the No Action Alternative, would benefit water column organisms in the long-term and the potential multiple environmental benefits (both short- and long-term) for each alternative has been considered in identifying the preferred restoration project to compensate for the benthic resource injury.

Because contaminant levels in surface waters do not currently pose a risk of injury to plankton, and historical data suggest a relatively small potential for past injury, the Trustees propose no further evaluation of injury to water column organisms.

4.4.2 Evaluation of Potential Injuries to Higher Trophic Level Organisms

Higher trophic level organisms include animals such as piscivorous fish, mammals, and birds. Potential injuries to such organisms may occur through direct exposure to contaminants, or indirect exposure through the consumption of contaminated prey.

The direct exposure route is frequently the most significant source of contaminants to fish, rather than piscivorous birds or mammals, because fish are continuously exposed through the surface waters and sediments that comprise their habitat. However, because no recent water column contaminant concentrations for this Site exceeded its corresponding AWQC value, only sediment exposure is relevant. As was the case with the evaluation of potential for injury to planktonic organisms, the contaminant levels in surface waters of Bayou Verdine and Coon Island Loop are below levels likely to cause injury to most fishes. Fish species that live in close association with sediments (e.g., blue catfish, flatfishes) have a potential for

injury through direct contact with metals and PAH contaminated sediments. In the injury assessment for this Site, however, the Trustees opted to treat these species as part of the benthic community since the pathway and potential effects among sediment dwelling species are similar. Losses due to potential injuries to these fish species are, therefore, considered and encompassed in the analysis of injury to benthic resources.

None of the contaminants linked to the historical releases from the ConocoPhillips and Sasol NA facilities and observed to be present at high concentrations in the sediments of Bayou Verdine and Coon Island Loop (i.e., PAHs or Zn) tend to biomagnify (increase in concentration from lower to higher trophic levels, or magnify up the food chain). Therefore, the potential for injury to higher trophic level organisms via indirect exposure to contaminants through their food chain (i.e., through consumption of lower level consumers of prey items from Bayou Verdine and Coon Island Loop sediments) is much lower than if there were substantial concentrations of contaminants that tend to biomagnify. The Bayou Verdine BERA evaluated the risk of injury through indirect exposures for representative bird and wildlife species common to the bayou. The great blue heron (*Ardea herodias*), belted kingfisher (*Ceryle alcyon*), American coot (*Fulica Americana*), muskrat, and mink were all specifically considered and served as surrogates for other potentially affected, upper trophic level organisms. The Bayou Verdine BERA concluded that the potential risk to most of these organisms from the contamination present in the bayou is negligible (ENTRIX, 1999). The exception is sediment probing birds and other avian guilds whose foraging strategies involve routine ingestion of contaminated sediments or insects emerging from those sediments (e.g., black-necked stilts (*Himantopus mexicanus*), spotted sandpipers (*Actitis macularia*), snowy egrets (*Egretta thala)*, green-backed herons (*Butorides striatus)*, tri-colored herons (*Egretta tricolor)*, barn swallows (*Hirundo rustica)*, etc.). The potential for injury to these species appears to be low and at a level that would likely not warrant the increase in assessment costs necessary to confirm exposures and assess that claim. Additionally, the Trustees recognize that most potential restoration undertaken to compensate for benthic injuries would ecologically benefit other resources, including birds. As was true for surface water resources, the restoration alternatives evaluated in Section 6, except the No Acton Alternative, would each benefit potentially affected birds either directly or indirectly. The potential multiple environmental benefits for each alternative has been considered in identifying the preferred restoration project to compensate for the benthic resource injury, and the preferred alternative will provide many benefits to potentially affected avian species.

Risk to higher level organisms from contamination in Coon Island Loop was addressed in the Calcasieu BERA conducted by the USEPA. The analysis of potential injury to higher trophic levels from PAHs in the Coon Island Loop, however, shows the same result as for Bayou

Verdine itself, i.e., that PAHs in Coon Island Loop present a low potential for injury to these resources.

Because available information indicates that neither Bayou Verdine nor Coon Island Loop contamination poses significant risk for injury to exposed higher trophic level organisms, the Trustees propose no further evaluation of injury to these resources relating to releases from the PRPs' facilities.

4.4.3 Evaluation of Potential Lost Recreational Use of Resources

Many natural resources support recreational activities or other public uses and these human uses are considered part of the array of services these resources provide. The uses can, at times, be affected by the presence of hazardous substances.

The Trustees considered an array of recreational uses potentially supported by the bayou or Coon Island Loop, including fishing, swimming, water skiing, wildlife viewing, and boating, but found no information indicating that services of this nature have been lost or diminished due to any contaminants released by the PRPs.

No advisories exist with respect to swimming or any other contact recreational activities in Bayou Verdine or Coon Island Loop (LDEQ, 2001). Although the sediment contamination present in Bayou Verdine has the potential to inhibit contact recreation in that area, public access to the bayou is extremely limited. Barges are normally present at its confluence with Coon Island Loop, and effectively preclude access to Bayou Verdine via water. Terrestrial access to the bayou is also restricted as the surrounding land is largely comprised of private industrial properties. No public boat ramps or other types of public access points are found along the bayou. Further, the Trustees could find no information indicating any active public use of the Site for recreation. The Trustees, therefore, found little likelihood of lost recreational use of surface waters due to the contamination in Bayou Verdine. The levels of contamination in Coon Island Loop sediments are lower and have no apparent affect on surface water contact recreation in that area.

An informational advisory regarding recreational fishing is in place for the entire Calcasieu Estuary, including Bayou Verdine and the Coon Island Loop. This advisory is based upon the presence of hexachlorobenzene, hexachloro-1.3-butadiene, and Polychlorinated Biphenyls (PCBs) in fish (LDEQ, 2001), and the risks associated with human consumption of these fish. None of the contaminants supporting the advisory are among those known or potentially released by the ConocoPhillips and Sasol NA facilities. Under these

circumstances, no compensation would be due from these PRPs for any recreational fishing losses within the Site due to the advisory.

Based on this analysis, the Trustees found that no recreational losses of any significance are likely to have occurred due to releases from ConocoPhillips or Sasol NA. On that basis, the Trustees propose no further evaluation of recreational fishing losses due to the PRPs' releases. This outcome is also consistent with results of the Human Health Risk Assessment (HHRA) conducted for Bayou Verdine (ENTRIX, 2001b).

4.4.4 Evaluation and Assessment of Injury to Benthic Resources (Habitat and Organisms)

The Trustees considered whether the contaminant levels present in the sediments of Bayou Verdine and Coon Island Loop were sufficient to cause harm to the organisms living within, upon, or closely associated with those sediments, or otherwise adversely affect ecological services provided by this habitat. Organisms common to the area were considered in this analysis, including invertebrates and fish species that are viewed predominantly as bottom dwelling species (e.g., flatfishes, catfishes).

Whole sediment toxicity tests, which expose biota to sediments taken from Bayou Verdine and Coon Island Loop, have been conducted at various times since the late 1980s. Results of these tests have consistently shown statistically significant toxicity to exposed organisms. The Bayou Verdine BERA found that contaminants, primarily non-polar organic compounds such as PAHs, contributed to the observed toxicity in its sediment (ENTRIX, 2001a). Therefore, benthic resources were identified as an injury category and retained for further analysis.

The Trustees also compared mean quotients of PAH and metal concentrations from individual sample locations to scientifically recognized screening values that are considered guidelines for sediment quality: the mean quotients of Effects Range Low (ERL) and Effects Range Medium (ERM) guidelines developed by Long and Morgan (1990) and Long *et al*. (1995). ERM and ERL are consensus based screening values which were calculated from the average results of toxicity tests for a variety of benthic invertebrates exposed to sediment contaminants. ERM and ERL values exist for some of the most commonly assessed contaminants, and will correspond to that particular contaminant. The ERL and ERM values are highly predictive numerical indicators of injury to sediment-dwelling organisms due to ingestion and bioaccumulation of contaminants. Adverse biological effects may occur at contaminant concentrations ranging between the ERL and the ERM. Above the ERM,

adverse effects are highly probable. Data indicate that the probability of observing toxicity to sediment dwelling organisms generally increases with an increased frequency of exceedances of both individual ERMs and mean ERM quotients. This information also supported the inclusion of benthic resources as an injury category in this assessment.

Benthos is a broad term that describes aquatic organisms (primarily invertebrates) living on or in the sediments of an aquatic ecosystem. Benthic organisms often feed on organic detritus that is mixed with the top few centimeters of sediment or is trapped in the silty fines that cover the sediment surface. Most other trophic niches (herbivores, predators, scavengers, etc.) are also represented in the benthic community. Benthic communities constitute an important part of the estuarine food web by utilizing sediment-bound nutrients and organic substances that are not generally available to epiphytic or pelagic organisms. The ecological services provided by benthos that can be affected by Site contaminants include:

Food and Production: Benthic populations include both meiofauna and macrofauna that are classified into groups based on their relationship with the sediments. These relationships include burrowing (infaunal), deposit feeders or epibenthic species. Benthic organisms are generally fast growing, adaptable, and serve as an important basal component of the estuarine food web. Infaunal and epibenthic organisms utilize nutritional resources (i.e., bacteria, algae, and partially decomposed organic detritus) that are not available to larger organisms. Benthic organisms serve as an important food source for fish, crabs, shrimp, and some birds that use the Estuary. The productivity of this habitat affects all trophic levels in the Estuary by providing the nutritional base for the developing stages of many finfish, shellfish, and some birds.

Conditioning and Improvement of Habitat: Many benthic species burrow through the sediments, increasing the oxygen content of deeper sediments and thereby allowing other organisms and aerobic bacteria to inhabit deeper sediment layers. In addition, the excavation of sediment re-introduces nutrients found at greater depths to the surface where grazers and deposit feeders can utilize them. The ingestion of sediments by deposit feeders occasionally results in the complete re-working of bottom sediments several times within a year.

Decomposition and Nutrient Cycling: A complex community of bacteria, meiofauna, and macrofauna contributes to the reduction and decomposition of organic matter and debris within the sediments. The process of decomposition is important for the cycling of carbon and nutrients back through the aquatic food web.

Thus, the benthic community provides important ecological services primarily related to food production, decomposition, and energy cycling. These services contribute to the productivity of the system and affect nearly all organisms within an estuarine system. Adverse impacts to benthic resources have the potential to impact biota in all trophic levels of the Estuary by reducing the overall productivity of the system.

Sediment Quality Guidelines in Benthos Injury Assessment

Effects Range Low (ERL) and Effects Range Medium (ERM) sediment quality guidelines, developed by NOAA, are highly predictive numerical indicators of potential injury to sediment-dwelling organisms due to ingestion and bioaccumulation of sediment contaminants. Adverse biological effects (such as organ impairment or death) are improbable below ERL and probable at contaminant concentrations at or above the ERM (Long & Morgan, 1990; Long & MacDonald, 1998). Long *et al*. (1998) found that the probability of observing toxicity to sediment dwelling organisms generally increases with increased ERM quotients (Figure 4.1).

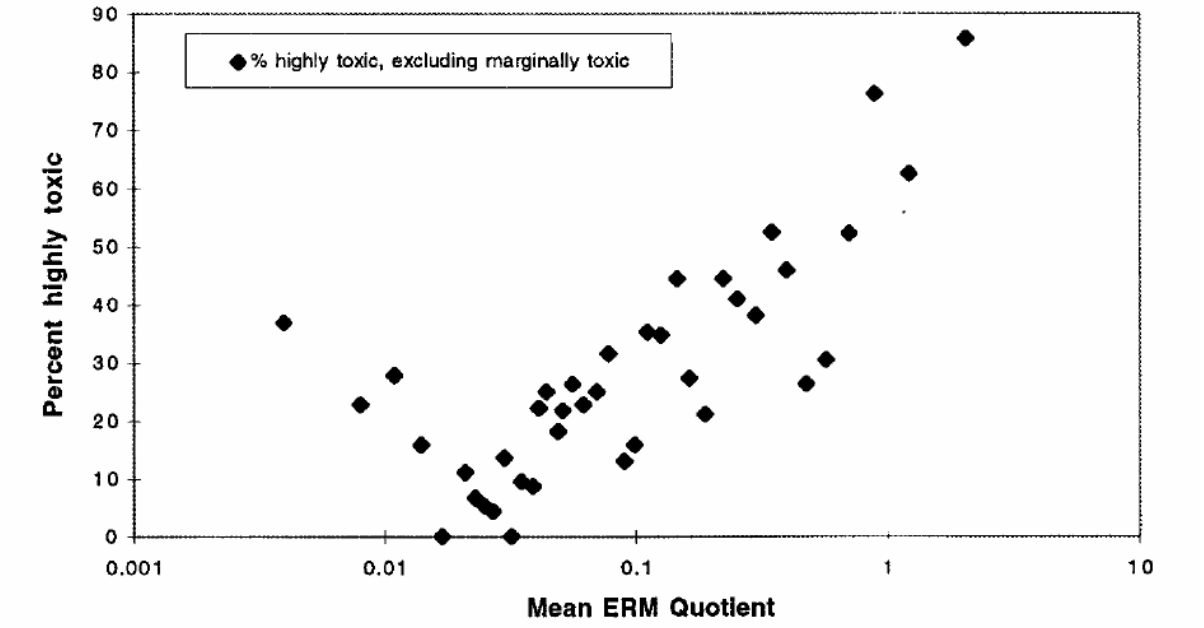

Figure 4.1 – The Relationship Between the Incidence of Toxicity in Amphipod Survival Tests and Mean Effects Range — Median (ERM) Quotients (Long and MacDonald, 1998).

The team selected conservative estimates of the level of injury (expressed as % of services lost) associated with the different ranges of mean ERM quotients based upon the available information, including results of Site specific toxicity tests and other information from scientific literature (Gouguet, 2005). For this assessment, the percent of benthic resource services lost was set at the "percent highly toxic", aka, probability of severe toxicity, which

would be used as an estimate of the loss of benthos services, e.g., 74% probability of toxicity = 74% loss of services. An inflection point appears in the relationship at approximated ERMQ = 0.1: Percent Highly Toxic = 20% thus mean ERMQ (Effects Range Medium Quotient) values less than or equal to 0.10 were considered not injured while those above were assigned injury values suggested by the observed slope. The ranges of mean ERM quotients, the probability of severe effects, and the levels of injury assigned by the Trustees are presented in Table 4.1.

Table 4.1 – Mean ERM Quotient Scores, Probabilities of Significant Toxicity in Amphipod Survival Tests and Assigned Injury Level. (Long *et al*. 1998)

Mean ERM Quotient	Probability (%) of toxicity in amphipod survival tests	Assigned Level of Injury
1.51 to 1.73	74%	74%
0.50 to 1.50	46%	46%
0.11 to 0.49	30%	30%
0.0 to 0.10	12%	0%

Geographic Strategy for Estimating Benthos Injury

In evaluating and estimating losses, the Trustees divided the area of interest into two main subareas: (1) Bayou Verdine (including associated aqueous portions of adjacent wetlands, and (2) Coon Island Loop. This approach is based on two major considerations. First, as explained later in this section, the levels of contamination and likely injuries in these areas are very different. Second, different response decisions and actions are applicable or expected for these two areas. The effect of such actions is very important to a determination of the injuries and losses that will occur, and the losses that will continue until baseline conditions for these resources are reached. The Trustees calculated mean ERMQs for each individual sample location based on measured hazardous substance concentrations in Bayou Verdine and Coon Island Loop.

For each area of benthic habitat identified as potentially injured, the Trustees estimated total ecological service losses due to the likely injury. This quantification of losses accounted for the resource service losses over the time required for the injured resources to recover to pre-release conditions through natural or enhanced means, as applicable. For each area with potential injuries due to response activities or the COCs, the process was accomplished by determining the likely severity of injury based on the available scientific information on potential biological effects.

4.4.5 Habitat Equivalency Analysis – Quantifying Losses (the 'Debit Model')

Habitat Equivalency Analysis, or HEA, (NOAA, 2000) is an accounting procedure that allows parties to identify "debits" (estimating habitat injuries or other resource service losses) due to exposure to hazardous substances, and to identify the scale of restoration required to compensate for assessed injuries or losses. It also allows the "debits' to be balanced against the ecological services to be gained (credited as 'compensation') from proposed habitat restoration projects. The scale, or size, of a restoration project should be such that it provides enough ecological service gains to offset the total of the losses.

The ecological service losses quantified using a HEA are used to identify the restoration requirements needed to compensate for injuries (generally in the form of habitat acreage). In this context, restoration is scaled to provide comparable habitat resources and ecological services (equivalency) between the lost and restored habitat resources and ecological services, adjusted through discounting to account for the difference in time when services gained through restoration are delivered. HEA also applies discounting to make losses occurring in different time periods comparable, resulting in a determination of "discounted service-acre-years", or DSAYs, lost.

The Trustees consider the HEA procedure to be an appropriate analytical tool for use to assess benthic resource losses for this Site. To quantify losses using the HEA method, information or estimates of ecological service losses used to define the resource injuries are needed.

HEA Debit Analysis

Inputs to the HEA for this injury assessment were based on sediment chemistry analytical results and conservative assumptions. A number of generic, conservative assumptions were associated with all of the areas that were assessed: 1) the discount rate is 3%, 2) the base year (the year from which a discount is applied) is the year 2007, 3) the onset of injury was

calculated beginning in 1981, 4) full recovery of the injured resources occurs within 2 years from the completion of response actions, and 23 years for areas with monitored natural recovery, 5) restoration will be initiated in 2008. Other specific values used in the HEA debit analysis are shown in Table 4.2. Table 4.2 also reflects the geographic strategy used in estimating benthic resource injuries, described above.

Table 4.2 – HEA Debit Analysis Input Parameters

Type(s) of Habitat Injured	**Bayou Verdine**	**BV Wetland**	**Coon Island Loop**	**CI Channel**
Current Year	2007	2007	2007	2007
Date of Initial Resource Injury	1981	1981	1981	1981
Extent of Injury (acres)	17.61	1.53	254	57
Severity of Injury (% Loss of Service) 1981-2008	100.0%	100.0%		
Severity of Injury (% Loss of Service) 1981-1993			36.5%	
% LOS 2000			7.9%	
Severity of Injury (% Loss of Service) 1981-1993				48.5%
% LOS 2008				7.9%
Percent Recovery of Injured Habitat	100%	100%	100%	100%
Response Implementation Date (recovery begins)	2008	2000	2000	2008
Years until NR complete (with any response)	2	23	23	2
Functional Form of the Recovery Curve	linear	linear	simple 2-pt linear	simple 2-pt linear
Habitat Conversion Factor	4.51:1		4.51:1	4.51:1
Real Discount Rate	3%	3%	3%	3%

Bayou Verdine Benthos Injury Estimate

Results of Bayou Verdine sediment toxicity tests conducted between 1988 and 1989 (Redmond *et al*. 1996), as well as those conducted as part of the recent BERAs (ENTRIX, 2001a; USEPA 2003), indicate that the contamination present in Bayou Verdine sediments is causing severe injury to exposed benthic organisms. Most of these tests resulted in the death of all test organisms. Although some organisms do live in these sediments, the Trustees and

PRPs conservatively agreed this area could be assessed as suffering a complete loss of benthic services (i.e., 100% injury) due to the contamination present and, further, that this level of injury could be assessed as having been constant in the past and as remaining at this level until the contaminated sediments are removed. Removal of these sediments is planned by USEPA under the Action Memorandum for the Bayou Verdine Removal Action. After removal of the contaminated sediments, a gradual return to full benthic resource service flows over two years is assumed. The recovery of benthos following dredging depends on numerous factors, including the time of year sediment removal occurs relative to the biological cycle for larval recruitment. Although some studies suggest that benthic recovery occasionally occurs within a few months to around a year (Swartz *et al*. 1980; Kenny and Rees, 1994; Van Dolah *et al*. 1984), the Trustees and the PRPs recognize that recovery may take longer and so agreed to assume full recovery at two years. The total contaminated portion of the bayou is approximately 17.61 acres in size.

An adjacent area of wetlands is also included in this analysis. Under the above approach, the injury analysis assesses the benthic injury as a 100% loss of benthic services over 1.53 acres of wetlands adjacent to, and associated with, Bayou Verdine. The choice of response for the wetlands associated with Bayou Verdine is expected to be no dredging (natural recovery) since natural attenuation of contaminants in this area is occurring at an acceptable rate. Consistent with this response scenario, the Trustees are estimating benthic losses from the present time until contamination levels in the biologically active sediment layer decline to a mean ERM quotient of 0.10 or less**.** Based on sedimentation rates extrapolated from Mueller *et al*. (1987), the Trustees have conservatively assumed that recovery of the resources to baseline conditions (and baseline services levels) in these areas will be complete in 2023.

Coon Island Loop Benthos Injury Estimate

The injury analysis for Coon Island Loop was divided into two subareas: (1) the Site areas within the shallow portion of Coon Island Loop, totaling approximately 254 acres, and (2) the Coon Island Loop Channel – a dredged channel (a lesser quality habitat of soft unvegetated bottom sediments) totaling approximately 57 acres.

The level of contamination in Coon Island Loop and Coon Island Loop Channel sediments is less than that found in the sediments of Bayou Verdine and its associated wetlands, and sediment toxicity test results for the Coon Island Loop area indicate a lesser degree of

benthos injury. Recent studies (Long *et al*. 1998; Long and MacDonald, 1998) have shown that the probability of sediment toxicity, an important indicator of benthic injury, is correlated with the mean ERM quotient associated with each contaminant. Because there are a number of contaminants present and with potential for synergistic or antagonistic interactions, the Trustees developed and applied a summary sediment quality statistic to delineate zones within Coon Island Loop (Figure 4.2), based on the differing injury potential represented by the presence of multiple contaminants. This summary statistic is calculated by first dividing the sum of the ratios of the contaminant concentrations by the ERM for each contaminant and then dividing that value by the total number of contaminants evaluated. The Trustees considered this an appropriate approach to account for the presence of multiple contaminants with potential to contribute to the benthic injury at this Site. All 34 hazardous substances detected at the Site were used in calculating mean ERM quotients, though PAHs and Zinc contributed most significantly to observed toxicity.

Figure 4.2 – Coon Island Loop Injury Zones, with Percent Loss of Service (%LOS), 1993 & 2000.

For the area of Coon Island Loop considered in this assessment, the choice of response is expected to be no dredging (natural recovery) since natural attenuation of contaminants in

this area is occurring at an acceptable rate. Consistent with this response scenario, the Trustees are estimating benthic losses from the present time until contamination levels in the biologically active sediment layer decline to a mean ERM quotient of 0.10 or less**.** Based on sedimentation rates extrapolated from Mueller *et al.* (1987), the Trustees have conservatively assumed that recovery of the resources to baseline conditions (and baseline services levels) in these areas will be complete in 2023. However, recovery may occur sooner as it will likely be aided and expedited by periodic dredging that occurs within the Coon Island Channel to maintain facility access and navigability of the waterway. This dredging entails removal of sediments to confined disposal facilities, which also eliminates or further reduces benthic resource exposure to contaminants in area.

Estimating benthic losses also requires assessing past trends in benthic resource injury levels. Data collected for PPG between 1992 and 1994 (NOAA, 2002) were used to develop a trend for benthic resource injuries to the present. Prior to 1992, there is little available information to inform an assessment of past losses. In the absence of usable data from prior years, the Trustees 'flatlined' the level of losses back in time from 1993 to 1981, i.e., assumed the injuries to benthos in the years prior to 1993 were the same as the injuries occurring in 1993. This 'recovery curve' is depicted in Figure 4.3.

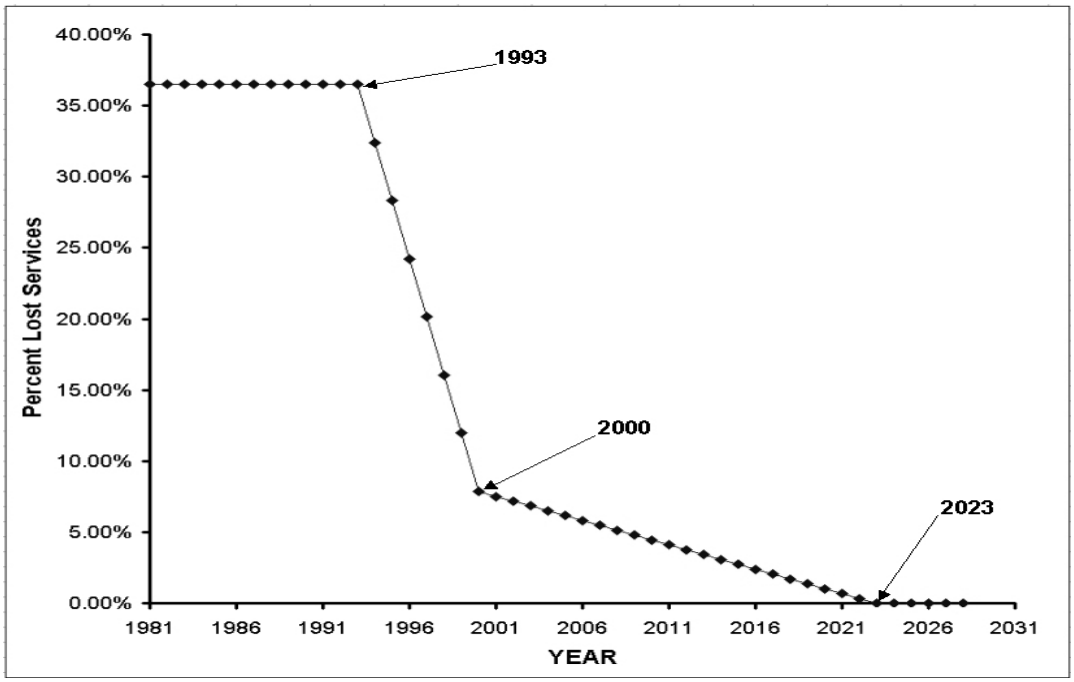

Figure 4.3 – Injury Recovery Curve Based on Sediment Chemistry Results and Sedimentation Rates Extrapolated from Mueller *et al.* 1987.

No data for the Coon Island Loop Channel were obtained in 2000, so the injury trend depicted in Figure 4.3 for Coon Island Loop is applied in estimating the benthic injury in the channel area for that year. Periodic dredging of the Coon Island Loop Channel is undertaken to maintain facility access and navigability of the waterway. Because this action removes contaminated sediments, recovery of the benthic communities in the Coon Island Loop Channel is expected to occur within two years following the next maintenance dredging cycle.

The results of the injury analysis for both the Bayou Verdine and Coon Island Loop areas are presented in Table 4.3.

Table 4.3 – Results of Benthic Resources Injury Analysis

Area Name	Area (acres)	Injury (ca. 1992) % LOS	Injury % LOS (Year % LOS is reached)	Time to recovery	EqDSAYs Lost
Bayou Verdine	17.61	100%	100% (2008)	2 years after dredging	163
Bayou Verdine Wetland	1.53	100%	100% (2008)	2023	76
Coon Island Channel	57	48.5%	7.9% (2008)	2 yrs after maintenance dredging	206
Coon Island Loop	254	36.5%	7.9% (2000)	2023	630
Total					1,075

Equivalent Injured Acres Ratio

The assessed benthic resource losses are for benthic injuries occurring in soft unvegetated bottom sediments, also referred to as open water habitats. The restoration project preferred for use to compensate for these losses involves creation and enhancement of brackish marsh. To determine the amount or scale restoration needed to offset losses, the DSAYs lost due to injuries have to be compared to DSAYs gained through restoration across these two habitat types (open water versus marsh). The comparison is complicated by differences in functions

or ecological productivity levels between these habitats. To translate the open water habitat losses into their 'equivalent' in the target restoration habitat, it is necessary to identify a conversion factor or ratio to be used to adjust for the differences in relative productivity across these habitat types.

To accomplish this, the habitat productivity of the injured open water habitat was first compared to the habitat productivity of a natural wetland. The Trustees reviewed the method used to develop a wetland conversion factor for the Lavaca Bay NPL Case (marsh equivalency factor: 4.51 acres of water bottom = 1 acre of tidal wetland) (Lavaca Bay, TX, Trustees, 2000). The Trustees decided that this same ratio, or 'marsh equivalency factor', could be used as a conversion factor for these same habitats in the Calcasieu Estuary because, in their professional knowledge, similar habitat functions were represented.

The ratio was applied by dividing the "raw" DSAYs assessed for the losses by the marsh equivalency factor. The result is a conversion of the benthic losses to their equivalent in lost services of marsh, *i.e.* Equivalent DSAYs (EqDSAYs). The results in Table 4.3 are presented as EqDSAYs Lost. The DSAYs to be gained from the preferred restoration action are estimated and compared to the EqDSAYs Lost in Section 6.1.5.

4.5 SUMMARY OF PROPOSED INJURY ANALYSIS FOR BENTHIC RESOURCES

The Trustees found benthic resources in Bayou Verdine and Coon Island Loop to be injured due to the effects of elevated concentrations of hazardous substances releases attributable to the ConocoPhillips and Sasol NA facilities. Using the RCIE approach, the Trustees have quantified the injury in terms of the ecological services of the benthos lost over time, until recovery to baseline conditions, using historical data and data collected for both the Bayou Verdine and Calcasieu BERAs and based on sediment benchmark concentrations known or suspected to result in adverse effects in benthic populations. Consistent with the RCIE approach, the analysis incorporated conservative technical judgments and assumptions regarding likely effects on benthos, including those of response actions known or expected within Bayou Verdine and Coon Island Loop. The quantification of benthic losses considered the present condition of the resource, the potential reduction in ecological services due to the injury, and accounted for service losses over the time required for the injured resources to recover to pre-release condition through natural or enhanced means, as applicable. Because the preferred restoration action (creation and enhancement of brackish

marsh) has a higher ecological productivity than the habitat within which the injuries occurred, an 'Equivalent Injured Acres' ratio of 4.51-to-1 was applied to convert benthic losses to their 'equivalent' in the target restoration habitat. The results of this analysis (see Table 4.3) indicate that compensation for assessed benthic resource losses is achieved by providing ecological services equivalent to 1,075 DSAYs.

5 THE RESTORATION PLANNING PROCESS

The goal of restoration planning under CERCLA is to identify actions appropriate to restore, rehabilitate, replace or acquire natural resources or services equivalent to those injured or lost as a result of releases of hazardous substances. The restoration planning process may involve two components: primary restoration and compensatory restoration. Primary restoration actions are designed to assist or accelerate the return of a resource, including its services, to pre-injury or baseline conditions. In contrast, compensatory restoration actions serve to compensate for the interim loss of resource services due to injury, pending the return of the resource to baseline conditions or service levels. The scale of a compensatory restoration project depends on the nature, extent, severity, and duration of the resource injury. Primary restoration actions that speed resource recovery reduce interim losses, as well as the amount of restoration required to compensate for those losses.

In this instance, response actions undertaken or anticipated at the Site (*i.e.*, for Bayou Verdine - dredging and on-facility consolidation and capping of material, and for Coon Island Loop – natural recovery) are expected to protect natural resources in the vicinity of the Site from further or future harm and to allow benthic resources to return to pre-injury or baseline conditions within a reasonable period of time. Under these circumstances and given the rapid return of benthic communities through recruitment, it is unnecessary for the Trustees to consider or plan for primary restoration actions. Accordingly, this Draft DARP/EA focuses only on defining appropriate compensatory restoration actions.

The Trustees have approached restoration planning with the view that the injured benthic resources and associated services lost are part of an integrated ecological system and that the Calcasieu Estuary represents the relevant geographical area for appropriate restoration actions. This helps to ensure that the benefits of restoration actions are related, or have an appropriate nexus, to the benthic resource injuries and losses being assessed for the Site.

In accordance with the NRDA regulations, the Trustees identified and evaluated a reasonable range of project alternatives capable of restoring ecological services comparable to those lost due to injury to benthic resources at the Site. These alternatives were identified by first searching for potential projects within the watershed, including via a public request for project proposals presented at meetings held in Lake Charles, LA on September 29, 2004. The alternative projects identified by the public and Trustees were then subjected to a first tier of screening (described in Section 5.3.1) to narrow the field of project alternatives to

those considered in this plan. The "No Action" alternative was also included for consideration, as required by NEPA and the CERCLA NRDA regulations. These alternatives were then evaluated more carefully by the Trustees based on the criteria outlined below. Each alternative, the results of that evaluation, and the restoration action(s) that the Trustees are proposing for implementation on the basis of that evaluation, are identified in the remaining sections of this document.

5.1 RESTORATION STRATEGY

The initial search and screening process led the Trustees to identify a preferred strategy for effecting restoration to compensate for benthic losses under this plan - estuarine marsh creation or enhancement. Converting other habitats to open water bottom is generally not favored or appropriate as a restoration strategy as it necessitates the loss of important resources and services that other habitats provide. Estuarine wetlands support benthic resources, have the capacity to replace the array of ecological services lost, and are ecologically more productive than open water bottom as a habitat, making this approach to providing compensatory services more efficient Further, intertidal marshes in coastal Louisiana, including those within the Calcasieu Estuary, are continually being converted to open water habitat due to inundation from subsidence and salt-water intrusion. Their increasing prevalence due to these processes makes open water areas a lesser-valued habitat, and an undesirable means of effecting restoration. Estuarine marsh creation or enhancement helps address a critical problem in this environment - the loss of these wetlands in the Estuary. Consistent with this strategy, all project alternatives considered in this plan represent opportunities to create or enhance estuarine marsh in this watershed.

5.2 RESTORATION EVALUATION CRITERIA

Consistent with the NRDA regulations, the following criteria were used to evaluate restoration project alternatives and identify the project preferred for implementation under this plan:

The extent to which each alternative is expected to meet the Trustees' restoration goals and objectives: The primary goal of any compensatory restoration project is to provide a level and quality of resources and services comparable to those lost due to the assessed injuries. In meeting that goal, the Trustees consider the potential relative productivity of the habitat to be restored and whether the habitat is being created or enhanced. Proximity to the injury and future management of the restoration site are also considered because management issues can influence the extent to which a restoration action meets its goals.

The cost to carry out the alternative: The benefits of a project relative to its cost are a major factor in evaluating restoration alternatives. Factors that can affect and increase the costs of implementing the restoration alternatives may include project timing, access to the restoration site (*e.g.,* with heavy equipment or for public use), acquisition of state or federal permits, acquisition of land necessary to complete a project, measures necessary to provide for long-term protection of the restoration site, and the potential liability from project construction.

The likelihood of success of each project alternative: The Trustees consider technical factors that represent risk to successful project construction, project function, or long-term viability of the restored habitat. Alternatives that are susceptible to future degradation or loss through contaminant releases or erosion are considered less viable. The Trustees also consider whether difficulties in project implementation are likely and whether long-term maintenance of project features is likely to be necessary and/or feasible.

The extent to which each alternative will avoid collateral injury to natural resources as a result of implementing the alternative: Restoration actions should not result in additional losses of natural resources and should minimize the potential to affect surrounding resources during implementation. Projects with less potential to adversely impact surrounding resources are generally viewed more favorably. Compatibility of the project with the surrounding land use and potential conflicts with endangered species are also considered.

The extent to which each alternative benefits more than one natural resource or service: This criterion addresses the interrelationships among natural resources, and between natural resources and the services they provide. Projects that provide benefits to more than one resource and/or yield more beneficial services overall, are viewed more favorably. For example, although recreational benefits are not an explicit objective in this Draft DARP/EA, the potential for a restoration project to enhance recreational use of an area was considered favorably.

The effect of each alternative on public health and safety: Projects that would negatively affect public health or safety are not appropriate.

The NRDA regulations give the Trustees discretion to prioritize these criteria and to use additional criteria as appropriate. In developing this Draft DARP/EA, the first criterion listed has been a primary consideration, because it is paramount to ensuring that the restoration action will compensate the public for the injuries to benthic resources attributed to Site releases, consistent with the proposed assessment of compensation requirements for the Site.

5.3 FIRST TIER SCREENING OF POTENTIAL PROJECT ALTERNATIVES

Twenty-five potential restoration project alternatives were identified as a result of the Trustees' search for restoration opportunities in the Calcasieu Estuary. This initial list of alternatives (Appendix A) was first screened based on the following preferences for restoration:

- Preference for project alternatives without significant impediment to implementation (i.e., complex land protection issues, phased projects, etc).
- Preference for project alternatives with a strong nexus to the injured resources.
- Preference for project alternatives with a high degree of habitat enhancement.
- Preference for project alternatives with limited potential to disrupt existing resources.

The results of that screening appear in Table 5.1. The potential projects advancing for full evaluation are indicated in bold.

Table 5.1 – Summary of Trustees' Tier-1 Screening of Potential Restoration Project Alternatives.

(++) indicates very positive, (+) indicates positive, (0) indicates neither positive nor negative, (-) indicates negative, and (--) indicates a very negative relationship between the project and that criterion.

Restoration Project Alternative	No significant impediments to implementation	Strong nexus to injured habitats	Amount of habitat function enhancement	Avoids injury to existing resources	Retain for detailed analysis
Boardwalk Shoreline Protection	--	+	+	0	N
Section 29 Marsh Creation	**+**	**++**	**++**	**0**	**Y**
Section 32 (Haymark Terminal) Marsh Creation	--	++	++	0	N
Coon Island Loop Marsh Creation	--	++	++	0	N
South Prien Lake Marsh Creation	0	+	+	0	N
North Moss Lake Marsh Creation	--	++	++	0	N
Old River/Turner's Bay Marsh Creation	--	++	++	0	N

Restoration Project Alternative	No significant impediments to implementation	Strong nexus to injured habitats	Amount of habitat function enhancement	Avoids injury to existing resources	Retain for detailed analysis
Long Point Shell Reef	+	+	0	0	N
South Fork Black Bayou (also named Hippolyte II)	**+**	**0**	**+**	**0**	**Y**
Rangia Reef Restoration	0	+	0	0	N
Basin-wide Riparian Restoration	0	0	0	0	N
Anti-logging in Swamps	--	0	--	0	N
Swamp re-vegetation in Moss Bluff area	++	0	+	0	N
Marsh Creation near Sam Houston State Park	--	++	++	0	N
Upper Calcasieu Estuary Wetlands Marsh Creation	--	++	++	0	N
Marsh Terracing	--	++	+	0	N
Hydrologic Restoration near West Cove Canal - Sabine NWR BU93, 96, and 99 Projects	**++**	**+**	**+**	**0**	**Y**
Oyster Bayou Marsh Terracing	0	++	+	0	N
Reduce Maintenance Dredging in Calcasieu Ship Channel	--	--	--	0	N
Seafood Awareness Campaign	0	--	--	0	N
Wetland education	0	0	--	0	N
Fishing Access	0	--	--	0	N

As a result of the Tier-1 screening, twenty projects were dropped from further consideration. The marsh creation projects at Coon Island Loop, Upper Calcasieu Estuary Wetlands, and near Sam Houston State Park were dropped due to probable landowner issues that are likely

to make these possible restoration sites unavailable in the near-term. The marsh creation projects at Section 32 and South Prien Lake were not considered further due to complexities in land ownership and environmental conditions, respectively. The marsh creation projects at Turner's Bay and North Moss Lake were also dropped due to land ownership complexities. The terracing projects were eliminated from further consideration because other project types, such as marsh platforms or hydrologic restoration, are anticipated to provide a higher degree of habitat enhancement than terracing. The re-vegetation of bottomland hardwoods near Moss Bluff was eliminated due to lack of nexus to the injured habitat and poor proximity to the injured Site. The *Rangia* and oyster reef restoration projects were not selected because *Rangia* reefs lack a proper nexus to the injured habitat and for oyster reefs because the potential enhancement to habitat functions are marginal compared to marsh restoration due to water quality conditions. The Boardwalk shoreline protection project and riparian restoration projects were not selected due to a combination of landowner complications and marginal nexus to the injured habitat. Lastly, the programmatic actions were not selected because they would not result in direct restoration of natural resources and they had a poor nexus to the injured habitat.

5.4 IDENTIFICATION OF PREFERRED RESTORATION ALTERNATIVE

The following projects (geographically represented in Figure 5.1) became the restoration alternatives that the Trustees evaluated using the criteria listed in Section 5.2:

Marsh creation within Section 29;

Marsh enhancement via restoration of freshwater flow, eradication of invasive species, and re-vegetation of the South Fork Black Bayou area (also named Hippolyte II);

Marsh creation and enhancement via hydraulic restoration at Units 1993, 1996, and 1999 of the West Cove Canal area through the degradation of levee impoundments (Restoration at Units 1993, 1996, and 1999 evaluated as separate project alternatives); and

No action.

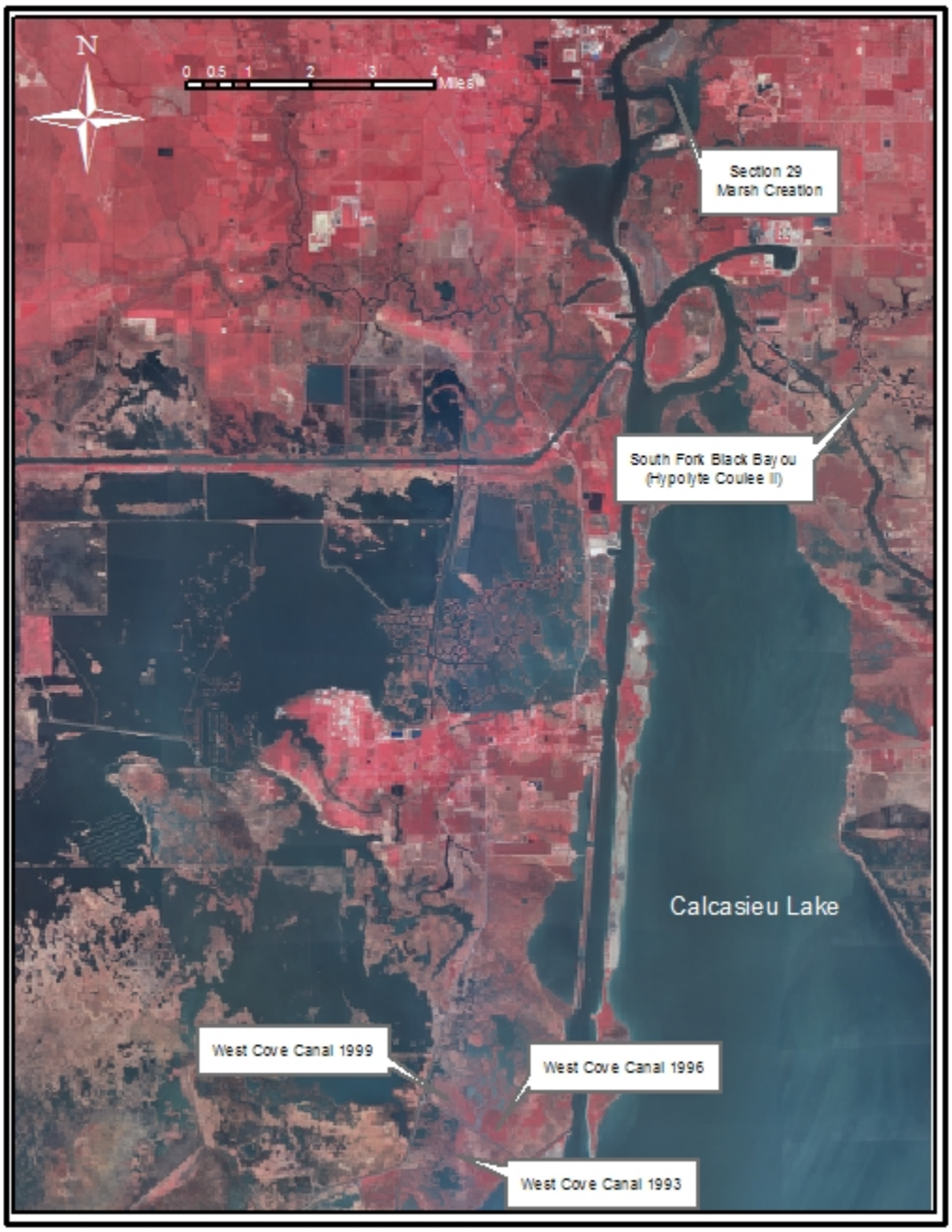

Figure 5.1 – Locations of the Restoration Project Alternatives in the Calcasieu Estuary Watershed

The Trustees' evaluation of these alternatives is summarized in Table 5.2. The preferred restoration alternative – marsh creation and enhancement of the 1999 Unit near West Cove Canal via hydraulic restoration – is identified in bold. Two of the restoration alternatives identified in Table 5.2 – marsh creation and enhancement via hydraulic restoration of the 1993 and 1996 Units near West Cove Canal – were dropped from further consideration during development of this Draft DARP/EA when the Trustees were notified that the

Louisiana Department of Natural Resources had received alternate funding and was proceeding with plans to restore these areas. Therefore, though these alternatives appear in Table 5.2, neither was evaluated further. Section 6.0 provides further information regarding the basis for choosing the preferred restoration alternative and the evaluation of the remaining non-preferred alternatives.

Table 5.2 – Summary of Trustees' Evaluation of Potential Restoration Project Alternatives. (++) indicates very positive, (+) indicates positive, (0) indicates neither positive nor negative, (-) indicates negative, and (--) indicates a very negative relationship between the project and that criterion. The preferred restoration alternative is identified in bold.

Restoration Alternative	Consistency with restoration strategy (incl. future management)	Cost-effectiveness	Likelihood of Success (incl. technical feasibility)	Avoid - Minimize Resource Injury	Maximize Resource Benefits	Effect on Public Safety
Section 29 Marsh Creation	+	+	+	+	+	0
South Fork Black Bayou (also Hippolyte II)	0	+	+	++	-	0
Marsh creation, and enhancement via hydraulic restoration, near West Cove Canal (Sabine 1993 project)	N/A	N/A	N/A	N/A	N/A	N/A
Marsh creation, and enhancement via hydraulic restoration, near West Cove Canal (Sabine 1996 project)	N/A	N/A	N/A	N/A	N/A	N/A
Marsh creation, and enhancement via hydraulic restoration, near West Cove Canal (Sabine 1999 project)	+	++	++	++	++	0
No Action	--	++	+	++	--	--

6 EVALUATION OF RESTORATION ALTERNATIVES

6.1 PREFERRED RESTORATION ALTERNATIVE: MARSH CREATION AND ENHANCEMENT VIA HYDRAULIC RESTORATION OF THE 1999 UNIT NEAR WEST COVE CANAL, IN THE SABINE NATIONAL WILDLIFE REFUGE (THE 'SABINE 99 PROJECT')

The preferred restoration project would occur in the mid-Calcasieu Estuary watershed, within the Sabine National Wildlife Refuge ('Sabine NWR'). The area is bordered to the east by Calcasieu Lake, to the west by LA Highway 27, is 8 km south of the town of Hackberry, and is 16 km north of the Gulf of Mexico. The Refuge is publicly owned and managed by the USFWS.

6.1.1 Proposed Restoration Site

In the latter half of the twentieth century, the intermediate estuarine marshes in and around the Sabine NWR deteriorated to broken marsh and/or open water areas due to salt water intrusion from a variety of causes, including the effects of the Calcasieu Ship Channel, storm damage, altered hydrology, and natural subsidence. In the 1990's, the U.S. Army Corps of Engineers beneficially disposed of dredged material (from maintenance dredging along the Calcasieu Ship Channel) into areas of broken marsh and shallow open water within spoil banks constructed on-site in an effort to create a platform for re-establishment of marsh habitat within the Refuge. This occurred as a series of three separate "projects", undertaken in 1993, 1996, and 1999, respectively. The area re-established in 1999 (Figure 6.1) is the site of the preferred project. It has a footprint of 280 acres consisting of 246 acres of existing estuarine marsh and 34 acres of shallow open water/mudflats.

An elevation survey conducted in 2005 indicates that the average marsh elevation throughout the project area is 0.41 meters National Geodetic Vertical Datum (NGVD). This elevation is conducive to hydrologic exchange through tidal inputs, a feature necessary to support and sustain functional marshes. However, the survey also indicates the crest of the spoil banks that were constructed at the site in 1999 to contain the deposited dredge material have an average elevation of 1.27 meters NGVD, which is too high for hydrologic exchange during typical flood events. Failure of the spoil banks to either degrade or naturally subside to marsh elevation has, therefore, contributed to water impoundment and prevented the desired tidal exchange. In studies of similar situations, Boumans and Day (1994), Cahoon (1994), Reed *et al.* (1997), and Kuhn *et al.* (1999) found that these conditions significantly decreased

mineral and nutrient inputs, important contributors to the soil accretion needed to sustain marshes. Herke *et al.* (1992) found that similar conditions impeded fish and crustacean access. Additionally, limited access and tidal exchange creates low quality habitat for benthic and epi-benthic communities, and for invertebrates, wading birds, and shore birds. Several studies (Bronmark 1985, Møller and Rørdam 1985, Findlay and Houlahan 1997, Keddy and Fraser 2000, Zedler 2003) have demonstrated a positive relationship between wetlands of increasing size (with proper hydrologic regime) and species richness of several organisms groups, including benthic organisms, invertebrates, and birds. Restoration of the hydrologic regime is thus likely to greatly affect the abundance and biodiversity of these organisms.

The preferred project area has public access via a boat ramp along LA Highway 27, but currently provides limited opportunities for non-consumptive (e.g. bird watching, photography, and boating) and consumptive (e.g. fishing and crabbing) recreational activities due to the impassability of the levees.

Figure 6.1 – Sabine NWR – 1999 West Cove Canal Marsh Platform Project Area

6.1.2 Proposed Restoration Action

The proposed restoration action involves activities to provide for spoil bank degradation, spoil bank gapping, and marsh creation (Figure 6.2). Approximately 2,500 feet of the nearly 10,000 feet of spoil bank that served as containment for the marsh platform constructed in 1999 will be degraded to elevations similar to the interior marsh[14]. Material will be excavated from the levees using a marsh buggy or similar track-propelled machinery. The material from the spoil bank degradation will be deposited in the adjacent flotation canals between the levees and the marsh platform. The deposition of this material will increase the elevation in the canals to between 0.85 and 1.75 feet (0.3 m and 0.53 m) NGVD. This action is expected to provide approximately 14.7 acres (5.95 hectares) of additional substrate for the natural recruitment and re-colonization of native, desirable marsh vegetation. Close proximity of an appropriate seed source should facilitate the establishment of native marsh vegetation in these areas within two growing seasons. The narrowness of the created areas facilitates encroachment of vegetation from the surrounding marsh.

In addition to the spoil bank degradation described above, five cuts or 'gaps' will be constructed in the remaining levees: one each in the west, north, and east levees, and two in the south levee. Each of these gaps, designed to aid in tidal flushing of the marsh platform, will be constructed where a channel previously existed. The width of the gaps will be determined in the engineering and design phase of the project, but basic guidelines outlined by Turner *et al.* (1994) will be used to guide those decisions.

The goals of the preferred project are (1) enhance the existing 247 acres of marsh by increasing tidal exchange; thereby, increasing the rate of accretion and decreasing the rate of elevation change across the project area, and (2) to create an additional 14.7 acres of sustainable, functionally equivalent brackish marsh.

[14] Refuge personnel have indicated this component has the greatest potential of improving marsh function within the project area since the interior elevations are similar to adjacent natural marshes (Walter, Pers. Comm. 2005). The opinion of Refuge personnel was corroborated by the 2005 topographic survey of the marsh platform. That survey indicates elevations inside the artificial levees are within the inter-tidal range experienced in West Cove Canal (within 0.3 to 0.53 meters NGVD).

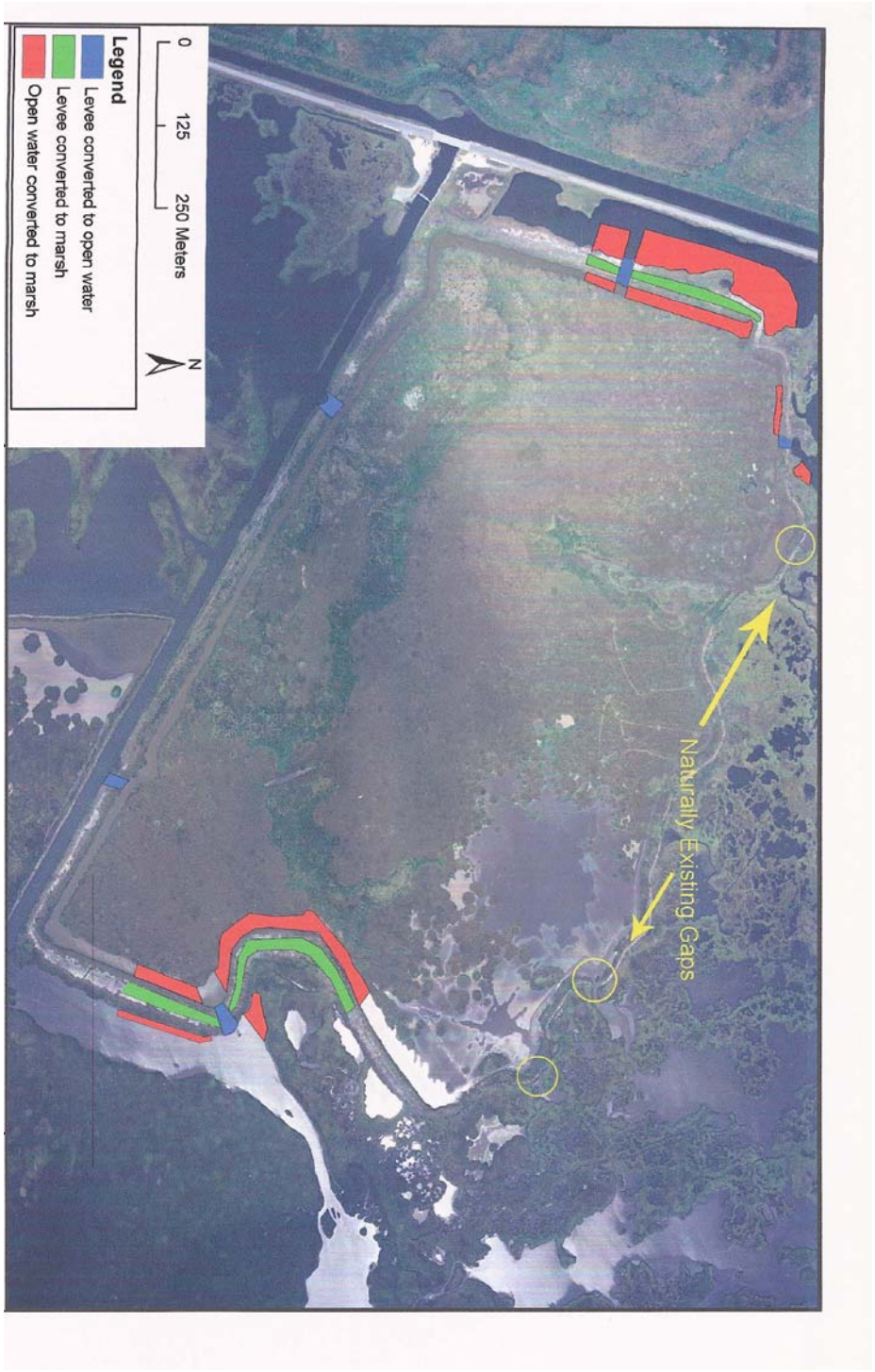

Figure 6.2 – Preferred Restoration Alternative – Sabine NWR 1999 Unit

6.1.3 Evaluation of Alternative

The project area, within the Calcasieu Lake system, was re-established in 1999, but has been functioning at a reduced level since that time due to poor hydrologic exchange caused by the adjacent spoil banks. These conditions and features present many opportunities to create and enhance brackish marsh though the re-establishment of elevations needed to support marsh vegetation and restoration of proper hydrologic exchange, respectively. The latter will be addressed by degrading and gapping a portion of the existing spoil banks surrounding the marsh platform, thereby, improving tidal exchange and increasing marsh function (marsh sustainability as a result of increased accretion) to a more desirable level. The former will be addressed by creating marsh in adjacent shallow open-water areas using sediments from the degraded levees. Marsh creation and enhancement projects of this nature have been sponsored by both the state and federal government in coastal Louisiana and are generally highly successful and cost-effective.

Improving the functionality of the 1999 re-established marsh through the partial degradation of spoil banks also avoids potential effects or disruptions to other habitats or resources. Optimizing wetland habitat by converting artificial uplands to marsh is the least disruptive restoration alternative to existing habitat and organism usage. Some impacts to natural resources such as temporary turbidity or other localized effects on surface water quality may occur, but these effects are generally minimal and of short duration.

Marsh restoration can be implemented without additional land acquisition costs because the restoration site is within the Sabine NWR, which is owned by the USFWS. Siting restoration within the Refuge will result in a larger area of protected, heterogeneous habitat than would be possible at other locations that are privately owned or not presently under active conservation. Further, as a designated NWR, the area is managed by USFWS for the long-term preservation and conservation of natural resources, including estuarine habitats. This management framework is fully consistent with the Trustees' restoration strategy. Under these conditions, the proposed project will provide an uninterrupted flow of services into the future. The nature of the project and the setting for construction would present no human health or safety issues beyond those met by standard procedures for safe construction. The USFWS supports this restoration effort and no public opposition to this project has been apparent during scoping by the Trustees.

6.1.4 Ecological and Socio-Economic Impacts

Degradation of the spoil banks and the construction of brackish marsh will affect noise levels and the pursuit of recreational activities in the vicinity of the project area. However, these effects will be short-term and are not expected to influence long-term use of the area by the public. In actuality, beyond the short-term effects mentioned above, the area is expected to foster and enhance the continued public use of this portion of the Sabine NWR through the improvements to the environment. Increases in the availability of organisms should enhance public use of the area, especially for recreational and commercial fishing. The implementation of this project should not affect the local economy or its citizens; therefore, no socio-economic effects are expected.

For more information on the ecological and socio-economic effects of the preferred project, refer to Section 7.0 – NEPA Considerations.

6.1.5 Habitat Equivalency Analysis – Project as Compensation (the 'Credit Model')

As explained in subsection 4.4.5**,** HEA is a model that is used to calculate "debits" (estimating habitat injuries or other resource service losses) due to adverse effects resulting from exposure to hazardous substances, and to balance these "debits" against the ecological services to be gained (credited as "compensation") from a proposed habitat restoration action. The scale, or size, of a restoration project should be such that it provides enough ecological service gains to offset the total of the losses.

The HEA method was used by the Trustees to determine whether this project would be adequate to compensate for the losses described in Section 4.0. To quantify the benefits of restoration, HEA uses several project-specific factors, including the elapsed time from the onset of injury to the implementation of the restoration action, the relative productivity of restored habitats (that is, the proportional equivalence of ecological services provided by the compensatory project relative to the baseline productivity of the injured habitat), the time required for the restored habitat to reach full function, and the project lifespan.

To identify an appropriate *relative productivity* input parameter for the marsh creation component, the Trustees relied on information found in the scientific literature regarding the levels of functional equivalency in herbaceous marshes throughout a project's life for primary productivity, soil development, nutrient cycling, food chain support, and fish and

shellfish production (Broome 1990; Broome *et al.* 1986; Cammen 1975; Craft *et al.* 1988; Craft *et al.* 1999; Currin *et al.* 1996; Langis *et al.* 1991; LaSalle *et al.* 1991; Levin *et al.* 1996; Lindau and Hossner 1981; Minello 1997; Minello and Webb 1997; Moy and Levin 1991; Peck *et al.* 1994; Scatolini and Zedler 1996; Seneca *et al.* 1985; Thompson *et al.* 1995). For the hydrologic project components (spoil bank degradation), the Trustees based the HEA input parameters on elevation, subsidence, accretion, and sea-level rise data collected from the restoration site and published in the literature, as well as literature values on algal and epiphytic production, and estuarine organism access. The Trustees' hydrologic restoration technical memorandum (Bayou Verdine Trustees 2008) describes the data relied upon to develop the input parameters.

Using this information, the Trustees estimated the created marsh component would likely yield 71.3 percent of the services of a fully functioning marsh in 15 years and would likely plateau at that level of service through the remainder of its project lifespan. The Trustees assumed services revert to 0 at the end of the project lifespan since the site will likely deteriorate to open water in the future due to subsidence and erosion. For marsh services created, enhanced or affected by the hydrologic project components, the Trustees' approach to determining the reduced level of services being provided by the currently impaired ('As-Is') marsh focused first on determining the increases in services expected following hydrologic restoration for algal and epiphytic production, and estuarine organism utilization, as two key indicators of overall marsh function and productivity. The Trustees assumed the 'As-Is' marsh at the site will improve, as predicted in the literature, for these two components of the marsh and that, following restoration, marsh at the site will attain a maximum service level of 71.3% (maximum level services of fully functioning created marsh relative to natural marsh). The 'As-Is' service level of the marsh at the site is calculated by subtracting the expected percent service increases for algal and epiphytic production (10.7%) and estuarine organism utilization (2.6%) from the services provided by a fully functioning created marsh (71.3%). The result is that the 'As-Is' marsh is estimated as providing a current level of marsh services that are 58% of a natural marsh. ((71.3% - (10.7% + 2.6%)) = 58%).

The Trustees estimate that the proposed action will increase the sustainability of the marsh through increased rates of accretion; thereby, increasing the life of the marsh by 16 years based on an accretion rate of 0.51 cm/year (Bayou Verdine Trustees 2008).

The estimated marsh services to be gained by implementing this project are presented in Table 6.1, and reflect application of a three percent annual discount rate.

Table 6.1 – HEA "credit" model input parameters estimating the services gained (expressed in DSAYs) due to implementation of Sabine NWR 1999 Project.

	Acres	Years to Full Service	Relative Value of Restored Services	DSAYs
Created Marsh	14.7	15	71.3%	198.24
Restored Marsh	246	7	13.3%[15]	1322.24
Open Water	34	5	5%	30.12
Total Project Benefits	294.7			1,550.60

A total of 1,075 DSAYs of resource services (all habitats combined) are estimated to have been lost due to the releases from the ConocoPhillips and Sasol NA facilities. The above analysis indicates the preferred restoration alternative will likely generate 1,550 DSAYs in equivalent services. This predicted credit is sufficient to compensate for the assessed benthic resource losses associated with historical hazardous substances releases from the ConocoPhillips and Sasol NA facilities.

6.2 NON-PREFERRED ALTERNATIVE - MARSH CREATION IN SECTION 29

This project involves marsh creation in the upper-Calcasieu Estuary watershed, within Calcasieu Parish, LA (refer to Figure 5.1), in an area that is approximately 14.0 km southeast of Lake Charles, LA, and is approximately 42.5 km north of the Gulf of Mexico. The project area is privately owned.

This project involves creating a containment levee to support a potential 164-acre marsh complex, and also creating marsh on a portion of the 164-acre area within the levee. Material for the levees and marsh creation would be dredged from the Calcasieu Ship Channel and

[15] The relative value of restored services will result in the Sabine 1999 project reaching 71.3% services compared to a natural marsh. That estimate is consistent with other created marshes in the region. The quantified benefits (DSAY's) were also based on the increased lifespan of the project and the continuation of services not otherwise provided if the marsh completely subsided and converted to open water.

transported to the project area via a slurry pipeline. Native marsh vegetation would be planted following de-watering of the dredged material.

6.2.1 Evaluation of Alternative

Of the restoration alternatives considered in this plan, the Section 29 project area is located closest to the Site (approximately 10 km) and its proximity to the Site does add to its nexus to the injured resources. The project is scaleable and offers an opportunity for additional, future restoration actions, if desired. The project, however, is a less cost-effective approach to marsh creation than the preferred project because levee construction requirements make the project costs significantly higher at the outset. Further, the area of marsh that would benefit from this alternative is privately owned. It would be necessary to establish and provide for future protection and management of the restored area in order for the public to realize the goal of restoration under this plan. Achieving suitable arrangements with non-public landowners often presents a set of complex issues that, even if surmountable, increases the time and cost to implement restoration, often significantly.

Construction of the marsh platform is technically feasible, as this technique has been widely used throughout coastal Louisiana. However, local subsidence and significant water flows in the project area during periods of high velocity have the potential to affect the integrity of the marsh platform.

6.2.2 Ecological and Socio-Economic Impacts

Construction of a marsh platform at an appropriate elevation would immediately re-establish more productive estuarine habitat in what is presently an open water habitat. Although some services associated with open water habitat would be lost, implementation of this project would be expected to greatly increase and/or improve the overall ecology of wetlands in this area, and to greatly increase and/or improve the ecological services of the area of influence as nursery habitat for estuarine resources. The effects would benefit a wide variety of fish and wildlife, including those of recreational and commercial importance. Construction may disturb or displace resources within the footprint and immediate vicinity of the project area, but these impacts would be minimal, largely temporary and result in no long-term effects other than the positive effects associated with the future functioning of the re-established marsh. At the end of the project life the area will return to open water, and with it, the return of existing resources and services.

Owing to the project's proximity to the greater Lake Charles area, benefits associated with this alternative would occur in areas where the public has an opportunity to utilize the restored resources. Increases in the availability of organisms should enhance public use of these resources, especially for recreational and commercial fishing. No adverse socio-economic effects would be expected due to the implementation of this project.

6.3 NON-PREFERRED ALTERNATIVE – RESTORATION OF SOUTH FORK BLACK BAYOU ('HIPPOLYTE II')

This project involves restoring the hydrology of an approximately 440-acre tract of land in the mid-Calcasieu Estuary watershed, within Calcasieu Parish, LA (refer to Figure 5.1). The area is 5.5 km north of the town of Grand Lake, LA, and is approximately 32 km north of the Gulf of Mexico. The project site is privately owned and presently includes freshwater marsh, wet coastal prairie, riparian, and bottomland hardwood forest habitat. Construction activities would involve degrading levees and reconnecting bayous, grading and contouring the property to proper marsh elevation, the eradication of exotic species, and re-vegetation with native marsh plants.

6.3.1 Evaluation of Alternative

The resource improvements and benefits of this project would generally occur within private property, with restricted or limited public access. In compensating for public claims, the Trustees generally favor implementing restoration in publicly accessible areas. In addition to restricted public use, implementing this restoration project would include increased time and cost due to the need to negotiate adequate site protection and management measures for the life of the project.

While construction of this project would increase marsh functions over a sizable area, the aerial extent and degree of ecological influence to be gained from the project is difficult to predict without additional data collection and more extensive modeling. Further, the likelihood of restoration success (i.e., meeting the goal of this restoration plan) is more difficult to assess than other restoration alternatives due to the diversity of the habitats across the 440-acre system. The project appears to be technically feasible, if constructed to optimal marsh elevation and if reconnection to the bayou system provides adequate marsh inundation. Presently, there is substantial uncertainty about its cost-effectiveness as an approach to marsh restoration that can only be resolved after further planning and modeling. Only after planning and modeling are complete could the Trustees determine the extent of levee degradation needed to influence the area, site-protection needs (such as conservation

servitudes), and long-term maintenance needs due to the presence of exotic, invasive species. Exotic species removal is an on-going activity at the site and the species present are resilient, even when treated aggressively. Each of these obstacles presents uncertainty in the project's overall cost-effectiveness and, based on past experiences of the Trustees, extends the time until implementation. The latter delays our ability to make the public and environment whole for natural resource injuries.

6.3.2 Ecological and Socio-Economic Impacts

The restoration of the hydrology in the area and the eradication of invasive species would improve the ecological health of the marsh. The restoration of hydrology would likely allow marsh access to estuarine organisms, fish, and wildlife. The effects of colonization of invasive plants are well documented and include: a decrease in vegetative species diversity and richness, changes in fauna utilizing the area, and impacts to water quality and nutrient cycling.

The eradication of invasive vegetation often involves the use of herbicide. While its use is part of a well accepted treatment, there is always the potential for herbicide applications to have collateral impact on the native plant community. Additionally, if applied incorrectly near waterways, some herbicides could impact the fish community (on a local scale). Such impacts to the desirable plant, fish, and animal communities are usually minimal, temporary, and result in no long-term effects other than the positive effects associated with the future functioning of the re-established marsh.

Although this project would benefit public resources, it would be on private land. Therefore, the opportunity for public-use of the restored resources at the site of enhancement would be limited if not non-existent. No significant socio-economic effects would be expected due to the implementation of this project.

6.4 NON-PREFERRED ALTERNATIVE - NO ACTION

Under the 'No Action' alternative, the Trustees would take no action to restore, rehabilitate, replace or acquire natural resources or services equivalent to those lost due to hazardous substance releases from the ConocoPhillips or Sasol NA facilities. Only natural recovery occurs under this option. Interim resource services losses are not compensated.

6.4.1 Evaluation of No Action Alternative

The Trustees' assessment of natural resource injuries due to hazardous substances released from the ConocoPhillips and Sasol NA facilities indicates benthic resources have been injured, and that ecological services losses equivalent to 1,075 DSAYs of estuarine marsh have been lost due to that injury. Response actions undertaken or planned for this Site will allow the injured resource to recover, but these actions will not compensate the public for the resource services lost over time due to the injury. Such compensation serves to make the public and the environment whole.

CERCLA allows the public to be compensated for such losses based on actions that restore, replace, or provide services equivalent to those lost. Within the Calcasieu Estuary watershed, there are feasible and appropriate opportunities to restore, replace, or provide services equivalent to those lost due to the release of hazardous substances and subsequent benthic injury. Under the "no action" alternative, restoration actions needed to make the environment and public whole for its losses would not occur. This is inconsistent with the goals of the natural resource damage provisions of CERCLA. Thus, the Trustees have determined that the "no action" alternative (*i.e.*, no compensatory restoration) should be rejected on that basis.

7 NEPA, ENDANGERED SPECIES ACT AND ESSENTIAL FISH HABITAT: ANALYSES AND PRELIMINARY FINDING OF NO SIGNIFICANT IMPACT

7.1 NEPA SIGNIFICANCE ANALYSIS AND FINDING OF NO SIGNIFICANT IMPACT

As noted in Section 1.2, NEPA requires federal agencies to produce an environmental impact statement (EIS) if they are contemplating implementation of a major federal action expected to have significant impacts on the quality of the human environment. NEPA defines the human environment comprehensively to include the "natural and physical environment and the relationship of people with that environment". 40 C.F.R. § 1508.14. All reasonably foreseeable direct and indirect effects of implementing a project, including beneficial effect, must be evaluated. 40 C.F.R. § 1508.8. Federal agencies prepare an environmental assessment (EA) to consider these effects and evaluate the need for an EIS. If the EA demonstrates that the proposed action will not significantly impact the quality of the human environment, the agency issues a Finding of No Significant Impact (FONSI), which satisfies the requirements of NEPA, and no EIS is required.

In accordance with NEPA and its implementing regulations, an EA is integrated into this Draft DARP/EA. The main body of this document summarizes the environmental setting, describes the purpose and need for restoration, identifies the alternatives considered, assesses their applicability and potential environmental consequences and summarizes the opportunity the Trustees provided for public participation in the development of this Draft DARP/EA.

This section of the document specifically addresses the factors and criteria that federal agencies are to consider in evaluating the potential significance of proposed actions, as identified in Section 1508.27 of the NEPA regulations. 40 C.F.R. § 1508.27. The regulations explain that significance embodies considerations of both context and intensity. In the case of a site-specific restoration project, as proposed in this Draft DARP/EA**,** the appropriate context for considering significance of the action is local, as opposed to national or worldwide.

With respect to intensity of the impacts of the proposed restoration action, the NEPA regulations suggest consideration of ten factors:

- likely impacts of the proposed project,
- likely effects of the project on public health and safety,

- unique characteristics of the geographic area in which the project is to be implemented,
- controversial aspects of the project or its likely effects,
- degree to which possible effects of implementing the project are highly uncertain or involve unknown risks,
- precedential effect of the project on future actions that may significantly affect the human environment,
- possible significance of cumulative impacts from implementing this and other similar projects,
- effects of the project on sites listed on the National Register of Historic Places, or likely impacts to significant cultural, scientific or historic resources,
- degree to which the project may adversely affect endangered or threatened species or their critical habitat, and
- potential violations of environmental protection laws.

These factors, together with the federal Trustees' proposed conclusion concerning the likely significance of the proposed restoration action, are reviewed below.

Nature of Likely Impacts

The proposed restoration action has two principal components – marsh creation and enhancement (via hydraulic restoration). The first component will add new areas suitable for the establishment of marsh at the project site within the Refuge. The second component will increase tidal exchange and decrease floodwater residence time to help re-establish and enhance marsh acreage across the full project area. These actions will increase marsh habitat function and habitat diversity at the site. Additionally, the action will generally provide improved nursery, foraging, and cover habitat for numerous species of fish that utilize fringe marsh, as well as other species that inhabit or utilize interior estuarine marsh and surrounding areas. The proposed actions will benefit the surrounding marshes by restoring landscape continuity and improving landscape-scale hydrology. The enhanced and increased marsh habitat resulting from these actions will also provide improved (from current conditions) and additional areas for birds and other wildlife species to nest, forage, and seek protection. All of the above impacts will be of general benefit to the marsh ecosystems within the mid-Calcasieu Estuary. Aesthetic and recreational benefits to humans will also accrue, consistent with the substantial public access and usage available within the Sabine NWR.

Effects on Public Health and Safety

The Trustees evaluated the potential for the proposed restoration action to impact public health and safety by considering the following: air and noise pollution, water use and quality, geological resources, soils, topography, environmental justice, energy resources, recreation, traffic, and contaminants.

Air Quality: Minor temporary adverse impacts would result from the proposed construction activities. Exhaust emissions from earth-moving equipment and/or supply boats contain air pollutants, but these emissions would only occur during the construction phase of the project, the amounts would be small, and should be quickly dissipated by prevailing winds. There would be no long-term negative impacts to air quality.

Noise: Noise associated with supply boats and earth-moving equipment represents a short-term adverse impact during the construction phase. It may periodically and temporarily disturb wildlife in the immediate vicinity of the site, or cause movement of wildlife away from the site to other ecologically suitable areas of the NWR. Similarly, recreating humans may avoid this area due to noise during construction, but as with wildlife, such disruption will be limited to the construction phase, and there are many comparable substitute recreation sites readily available within the NWR. No long-term affects would occur as a result of noise during construction.

Water Quality: In the short term, during the period of construction, earth moving activities (either the mining or placement of sediments) will increase turbidity in the immediate vicinity of West Cove Canal and the adjacent marshes to some degree, though actions during construction will minimize this effect. After construction is completed, the sediments should generally be stable as the material removed from the levee has already de-watered. The newly created substrate should colonize within two years. Over the longer term, the proposed restoration action will re-establish, enhance and increase estuarine marsh at the site, aid in the future retention of sediments, and help improve local water quality via filtration of larger volumes of water as a result of more frequent exchange.

Geology: Neither of the components of the proposed restoration action includes activities with the potential to directly or indirectly affect, positively or negatively, the geology of the area.

Energy: No energy production, transport, or infrastructure occurs in the immediate vicinity (*i.e.,* in and along West Cove Canal) of the restoration site. Further, neither of the components of the proposed action involves activities or potential results that could directly or indirectly affect, positively or negatively, energy production, transport, or infrastructure in this area of coastal Louisiana.

Recreation: The noise and increased turbidity of surface waters arising from earth-moving activities during project construction are expected to discourage and decrease recreational activities in the vicinity of the site during construction. Any such affect will be limited to the period of construction and should be minor, however, as there are many comparable substitute recreation sites readily available within the NWR. Over the longer term, the proposed restoration action will increase the quality, productivity and quantity of marsh habitat in this area. The marsh habitat in the NWR is a foundation for many recreational activities (e.g., fishing, hunting, bird watching, etc) and the improvement in site conditions will enhance opportunities for, and quality of, a variety of recreational uses.

Traffic: Both land- and water-based equipment traffic will occur or increase at the site during the period of construction. There is little to no other land-based traffic in the area, so no affects on other land-based traffic will occur. Affects on other boat traffic are not expected as West Cove Canal itself is large and has ample room for boats to easily maneuver in and around the construction zone. Once construction is complete, the added land- and water-based equipment traffic will end. No long-term impacts to traffic in the area are indicated.

Contaminants: The proposed project involves the re-distribution of sediments dredged and placed by the U.S. Army Corps of Engineers at the project site in 1999. Procedures for project implementation at that time revealed no facts or evidence indicating the sediments being moved were contaminated and no activities have occurred at the NWR since that time to result in releases of contaminants in the vicinity of the project site. Accordingly, there is no reason to believe the sediments now proposed for re-distribution are contaminated or are a potential source of contamination.

Unique Characteristics of the Geographic Area

While the proposed action would occur in a National Wildlife Refuge, which could be considered a unique feature in the landscape, the project site is currently comprised of open

water, artificial levees, and degraded emergent marsh. These habitats are not unique in the mid-Calcasieu Estuary or across the northern coast of the Guld of Mexico. Degraded marsh and open water are displacing highly functional wetland habitat, resulting in a net loss of habitats and habitat productivity. No unique or rare habitat would be destroyed due to improvement of wetlands in those areas that have deteriorated due to marsh impoundments. Rather, the features that would contribute to the unique characteristics of a National Wildlife Refuge would be restored.

Controversial Aspects of the Project or its Effects

The potential for controversy associated with the proposed action was evaluated by considering the potential effects of the project actions on area historic sites, cultural resources, ecological resources, and local aesthetics, and human populations. The State Historic Preservation Officer reviewed the proposed project site and concurred that there are no known historic sites or resources in the area to be affected. Additionally, the Tribes of Louisiana were contacted and provided no written or oral records of Traditional Cultural Properties in the project vicinity. Ecologically, the impairment of marsh function at the site due to the 1999 impoundment is well documented (Boumans and Day 1994, Cahoon 1994, Reed *et al.* 1997, Kuhn *et al.* 1999). Reversing the deteriorated condition of Louisiana's coastal marshes is a well known public goal and the restoration techniques being used in this project have been successfully used elsewhere for this purpose in the state. Aesthetics at the project site will be affected by equipment and activities associated with project construction, but these affects will cease when construction is complete. In the long-term, the creation and enhancement of marsh at the site will enhance the aesthetics of the area. Further, because humans do not reside in the general vicinity of the site, the action proposed does not conflict with local residential uses or involve potential environmental justice considerations. Overall, the proposed project appears to have no elements or affects that are controversial or likely to cause adverse public reaction.

Uncertain Effects or Unknown Risks

The project site is within the Sabine NWR, a publicly protected and managed conservation area. NWR personnel were consulted in evaluating potential project affects and risks. Additionally, a thorough site-specific survey (topographic, bathymetric, and vegetative) was conducted in 2005 and provided additional information that has been of substantial use in considering, anticipating, and evaluating possible project effects or risks. Given the setting and information available, the Trustees do not believe there is any meaningful uncertainty as

to potential effects or unknown risks to the environment associated with implementing the proposed action.

Precedential Effects of Implementing the Project

Wetland restoration and creation projects are regularly implemented along the Louisiana coast to address erosion, subsidence, and sea-level rise, and have been used as a means of compensating the public for other natural resource damage claims arising in Louisiana. Therefore, the proposed project does not in and of itself represent or create a precedent for future settings of a type that would significantly affect the quality of the human environment.

Possible, Significant Cumulative Impacts

Project effects will be cumulative in the sense that the re-establishment, enhancement and creation of marsh at this site will provide ecological services into the future. The proposed project is not expected to have a significant cumulative effect on the human environment since it alone, or in combination with other wetland restoration projects in the vicinity, should not change the larger current pattern of hydrologic discharge, boat traffic, economic activity or land-use in the NWR or the watershed. The proposed action will only restore habitat that originally existed and occurred naturally at this location within the NWR. Further, the actions proposed are intended to compensate the public, *i.e.*, make the public and the environment whole, for resources injuries caused by releases of hazardous substances into the watershed. The proposed restoration action is not part of any systematic or comprehensive plan for the restoration of coastal wetlands in Louisiana or the larger Gulf coast.

Effects on Sites Listed on the National Register of Historic Places or Significant Cultural, Scientific or Historic Resources

Following a review of the maps on file at the Louisiana Department of Culture, Recreation, and Tourism, the Trustees determined that no sites listed on the National Register of Historic Places or Traditional Cultural Properties exist in the vicinity of the selected project. Letters were sent to the State Historic Preservation Officer and various Louisiana Tribes on January 18, 2005, requesting concurrence with the determination that the preferred project will not adversely affect any areas of cultural significance or registered historic places. The State Historic Preservation Officer concurred with the Trustees determination on January 28, 2005. The Chitimacha Tribe and Jena Band of Choctaw Indians concurred with the Trustees

determination on January 25 and February 1, 2005, respectively. The correspondence is included in Appendix xx and the Administrative Record.

Effects on Endangered or Threatened Species, and Their Critical Habitat

The proposed restoration project – restoration and creation of estuarine marsh within the Sabine NWR – is not likely to adversely affect threatened or endangered species or their designated critical habitats. The rationale supporting this conclusion is set forth below.

West Indian Manatee

West Indian manatees may occasionally occur in canals adjacent to the Gulf of Mexico, but there has never been a recorded sighting in the Sabine NWR. The specific habitat at the site is not known to be utilized by the West Indian Manatee, and the equipment that will be used at the site has never been known to present a risk of harm to a manatee. The Trustees believe that the proposed project is not likely to adversely affect this species.

Brown Pelican

The project site is located approximately 5 km north of the brown pelicans' preferred habitat within the NWR, so utilization of the site by this species during construction is not likely. The preferred habitat is also too distant from the site for birds there to be affected by any of the temporary affects activities (*i.e.*, by noise; traffic, etc). The restoration will benefit brown pelican foraging since degradation of the levees to marsh elevation will increase available nursery grounds and habitat for fish; thereby, potentially increasing the amount of food available. The Trustees believe that the proposed restoration action is not likely to adversely affect the brown pelican.

Piping Plover

The piping plover has not been found within the Sabine NWR and there are no areas in the Sabine NWR designated as critical habitat for the piping plover. If a plover uses the Sabine NWR, this proposed restoration action would likely be beneficial to the species since higher elevation spoil banks are being degraded to marsh elevation. Areas with no or sparse vegetation would initially be created through these activities, thereby increasing the amount of available habitat for the plover. The Trustees believe that the proposed restoration action is not likely to adversely affect the piping plover or its designated critical habitat.

Sea Turtles

There are no recorded sightings of sea turtles in the Sabine NWR. Indeed, the lower salinity range associated with the project area, and its location north of the marine and beach zone preferred by the sea turtles, make it extremely unlikely that the green, hawksbill, Kemp's Ridley, leatherback, or loggerhead sea turtles would utilize the area. The Trustees believe that the proposed project is not likely to adversely affect sea turtles.

While the Trustees assessment indicates that this action is not likely to adversely affect threatened or endangered species, informal ESA consultations were initiated with USFWS and NMFS on xx xx, 2007, and xx xx, 2007, respectively.

Violation of Environmental Protection Laws

Wetland restoration and creation projects similar to the proposed project have been implemented along the Louisiana coast consistent with federal, state and local laws designed to protect the environment. The proposed project has no unique attributes or characteristics in that regard. Therefore, the Trustees have no reason to believe, and do not anticipate, that any federal, state or local laws would be violated incident to or as a consequence of the implementation of the proposed action.

7.2 Preliminary Finding of No Significant Impact

Under 40 C.F.R. §§ 1501.5 and 1501.6, for the purposes of this NEPA analysis, NOAA is the lead agency and USFWS is a cooperating agency. Based on the analysis of the available information presented in this document, the federal Trustees have preliminarily concluded that implementation of the marsh creation and enhancement via hydrologic restoration, near West Cove Canal (1999 Unit) within the Sabine NWR ("Preferred Restoration Alternative"), as proposed herein, will not significantly impact the quality of the human environment. All potential beneficial and adverse impacts have been considered in reaching this conclusion. Unless information indicating the potential for significant impacts is revealed through the public review and comment process on this Draft DARP/EA, an Environmental Impact Statement (EIS) will not be prepared for the proposed restoration action.

Issuance of a Finding of No Significant Impact (FONSI) based upon this Draft Environmental Assessment would fulfill and conclude all requirements for compliance with NEPA by the federal Trustees.

7.3 LIKELY IMPACTS OF THE PREFERRED PROJECT ON ESSENTIAL FISH HABITAT

During the construction phase of this project, some short-term and localized adverse impacts will occur. As a result of earth-moving activities, there will be localized increases in turbidity and sedimentation near the project area. These conditions may affect fish and filter feeders in the local area, by clogging gills, increasing mucus production and smothering organisms found in the shallow open-water area. Mobile fish and invertebrates would probably not be affected, since these would most likely leave the area, and return after project completion. Increased noise levels due to the operation of earth-moving equipment would also cause mobile fish to leave the area until operations (the source of the noise) end.

The EFH would be positively impacted by the re-establishment, enhancement and creation of marsh achieved through the proposed restoration action, including by increasing and providing continuity and access to marsh areas currently bordered by levees. The areas of marsh serve as habitat for prey species of some of the managed fish as well as provide a nursery for the larvae and juvenile stages of many managed species. The Trustees do not believe that the proposed restoration project will result in net adverse impact on any EFH designated under the Magnuson-Stevens Act, but will initiate an informal EFH consultation with NMFS before finalizing that determination.

8 COMPLIANCE WITH OTHER KEY STATUTES, REGULATIONS AND POLICIES

8.1 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT OF 1980 (CERCLA), 42 USC 9601, ET SEQ.

CERCLA applies to sites contaminated with hazardous substances and to spills of such substances. In addition to addressing the cleanup of contaminated sites, CERCLA establishes liability for the injury to, destruction of, or loss of natural resources caused by releases of hazardous substances. Damage recovered for these losses must be used to restore, replace, rehabilitate or acquire equivalent natural resources or services, in accordance with a restoration plan developed by designated natural resource trustees.

CERCLA is the primary statute under which the Trustees are acting in releasing this Draft DARP/EA**.** It identifies the specific project proposed for use to restore and compensate for natural resource injuries and losses attributable to hazardous substances releases to Bayou Verdine and Coon Island Loop. Issuance of this Draft DARP/EA is part of the restoration planning process under CERCLA, and is consistent with all applicable provisions pertaining to natural resource damages.

8.2 FEDERAL WATER POLLUTION CONTROL ACT, 33 U.S.C. § 1251 *ET SEQ.*

The Federal Water Pollution Control Act, also known as the Clean Water Act (CWA), is the principal law governing pollution control and water quality of the nation's waterways. Section 404 of the Act establishes a permit program, administered by the U. S. Army Corps of Engineers (USCOE), to regulate dredge and fill activities in navigable waters. Section 401 of the CWA also requires that such projects be certified as compliant with state water quality standards. Restoration projects that move significant amounts of material into or out of waters or wetlands, such as the restoration project proposed herein, must be permitted under Section 404 and certified as compliant with state water quality standards under Section 401. All necessary 404 permits and 401 certifications will be obtained for the preferred project prior to implementation.

8.3 RIVERS AND HARBORS ACT OF 1899, 33 U.S.C. § 401 *ET SEQ*.

The Rivers and Harbors Act (RHA) regulates development and use of the nation's navigable waterways. Section 10 of the Act prohibits unauthorized obstruction or alteration of navigable waters and vests the U. S. Army Corps of Engineers with authority to regulate discharges of fill and other materials into such waters. Restoration actions that must comply with the substantive requirements of Section 404 must also comply with the substantive requirements of Section 10. Compliance with the RHA is addressed as part of the CWA Section 404 permitting process.

8.4 COASTAL ZONE MANAGEMENT ACT (CZMA), 16 U.S.C. § 1451 *ET SEQ.*, 15 C.F.R. PART 923

The goal of the CZMA is to encourage states to preserve, protect, develop, and, where possible, restore and enhance the nation's coastal resources. Section 1456 of the CZMA requires that any federal action inside or outside of the coastal zone be consistent, to the maximum extent practicable, with the enforceable policies of a state's federally approved Coastal Zone Management Program. Regulations adopted under the CZMA outline procedures applicable to determining the consistency of federal actions with state approved plans. The Trustees believe the restoration action proposed in Section 5.0 of this Draft DARP/EA is consistent with the Louisiana CZMA Program. NOAA and USFWS – the involved federal trustee agencies - will be submitting this determination to the Louisiana Department of Natural Resources for review and concurrence.

8.5 ENDANGERED SPECIES ACT (ESA), 16 U.S.C. § 1531 *ET SEQ.*, 50 C.F.R. PARTS 17, 222, & 224

The ESA is directed at conserving endangered and threatened species, and the habitats upon which they depend. Under the Act, all federal agencies are required to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of habitat designated as critical for such species, unless the agency is granted an exemption for its action. The Department of Commerce, acting through NOAA, and the Department of the Interior, acting through the USFWS, publish lists of the endangered and threatened species and have been delegated primary authority to oversee federal compliance with the ESA.

The Trustees believe implementation of the restoration action proposed in this Draft DARP/EA will not adversely impact any threatened or endangered species, or habitats critical to such species, under the ESA. The Trustees will be conferring with the USFWS and NOAA's National Marine Fisheries Service (NMFS) coincident with public review of the Draft DARP/EA to ensure that the proposed restoration action will be in accordance with the ESA. If, based on those conferences, it appears the proposed project has the potential to adversely affect any listed species, the Trustees will initiate formal consultations with the appropriate agencies in order to identify and implement appropriate safeguards for the protection of such species during project construction.

8.6 FISH AND WILDLIFE CONSERVATION ACT, 16 U.S.C. § 2901 *ET SEQ.*

This Act encourages all federal agencies to use their statutory and administrative authorities, to the maximum extent practicable and consistent their statutory responsibilities, to conserve and to promote the conservation and protection of non-game fish and wildlife species and their habitats. The proposed restoration action will promote and conserve, and have no adverse affect on, fish and bird habitat, including non-game fish and wildlife and their habitat.

8.7 FISH AND WILDLIFE COORDINATION ACT (FWCA), 16 U.S.C. § 661 *ET SEQ.*

The FWCA requires that federal agencies consult with the USFWS, NOAA's National Marine Fisheries Service (NMFS), and state wildlife agencies regarding activities that affect, control, or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources and habitat. For restoration projects that move significant amounts of material into or out of coastal waters or wetlands, such as the restoration project proposed herein, these consultations are generally incorporated into the process of complying with Section 404 of the CWA, the RHA, or other required federal, permit, license, review or consultation requirements.

The Trustees have coordinated directly with the USFWS, the NMFS, and the Louisiana Department of Wildlife and Fisheries (the appropriate state wildlife agency under FWCA) in developing the restoration plan proposed herein and believe that the proposed restoration project will have a positive effect on fish and wildlife resources.

8.8 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT, AS AMENDED AND REAUTHORIZED BY THE SUSTAINABLE FISHERIES ACT (PUBLIC LAW 104-297) (MAGNUSON-STEVENS ACT), 16 U.S.C. §§1801 *ET SEQ.*

The Magnuson-Stevens Act, as amended and reauthorized by the Sustainable Fisheries Act (Public Law 104-297), established a program to promote the protection of essential fish habitat (EFH) through the review of projects that affect or have the potential to affect such habitat that are conducted under federal permits, licenses, or other authorities. Once EFH is identified and described in fishery management plans by the appropriate fishery management council(s), federal agencies are obliged to consult with the Secretary of Commerce, via consultation with NOAA's NMFS, with respect to any action proposed to be authorized, funded or undertaken by such agency that *may* adversely impact any EFH.

The Trustees do not believe that the proposed restoration project will result in net adverse impact on any EFH designated under the Act but will initiate an informal EFH consultation with NMFS before finalizing that determination.

8.9 MARINE MAMMAL PROTECTION ACT, 16 U.S.C. § 1361 *ET SEQ.*

The Marine Mammal Protection Act provides authority for the long-term management and protection of marine mammals, including maintenance of their ecosystem. It establishes a moratorium on the taking and importation of marine mammals and marine mammal products, with limited exceptions involving scientific research, incidental taking, subsistence activities by Alaskan natives, and hardship. The Department of Commerce is responsible for whales, porpoise, seals, and sea lions. The Department of the Interior is responsible for all other marine mammals. The proposed restoration action is not expected to affect any marine mammals.

8.10 MIGRATORY BIRD TREATY ACT, 16 U.S.C. § 703 – 712

The Migratory Bird Treaty Act provides for the protection of migratory birds. The proposed restoration action will have no adverse effect on migratory birds. Under the proposed restoration action, no migratory birds will be pursued, hunted, taken, captured, killed, attempted to be taken, captured or killed, possessed, offered for sale, sold, offered to purchase, purchased, delivered for shipment, shipped, caused to be shipped, delivered for transportation, transported, caused to be transported, carried, or caused to be carried by any means whatever, received for shipment, transported or carried, or exported, at any time, or in

any manner. While the Act does not specifically protect the habitats of migratory birds, conditions may be included in project permits (e.g., restricting construction activities to avoid nesting season) in order to avoid or minimize negative impacts to migratory birds and to ensure compliance with the Act.

8.11 MIGRATORY BIRD CONSERVATION ACT, 16 U.S.C. § 715 *ET SEQ.*

The Act provides authority for the U. S. Department of the Interior to acquire and manage lands for conservation of migratory birds. The proposed restoration action will occur within the Sabine National Wildlife Refuge, land that is managed by the USFWS for the conservation of migratory birds and other wildlife. The proposed restoration project will re-establish, enhance and create habitat that is important to the USFWS' efforts to conserve migratory birds and wildlife within the Refuge, consistent with this Act.

8.12 NATIONAL HISTORIC PRESERVATION ACT, 16 U.S.C. § 470 *ET SEQ*, & ARCHEAOLOGICAL RESOURCES PROTECTION ACT, 16 U.S.C. § 470AA-MM.

These statutes require federal agencies, or federally funded entities, to consider the impacts of their proposed actions on historic properties and cultural or archeological resources. The proposed restoration project does not involve and will not occur near any site listed on the National Register of Historic Places and the Trustees have no information indicating that there are known sites or properties eligible for listing on the National Register of Historic Places, or any cultural or archeological resources, in the vicinity of the project area. Letters were sent to the State Historic Preservation Officer and identified Louisiana Tribes on January 18, 2005, requesting concurrence that the proposed restoration project will not adversely affect any culturally significant areas or historic places. The State Historic Preservation Officer and Jena Band of Choctaw Indians concurred with this determination on January 28, 2005, and February 1, 2005, respectively. The Chitimacha Tribe informed the Trustees that Cameron Parish is not a part of their aboriginal homeland.

8.13 INFORMATION QUALITY ACT, PUBLIC LAW 106-554

Information disseminated by federal agencies to the public after October 1, 2002, is subject to guidelines developed by each agency pursuant to Section 515 of Public Law 106-554 that are intended to ensure and maximize the quality of information (i.e., the objectivity, utility and integrity) each agency disseminates to the public. This Draft DARP/EA is an information product covered by information quality guidelines established by NOAA and

DOI for this purpose. The quality of the information contained herein has been certified to be consistent with applicable guidelines.

8.14 SECTION 508 OF THE REHABILITATION ACT, 29 U.S.C. 794D

Under Section 508 of the Rehabilitation Act, all Federal agencies must take steps to afford persons with disabilities, including members of the public, access to information that is comparable to the access available to others. Section 508 was enacted in part to eliminate access barriers associated with information technology. For web accessibility under Section 508, documents posted must make text equivalents available for any non-text elements (including images, navigation arrows, multimedia objects (with audio or video), logos, photographs, or artwork) to enable users with disabilities access to all important (as opposed to purely decorative) content. Compliance also extends to making accessible other multimedia and outreach materials and platforms, acquisition of equipment and other assistive technologies, and computer software compliance. To provide for access to this document by disabled persons who use special assistive technology type devices and services, an electronic version of this Draft DARP/EA incorporating electronically readable text equivalents for all non-text elements has been created and is available at www.darrp.noaa.gov/southeast/bayou_verdine/index.html. This website is regularly reviewed for Section-508 compliance. Disabled persons experiencing any difficulty accessing this document on this web site should contact the DARRP Program webmaster at darrp.webmaster@noaa.gov for further technical assistance or to request an alternative means of access to the referenced information and data.

8.15 EXECUTIVE ORDER NUMBER 11514 (35 FED. REG. 4247) – PROTECTION AND ENHANCEMENT OF ENVIRONMENTAL QUALITY

This Executive Order directs federal agencies to monitor, evaluate, and control their activities in order to protect and enhance the quality of the nation's environment, to inform and seek the views of the public about these activities, to share data gathered on existing or potential environmental problems or control methods, and cooperate with other governmental agencies. The proposed project and the release of this Draft DARP/EA are consistent with the goals of this Order. The proposed project is the product of inter-governmental cooperation and will protect and enhance the environment. The restoration planning process has and continues to provide the public with information about the restoration effort.

8.16 EXECUTIVE ORDER 12898 (59 FED. REG. 7629) - ENVIRONMENTAL JUSTICE

This Executive Order directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. There are no low-income or ethnic minority communities that would be adversely affected by the proposed project. The proposed restoration project will enhance the quality of the environment for all populations.

8.17 EXECUTIVE ORDER NUMBER 11988 (42 FED. REG. 26,951) – FLOODPLAIN MANAGEMENT

This Executive Order requires federal agencies to reflect consideration of flood hazards and the natural and beneficial values served by floodplains in carrying out responsibilities involving federally financed or assisted construction and improvements and federal activities and programs affecting land use. While proposed restoration project will take place within a floodplain, it is consistent with this Order as it involves activities that will serve only to restore, expand and preserve the beneficial values of the floodplain.

8.18 EXECUTIVE ORDER NUMBER 11990 (42 FED. REG. 26,961) - PROTECTION OF WETLANDS

This Executive Order directs federal agencies to take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out agency responsibilities for acquiring, managing, and disposing of federal lands and facilities; providing federally undertaken, financed, or assisted construction and improvements; and conducting federal activities and programs affecting land use, including water and related land resources planning, regulating, and licensing activities. The proposed restoration project is compliant with this Executive Order as it will operate to restore and enhance existing wetlands, create additional wetlands, and protect new and existing wetlands and the services they provide.

8.19 EXECUTIVE ORDER NUMBER 12962 (60 FED. REG. 30,769) - RECREATIONAL FISHERIES

This Executive Order directs federal agencies to, among other things, foster and promote restoration that benefits and supports viable, healthy, and sustainable recreational fisheries.

The proposed project will enhance or create habitats that will help support and sustain recreational fisheries in the Calcasieu Estuary.

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APPENDIX A. PRELIMINARY LIST OF PROJECT ALTERNATIVES FOR THE BAYOU VERDINE CERCLA CASE

Project Name	Project Description	Sponsor Organization	Parish
Boardwalk Shoreline Protection	This project involves the installation of rip-rap in order to stabilize the shoreline and prevent soil and biomass loss.	ConocoPhillips and Sasol NA	Calcasieu
Section 29 Marsh Creation	This project would create 154 acres of marsh through the use of dredged material.	ConocoPhillips and Sasol NA	Calcasieu
Section 32 (Haymark Terminal) Marsh Creation	This project involves constructing a containment levee suitable for the creation of 300 acres of marsh via dredge and fill. 55 acres of the containment footprint would have been considered for in-filling to satisfy the compensatory requirement.	CCA	Calcasieu
Coon Island Loop Marsh Creation	This project involves the construction of revetment along the shoreline of the Coon Island Loop marsh. Dredged material would be added behind the revetment to create/restore marsh.	CCA	Calcasieu
South Prien Lake Marsh Creation	This project involves the creation of between 200 and 300 acres of marsh, via dredge and fill, in what is currently open-water habitat.	CCA	Calcasieu
North Moss Lake Marsh Creation	This project involves the construction of revetment along the shoreline of the North Moss Lake marsh. Dredged material would be added behind the revetment to create/restore marsh.	CCA	Calcasieu
Old River/Turner's Bay Marsh Creation	This project involves the construction of revetment along the shoreline of the Old River/Turner's Bay marsh. Dredged material would be added behind the revetment to create/restore marsh.	CCA	Calcasieu

Project Name	Project Description	Sponsor Organization	Parish
Long Point Shell Reef	This project would involve constructing an oyster reef in Calcasieu Lake near Long Point. There is already an approximately 5 acre reef at Long point and this proposed reef would be built adjacent to it.	CCA	Cameron
South Fork Black Bayou (also named Hippolyte II)	Various restoration/creation opportunities exist in the proposed project area for the following habitats: freshwater marsh, riparian zone, swamp forest, bottomland hardwood forest, and coastal prairie.	Arabie Environmental Solutions	Cameron
Rangia Reef Restoration	This project involves the creation/restoration of *Rangia* reefs in the northern Gulf of Mexico and Bay system south of the Site.	RESTORE	Calcasieu and Cameron
Basin-wide Riparian Restoration	This proposed project seeks the perpetual conservation of un-developed riparian shorelines in Cameron and Calcasieu Parishes.	RESTORE	Calcasieu and Cameron
Anti-logging in Swamps	This proposed effort would restrict the logging of cypress-tupelo forests in Cameron and Calcasieu Parishes.	RESTORE	Calcasieu and Cameron
Swamp re-vegetation in Moss Bluff area	This project would build upon a previous effort to re-vegetate the Moss Bluff swamp. Future efforts would involve the planting of native trees.	RESTORE	Calcasieu
Marsh Creation near Sam Houston State Park	This project involves the acquisition of property rights and the restoration of approximately 160 acres of freshwater wetlands and upland habitat.	ConocoPhillips and Sasol NA	Calcasieu
Upper Calcasieu Estuary Wetlands Marsh Creation	This project would both create and restore between 50 and 100 acres of brackish marsh in a largely fragmented wetland. Dredged material would be used to fill in open water areas and thereby enhance the adjacent marsh islands.	ConocoPhillips and Sasol NA	Calcasieu

Project Name	Project Description	Sponsor Organization	Parish
Marsh Terracing	This project would involve creating marsh terraces in an approximately 200 acre open water area.	ConocoPhillips and Sasol NA	Cameron
Hydrologic Restoration near West Cove Canal - Sabine NWR BU93, 96, and 99 Projects	These projects involve the degradation of levees created as containment in 1993, 1996, and 1999. Other project features include the creation of marsh and levee gaps. The latter would be designed to restore hydrology of the marsh platforms.	ConocoPhillips and Sasol NA	Cameron
Oyster Bayou Marsh Terracing	This project would involve creating marsh terraces in an approximately 500 acre open water area.	ConocoPhillips and Sasol NA	Cameron
Reduce Maintenance Dredging in Calcasieu Ship Channel	This effort would seek to change dredging policy for the Calcasieu Ship Channel. Additionally, it is proposed that the compensatory requirement could be satisfied by converting the Port system to a Lighter Aboard Ship (LASH) system.	RESTORE	Calcasieu and Cameron
Seafood Awareness Campaign	This campaign would seek cooperative financing for a seafood consumption warning to be posted in the vicinity of the releases.	RESTORE	Calcasieu and Cameron
Wetland education	This proposal advocates the creation of teaching materials, classroom aids, etc., to be disseminated to local schools. The materials would complement the alternative selected in the final DARP/EA.	RESTORE	Calcasieu and Cameron
Fishing Access	Three locations were proposed for the construction of boat launches and piers. Each would be designed and placed to improve fishing access.	CCA	Calcasieu and Cameron

APPENDIX B. TECHNICAL MEMORANDUM – HURRICANES KATRINA & RITA: REVIEW OF POTENTIAL AFFECT ON INJURY ASSESSMENT PROPOSED FOR BAYOU VERDINE

The information and data considered by the Trustees and the PRPs in assessing the injuries and losses of natural resources due to hazardous substances within Bayou Verdine and Coon Island Loop pre-dates 2005, the year in which both Hurricanes Katrina and Rita came ashore along the Louisiana/Mississippi coast. While weather in western Louisiana was affected by Hurricane Katrina to some degree, the storm surge, major flooding and destructive wind conditions associated with Katrina occurred in coastal areas of eastern Louisiana, Mississippi and Alabama. Hurricane Rita, however, made land-fall in southwest Louisiana just 26 days later. This storm produced heavy winds and flooding, causing extensive devastation to people, property and natural resources within Cameron Parish (including the towns of Holly Beach, Hackberry, and Cameron). Calcasieu Parish was also adversely impacted by the storm, though to a lesser extent than Cameron, its coastal neighbor to the south.

In light of the severe flood and wind conditions from Hurricane Rita occurring in western Louisiana, the Trustees have considered whether there is a present need to revisit the proposed injury assessment for Bayou Verdine and Coon Island Loop developed prior to 2005. Such a need might exist if storm effects in these areas are likely to have significantly affected the presence and distribution of hazardous substances in these areas, or the residual effects of known or anticipated response actions. After consideration of information bearing on this question, the Trustees have concluded the storm likely did not alter these conditions in any substantial way and, on that basis, will propose the injury assessment as originally developed in the Draft Damage Assessment and Restoration Plan (Draft DARP) for the Site.

The Trustees evaluated data from environmental sampling results obtained from collections prior to and after Hurricane Rita in order to determine whether concentrations of contaminants found in sediments in upper reaches of the Calcasieu Estuary had changed (sediments are a sink for contaminants released into this system). Sediment data for Bayou d'Inde, the next bayou to the south (downstream) of Bayou Verdine, were used as a general indicator of potential hurricane-related sediment impacts in the upper portion of the Calcasieu Estuary. The focus on sediments in Bayou D'Inde is appropriate as an indicator of change in Bayou Verdine because both are located in the same general area of the Estuary, are industrially influenced waterways, and experienced the same environmental influence

from Hurricane Rita. The evaluation of the data for Bayou D'Inde is actually a conservative indicator for Bayou Verdine and Coon Island Loop because Bayou D'Inde is a higher energy system and would be more likely to experience changes in sediments from changes in meteorological and hydrological conditions. The review of Bayou d'Inde sediment data suggests contaminant concentrations in the sediments of that bayou did not experience substantial changes as a result of Hurricane Rita. While some statistically significant changes were noted (some increases; some decreases), the overall changes were consistent with natural shifts in sediments from the normal dynamics of the bayou environment.

Post-storm visual inspections of hurricane-related damage in the Estuary provide a second line of evidence. Flooding did occur within Bayou Verdine and Coon Island Loop; however, the impacts of this flooding were far less than that seen farther south in the Estuary. At USEPA's request, ConocoPhillips contracted with URS to assess the impacts of Hurricane Rita on the West Ditch and Bayou Verdine removal area, including surrounding uplands. A URS engineer inspected the site on October 10, 2005 and the results of his inspection were documented in a report provided to the USEPA. (Letter from D. Reese, URS, to A. Stow, ConocoPhillips, dated 3/2/06). The area was found to be in good condition overall, with no evidence of scouring or erosion along Bayou Verdine, the West Ditch, or any of the adjacent uplands. Some debris and downed or damaged trees were scattered in the upland areas, but none was in contact with water or sediments. The cap within the West Ditch appeared to have remained intact, as there was no evidence of damage to the submerged barrier layer. Thus, the information from both the quantitative assessment of sediment data and visual inspections within Bayou Verdine indicates Hurricane Rita is not likely to have altered the physical environment of Bayou Verdine and Coon Island Loop in a manner or to an extent that would negate the proposed assessment of natural resource injuries in Bayou Verdine or Coon Island Loop, or the proposed plan for restoration that is based thereon.

Finally, a significant portion of the resource losses included in the proposed assessment are for injuries occurring in Bayou Verdine, where losses are assessed at 100% due to past contamination levels and/or identified response actions. Within the scope of the assessment, the hazardous substances present in Coon Island Loop are at levels appropriate for natural recovery and represent a lower degree of injury to benthic resources pending recovery. It is unlikely that storm effects in Coon Island Loop would have redistributed these low level contaminants in a manner that would greatly increase their concentration within this area. These circumstances further support the Trustees' determination not to revisit the proposed assessment.